

**European
Journal**



**of Contemporary
Education**

Has been issued since 2012.
ISSN 2304-9650, E-ISSN 2305-6746
2017, 6(3). Issued 4 times a year
MIAR ICDS 2017 – 9,202

EDITORIAL BOARD

Dr. Yury Tyunnikov – Sochi State University, Sochi, Russian Federation (Editor-in-Chief)

Dr. Rushan Ziatdinov – Keimyung University, Daegu, Republic of Korea (Deputy Editor-in-Chief)

Dr. Aufenanger Stefan – University of Mainz, Mainz, Germany

Dr. Bartik Pavol – Matej Bel University, Banská Bystrica, Slovakia

Dr. Bendikova Elena – Matej Bel University, Banská Bystrica, Slovakia

Dr. Bilovesky Vladimir – Matej Bel University, Banská Bystrica, Slovakia

Dr. Birova Jana – Comenius University, Bratislava, Slovakia

Dr. Esi Marius-Costel – Stefan cel Mare University of Suceava, Romania

Dr. Alexander Fedorov – Anton Chekhov Taganrog State Pedagogical Institute, Taganrog, Russian Federation

Dr. Kharisov Faris – Federal Institute of education development, Moscow, Russian Federation

Dr. Malisa Mark – College of Saint Rose School of Education, Albany, USA

Dr. Malinauskas Romualdas – Lithuanian Academy of Physical Education, Kaunas, Lithuania

Dr. Nabiyev Rifkat – Ufa State Aviation Technical University, Ufa, Russian Federation

Journal is indexed by: **Cross Ref** (USA), **Directory of Open Access Journals** (UK), **EBSCOhost Electronic Journals Service** (USA), **Electronic scientific library** (Russian Federation), **Global Impact Factor** (Australia), **Index Copernicus** (Poland), **Journal Index** (USA), **Open Academic Journals Index** (Russian Federation), **Scopus** (Netherlands), **Web of Science** (USA).

All manuscripts are peer reviewed by experts in the respective field. Authors of the manuscripts bear responsibility for their content, credibility and reliability.

Editorial board doesn't expect the manuscripts' authors to always agree with its opinion.

Postal Address: 1367/4, Stara Vajnorska str., Bratislava – Nove Mesto, Slovak Republic, 831 04

Website: <http://www.aphr.ru>
E-mail: ejce@inbox.ru

Founder and Editor: Academic Publishing House Researcher s.r.o.

Release date 15.09.17.

Format 21 × 29,7/4.

Headset Georgia.

Order № 220.

European Journal of Contemporary Education

2017

Is. **3**

C O N T E N T S

New Approaches and Emerging Trends in Educational Technology for Learning and Teaching in Academia and Industry
Ismail Ipek and Rushan Ziatdinov (Eds.)

| | |
|--|-----|
| New Approaches and Trends in the Philosophy of Educational Technology for Learning and Teaching Environments I. Ipek, R. Ziatdinov | 381 |
| Innovative Methods in Teaching Programming for Future Informatics Teachers J. Majherová, V. Králík | 390 |
| mSciences: an Affinity Space for Science Teachers J. Mota, C. Morais, L. Moreira, J.C. Paiva | 401 |
| Lower-Order Mathematical Thinking Skills in Finance, from the Viewpoint of Financial Employees in the Iranian Bank of Industry and Mine S. Zahra Aboalhasani Kumleh, F. Rahnamay Roodposhti, A. Shahvarani, F. Hosseinzadeh Lotf | 414 |
| The Prediction of the Students' Academic Underachievement in Mathematics Using the DEA model: A Developing Country Case Study F. Moradi, P. Amiripour | 432 |
| The Effects of Training and Other Factors on Problem Solving in Students R. Puran, M. Hasan Behzadi, A. Shahvarani, F. Hosseinzadeh Lotfi | 448 |
| Factor Analysis of Inertia, Capacities, and Educational Performance of At-Risk Students' Training Centres According to Their Academic Failure in Mathematics P. Amiripour, J.A. Dossey, A. Shahvarani | 461 |
| Development of Information Competency in Students during Training in Al-Farabi's Geometric Heritage within the Framework of Supplementary School Education Y. Bidaybekov, G. Kamalova, B. Bostanov, I. Salgozha | 479 |
| Understanding of Selected Geometric Concepts by Pupils of Pre-Primary and Primary Level Education J. Gunčaga, Š. Tkačik, K. Žilková | 497 |
| The Problems of Contemporary Education | |
| Directions, Objectives, and Author's Concepts of Audiovisual Media Interpretations of School and University Theme in the Soviet Cinema of the "Thaw" Period (1956–1968) A. Fedorov, A. Levitskaya, O. Gorbatkova, A.M. Mamadaliev | 516 |

| | |
|---|-----|
| Education and Knowledge in the Use of Financial Products and Services in Bachelor's Degree Students A. García-Santillán, E. Moreno-García, V.S. Molchanova | 530 |
| The Study of Relationship between Women Teachers' Career Barriers and Organizational Silence: Viewpoint of Women and Men Teachers Y. İnandi, M.E. Gün, F. Gılıç | 542 |
| The Polyethnic Competence of Class Teacher as a Resource for Ensuring the Psychological Security of Pupils in a Polycultural Educational Environment T.I. Kulikova, K.S. Shalaginova, S.A. Cherkasova | 557 |
| Model of Distant Learning Educational Methods for the Students with Disabilities T.A. Naumova, N.I. Vytovtova, N.W. Mitiukov, T.E. Zulfugarzade | 565 |
| Incorporating Beliefs, Values and Local Wisdom of Betawi Culture in a Character-Based Education through a Design-Based Research Suswandari | 574 |
| The Development of Informal Learning and Museum Pedagogy in Museums P. Tišliar | 586 |
| The Speed Reading is in Disrepute: Advantages of Slow Reading for the Information Equilibrium M.I. Tsvetkova | 593 |
| Education Faculty Students' Levels of Satisfaction with E-Learning Process M. Yalman, B. Basaran, S. Gonen | 604 |



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.

All rights reserved.

Published in the Slovak Republic

European Journal of Contemporary Education

ISSN 2304-9650

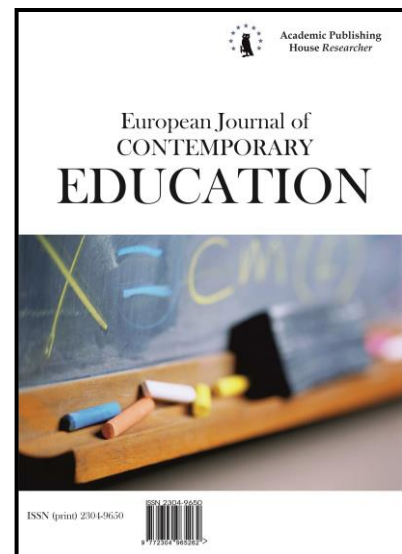
E-ISSN 2305-6746

2017, 6(3): 381-389

DOI: 10.13187/ejced.2017.3.381

www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



New Approaches and Emerging Trends in Educational Technology for Learning and Teaching in Academia and Industry

Ismail Ipek and Rushan Ziatdinov (Eds.)

New Approaches and Trends in the Philosophy of Educational Technology for Learning and Teaching Environments

Ismail Ipek ^a, Rushan Ziatdinov ^{b,*}

^a Department of Computer and Instructional Technologies, Istanbul Aydin University, Istanbul, Turkey

^b Department of Industrial and Management Engineering, Keimyung University, Daegu, Republic of Korea

URL: <http://www.ziatdinov-lab.com/>

Abstract

The purpose of this study is to discuss instructional design and technology (IDT) model strategies for developing learning and teaching environments, based on philosophical approaches to educational technology theory. The study begins with a discussion of IDT models to define the history of educational technology or instructional technology theories, based on instructional strategies and improvements. In the study, authors discuss the strategies and steps that a design team should follow when designing learning environments in industry, business and military scenarios, based on the philosophy of educational technology and latest technologies, which should give way to effective learning environments. The steps include recognizing terminology in educational technology concepts, psychological and instructional foundations in instructional design (ID), as well as approaches to educational technology. To recap, our purpose is to combine necessary IDT model strategies for the pedagogical design of learning environments, with new

* Corresponding author

E-mail addresses: ismailipek34@gmail.com, ismailipek@aydin.edu.tr (I. Ipek),
ziatdinov.rushan@gmail.com, ziatdinov@kmu.ac.kr (R. Ziatdinov)

technologies. We will also discuss powerful IDT models that aim to meet the very high expectations of digital and humanist education. To develop a high-quality learning environment, we will explain technology design steps and practice in order to improve the learning of tasks, complex cognitive skills, attitudes, motivations and competencies in the future trends of educational technology. At the end of the study, integrated technologies in e-learning were discussed and presented, based on foundations of IDT and the philosophy of educational technology. These included pedagogical, technological and organisational technologies, as well as the main barriers of implementation, which, in turn, include the perspectives of students, teachers and designers, learning materials, digital education, epistemology in educational technology, courseware design, new technologies and contextual settings.

Keywords: philosophy of education, educational technology, instructional design, instructional design and technology, digital education

"I cannot teach anybody anything, I can only make them think."

Socrates

1. Introduction

Today, the developments in technology and the improvement of instructional design (ID) procedures with models have become focused on different sectors, such as industrial, business and military sectors, as well as on educational environments. With this in mind, new trends, technological innovations, philosophies pertaining to education, cultural perceptions and approaches all need to be discussed effectively, efficiently and globally, in order for us to recognize how badly we need international relationships, knowledge and active promotion of digital mobility with our partners for developing new schools, technologies, courseware, and learning design strategies, so that we may apply new ideas to them, and to potential learners. With this approach, scholars in the field of education, in addition to instructional design and technology (IDT), as well as other learning environments entailing different sectors, should commence discussing the philosophy of education from the beginning, in order to present possible changes for the future. They should start defining philosophical concepts, and follow, with understanding, the instructional terms and methods applied, thus far. Therefore, technology, education, instruction, learning design and multimedia design, for different levels, will be defined in order to provide the reaching of goals with learners and teachers, in learning environments for industrial, business and educational sectors.

The field of educational technology (ET) consists of both theory and ethical practice in the educational process, across different sectors (Januszewski, Molenda, 2008; Reiser, Dempsey, 2007; Seels, Glasgow, 1998; Seels, Richey, 1994). In this process, instructional design strategies provide contributions to global emerging technologies, for learning and teaching in educational technology and learning environments. These strategies deal with new technologies to develop learning environments, including digital learning, pedagogy online, learning design, humanism as digital humanism, collaborative learning, user-centered design and programming language, as well as instructional design models. The aim of the paper is to discuss and address basic dimensions, from past to present, for developing learning strategies to meet the objectives of temporary educational technology and its philosophical approach, which can be used interchangeably by instructional technology (IT) in the field of education, and in different sectors, as well.

2. Philosophy of Educational Technology and ID Models

All human societies, in the past and present, have focused on learning processes, and were interested in education. They have mentioned that teaching is the oldest career after dealing interests in education. There were no educated children who could read but, later on, they would learn to read, write and calculate, and also to employ the appropriate techniques in social learning, in order to reach individual goals. In addition to family life and learning skills, children need more activities and ways to live and thrive, within social groups. For this reason, perspectives on pluralistic societies might be changed, in individualistic terms, based on how the respective lifestyle changes. At this time, social life can be organised by rules, which are mentioned as parts of democracy and modern education. All social groups have been equally defined when meeting problems and shared responsibility, not based on majority, and have provided consensus with minority groups, as well. From this perspective, Dewey (1916) pointed out that the "primary

ineluctable facts of the birth and death of the each one of the constituent members in a social group” make education important, despite the biologically inevitable fact that “the life of the group goes on” (p.3). The great importance of education is underscored, at this time. When a society is met by crisis, many problems emerge, which may be considered signs of educational breakdown, pertaining to components in educational technology, education, and educators, as well as technological changes with their effects on vocational education, industry, business, military, and their respective learning systems (Richey et al., 2007).

As a result, philosophical trends and educational disciplines deal with ontology (existentialism), knowledge, epistemology and ethics, which, in turn, consist of ethics and aesthetics. All procedures and processes in educational movement for philosophers, from ancient times to the present day, include those of Socrates, Plato, Aristotle, Comenius, Locke, Rousseau, Pestalozzi, Voltaire, Diderot, Herbart, Dewey, Pazzi, Skinner, Bacon, Bagler, Pablo Pierre and others (Phillips, 2008). Each philosopher or scientist of education addressed and worked on philosophical trends, which could be defined as idealism, realism, pragmatism, ontology, naturalism, behaviourism and analytical philosophy. In addition to these are today’s educational technologies or instructional design dimensions, used to develop ID models for teaching in industry, business, military and schools, and may also be used in their e-learning environments with new technologies (İpek et al., 2008a, 2008b).

3. Psychological and Instructional Foundations of Instructional Design

Instructional design practices have been greatly influenced by a variety of theories concerning learning and instruction. Over many years, cognitive learning theory, behavioral learning theory, cognitive information processing theory, and Gagne’s theory of instruction and instructional design, have had effects on instructional design and learning strategies. In recent years, schema theory, cognitive load theory, situated learning theory and constructivism have offered different approaches and learning strategies to develop methods for learning environments, as well as for design instruction, by using educational technology tools. Psychological foundations of instructional design are offered as philosophical perspectives for learning and instruction, in order to develop lessons by using those tools in educational technology. These approaches in learning design have defined and addressed the question of how to facilitate instruction, based on various theories, from behavioral theory to the constructivist approach.

Over the last decades of the twentieth century, constructivist epistemologies in learning sciences have been mentioned as alternatives to instructional sciences (Jonassen et al., 2007). On the other hand, Hannafin, Hill (2007) discussed learning environments, including epistemological perspectives, design frameworks, and design practices. From this approach, epistemology was defined as the branch of philosophy concerned with the nature of knowledge, with the understanding of study, and ethical practices of facilitating learning and improving performance in educational technology. This point has already been presented by AECT* (Januszewski, Molenda, 2008). As discussed before, the word ‘study’ refers to research with all steps included, and ethics are not merely rules and expectations, but are a basis for practice and other stages, in the definition of ET. In addition to the main concepts of definition, facilitation considers the design of the environment, the resources and the provision of technological tools. For this, educational technology has a role for facilitating learning, rather than controlling. The epistemological perspectives are indicated as epistemological design frameworks and design practices. Thus, epistemological and psychological concepts have several interesting intersections, and invaluable contributions to the sectors of learning design, and the development of learning environments for the IDT field.

The purpose of using educational technology is to enhance pedagogy, and to enable students to learn. A recent definition of educational technology is given by the Definition and Terminology Committee of AECT as follows:

“Educational technology is the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources” (Januszewski, Molenda, 2008).

* Association for Educational Communication & Technology, Bloomington, IN, USA. URL: <http://aect.site-ym.com/>

With this definition, there are studies (research) and ethical practices for gathering information and analysing beyond traditional issues of research, and also for defining the field's ethical standards and case examples for practice. Educational technology also has a role in facilitating cognitive and constructivist learning theories, in order to obtain a connection between instruction and learning. It is a more facilitative approach, than a controlling one. Thus, educational technology claims to facilitate learning, rather than to cause or control learning activities. Facilitation includes design of learning environments, organising of resources, and the provision of learning tools. The learning environments can be in face-to-face settings, virtual environments, as well as microworlds, augmented realities, distance learning and learning designs.

Today, many instructional design models have been developed to be used within different learning environments for applying various learning theories in education, and for different purposes in different sectors. All ID models have generic steps of approach when it comes to the design of instructional systems, including design itself, development and evaluation stages. After all, later on, those stages have been referred to as analysis, design, development, implementation and evaluation stages. This was abbreviated as the (ADDIE) model. First, the generic IDI model, as a systematic design model, will be shown in the below image. The IDI model has three phases, which are shown in figure 1:

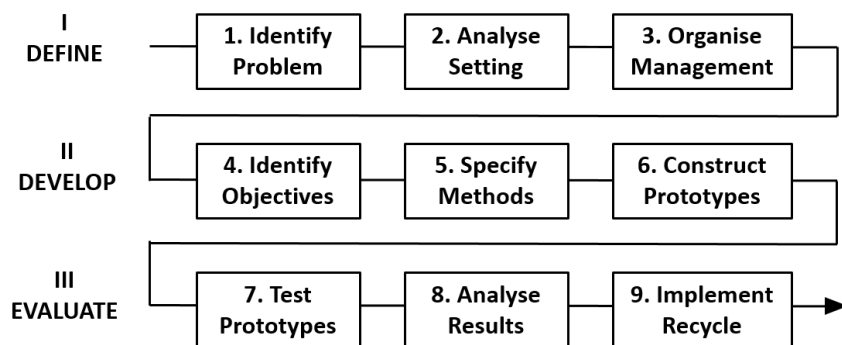


Fig. 1. The Instructional Development Institute (IDI) Model

In addition to the IDI model, which is the first model-based approach, several ID models were developed after 1970. One of them is the Seels and Glasgow (1998) model, which is well known for using project development and class teaching, as well. The model is also available for cognitive and constructivist approaches to education for different sectors. The basic steps of the model, and a comparison to the generic ADDIE model, are given in table 1:

Table 1. A comparison of the ADDIE model and Seels, Glasgow Model (1998)

| | ADDIE Model | Seels, Glasgow Model |
|----|----------------|--|
| 1. | Analysis | Need analysis, task and instructional analysis |
| 2. | Design | Objectives and assessment, instructional strategy, delivery system selection and prototyping |
| 3. | Development | Materials development, formative evaluation |
| 4. | Implementation | Implementation and maintenance |
| 5. | Evaluation | Summative evaluation, diffusion and dissemination |

Instructional design models include learning strategies, and learning performance does not use today what it connoted several years ago, when the first AECT definition, as learning procedure, was developed. There is a difference between retention of knowledge for testing purposes, and the acquisition of knowledge, skills, and attitudes used in the learning process. There are important variables to be found in learning, understanding, retention and assessment. For this reason, learning should be active, assessed by means of paper-and pencil tests, and should require demonstrations in keeping information, and in deep learning, as well.

4. Future Instructional Design Trends and Newest Technologies

Nowadays, instructional design trends and learning, as well as development professionals, should aware of what learners, clients and companies might be expecting. At this time, instructional designers and developers look at new ideas and reading materials for their own positions and those of their colleagues, and also look at industrial, business and military activities, for the development of future e-learning materials, in order for them to become much more productive and effective in different learning environments. Coffey (2017) indicated that instructional design trends, nowadays, include the following trends:

- Personalisation of instructional design, including traditional e-learning, social media, mobile phones, and the use of visual or technological landscapes.
- Providing contributions by means of training and communication, concerning the learning of corporate values and cultural changes.
- Consistent time with organisations and the cultural norms of learners, for rapid delivery of instruction.
- Using behavioral changes in ideal environments, and advances in blended and social learning, which can be designed and constituted from a combination of e-learning and integrated e-learning, with instructor-led content and social learning programs.
- Technological literacy and newer technologies will, in future, be part of instructional design and educational technology (IDT) for designers, developers and learners.

Finally, instructional design should be focused on how learners will actually take the training, and what most effective method of learning with new technologies will be. With this in mind, instructional design movements regarding educational technology or instructional technology, of course, enhances learning strategies in becoming successful for learning design with philosophical trends in educational technology and learning theory, as well as in instructional design theories and ID models. These trends influence problem-solving, motivation, achievement in sciences and social studies, visual and object-oriented programming behaviours for designing lessons, learning materials, developing e-learning environments for different sectors with instructional approaches and ID theories. In addition to these perspectives, there are other cases, such as digital education as pedagogy online, where teachers can be replaced with computer-based tutors, and where universities will be moving towards the hosting of online courses, in the next decade (Sharples, 2016). For this reason, we offer examples, such as massive open online courses (MOOCs) for future classrooms and learning environments. This process will be a form of modern education, supported by resources and services. There is also another point to consider, and that is that education can be designed for a new humanism and global university, by using information communication technology (ICT) applications. Thus, science and technology are becoming very important sections within the areas of humanism and educational technology, in which new, 21st century literacies are needed (Varis, 2017).

Based on emerging trends in instructional design and technology (IDT) approaches, the following print or digital technologies can be used as new technologies for future classrooms, and to develop other learning environments. Jacobs, Dempsey (2007) indicated emerging technologies for the future, and classified those technologies within learning environments. The environments consisted of object-oriented distributed learning, artificial intelligence applications, as well as cognitive science and neuroscience contributions, and they are explained as follows:

- Object-oriented distributed learning includes linked objects, electronic training jackets and metadata tag (courseware design-SCORM) areas.
- Artificial intelligence applications include instructional system approach variables, data mining technologies, expert system model stages, intelligent tutoring systems and cognitive models.
- Cognitive science and neuroscience contributions deal with brain structure and associated neural activity, including psychomotor behavior, recall of information, and decision making processes.

On the other hand, there are additional discussions concerning future learning and digital education. In the case of digital textbooks for digital learning environments, the amount of digital materials used is increased, but experts in this area are only predicting that digital concepts will be about 28 % of the total instructional materials used in 2017 (Kring, 2015). Learning analytics is

generally focused on subjects in STEM, on helping educators and on measuring students' concept levels, by way of a multitude of formats. If the approach is used effectively, learning analytics can help bring early hints to the surface, that could, in turn, indicate a students' performance in faculty and teaching subjects, as soon as possible. It also draws new patterns and analysis techniques for both simple and complex contents, in different fields. Basically, the learning analysis includes following stages as descriptions, diagnostics, predictions and prescriptions in IDT applications. With this process, digital education, in the next 10 years, could have its own virtual reality, which would deal with mobile computing and internet use, for learning environments ([University of Europe Laureate Digital, 2017](#)). Virtual and augmented reality will play an important role in gaming and gamification as well. These are new technologies for the future, based on cybernetics and nanotechnology, and are able to provide aid programs, such as electronic paper and wearable technology, in instructional design.

As we know, virtual reality has been used to help students to learn as effectively and efficiently as possible, in courses such as biology and other sciences. We should be aware of the boundaries between real and virtual learning environments, while designing courses and materials therein, as actual demonstrations or simulations based on ID theories and learning needs. As discussed, regarding virtual reality, augmented reality has similar functions but with more limited possibilities than virtual reality. It might become a dominant factor in the coming years, in the IDT sector. The applications can be seen on smartphone and tablet platforms, for different scientific programs. It is also considered to have an important role in connecting between the virtual and physical worlds. Although virtual reality is a complete step into virtual environments, augmented reality facilitates both visual and physical worlds. Once these systems are purchased for schools, it would be possible to conduct tests and simulations on them in real time, and to make use of live applications to learn, both by doing and by being immersed in real and active learning environments, at the same time. This achievement will be possible by using future technologies in educational settings, as well as digital humanism, and will also become more useful and important in real time for enabling students.

5. Learning Sciences and Research in IDT

In the last century, behaviourism and cognitive psychology had entailed learning and teaching theories, as well as instructional design theories. In recent years, constructivism, besides other learning approaches, had been mentioned to influence the instructional design field, whereas constructivism is not a single theory in education, and its roots depend on historical developments with philosophers and educators from the era BC to the modern day. Some of them, as philosophers and scientists, have been indicated in this paper above. Learning sciences review learning from different sets of assumptions and scientific perspectives, than instructional sciences do, as is the case with instructional design and technology ([Jonassen et al., 2007](#)). Like traditional instructional sciences, it is a theory based and focused on cognitive sciences. As a constructivist approach, learning sciences rely on other factors, such as cognitive anthropology, situated learning, ecological psychology, distributed cognition and Dewey's philosophy, rather than other information-processing theories. In this approach, the learner is intentional, active and ready to take responsibility for constructing all personal mental models. This approach, epistemologically, deals with different learning types, enhanced learning environments, and collaboration among learners. The approach also has connections to design, and makes use of quantitative research methods, in order to establish general theories for designing instructional materials. As a result, design research activities, in IDT, follow many stages. These progress from initial design, to problem solving or needs assessment, to evaluation and reporting on the final product, as in project development for ID models.

6. Epistemology and Design Environments

Epistemology is a branch of philosophy. In history, many educators and scientists have focused on learning and teaching procedures, and the development of theories in instructional design and technology. At this time, knowledge of philosophy, truth information, designing materials and also design practice perspectives, have been indicated. There are systems approaches, grounded and/or cognitive design practices that will be used in design environments. All perspectives will be integrated into technologies to develop virtual and real-time simulations.

These activities, in philosophical perspectives, include types of future instructional designs, such as learning environments, digital designs, gamification, applications of virtual reality, cloud-applications, integrated e-learning, mobile learning design, interface design, motivation, visual designs, multimedia learning methods and the use of instructional design models and networks in education, for the future of learning.

7. Reflection on Learning Theories and IDT

The definition of educational technology, or the field of instructional technology, had been discussed and redefined as a movement with instructional design process, during World War II (Seels, 1989). When we look at 1994 and the newest definitions of AECT in 2008, two main points are addressed as theory and ethics practice with sub-domains, which were given above. With the arguments concerning the definition of IDT, Januszewski and Molenda (2008) provide a full discussion of the conceptual components of this definition. In so doing, they provide a history of the field and its developments, based on learning theories and on instructional theory. On the other hand, Richey (2008) indicated that there are instructional designs and development steps, and also found that creation is broad and includes design, development and evaluation stages. But performance improvement for interpretation was limited in the new definition of ET. In another study, Tennyson (2010) indicated that learning theories and instructional design in history were mentioned by educational psychologists. One of them is Dewey (1975), and another is Thorndike (1913). Dewey was working on a special linking science between theory and educational practice, and Thorndike investigated some golden learning rules to apply in the teaching process, and developed a body of ID principles that include task analysis and teaching methods based on different types of findings from students and research applications. Both Dewey and Thorndike deal with learner behaviours and the law of effect and exercises, and Dewey focuses on discovery of learning strategies, as learning by doing. After this, the improvements provide integration of technology and instruction. As an example, Skinner (1954) developed the science of learning as programmed instruction. Thus, after this, Skinner became a founder of conventional computer-based instruction. Robert Gagne, Leslie Briggs, and Robert Glaser (1962) followed studies to develop ID models from the behavioral approach to cognitive theory (Gustafson, Branch, 2007; Morrison, Ross, Kemp, 2004; Reiser, 2007, Smith, Ragan, 2005). After all, the rest of the studies have conducted instructional theory research, which set the wheels in motion for the development of ID models, as well as technology education from needs assessment and writing objectives for the evaluation of learner performance. By the 1990s, instructional design moved toward an integrated instructional design approach. That means that more than one ID model stage was selected and used to solve learning problems, at the same time, by way of both learning theory and educational technology. At this time, the constructivist approach was accepted to design learning environments with reality and world experiences, and it then became a well-known paradigm. So, educational technology or instructional technology definitions are still under construction by being used interchangeably with instructional design, as well. As a result, we can make a decision about the instructional design and technology (IDT) field that's making great progress in solving learning and technology resource problems, by using IDT foundations and the philosophy of ET, and adapting the latest technologies.

8. Conclusion and Future Work Recommendations

The definition of instructional design and educational technology, with different approaches in the learning process, will still be an important topic with new technological developments. The latest technologies, and their considerations for instructional technology, will be the main subjects for developing learning materials as e-learning, or as integrated e-learning and virtual learning environments, with new trends for online MOOCs, SCORM or face-to-face learning classrooms. For future design and learning environments, instructional design concepts and contexts should be used effectively and efficiently, by experts in educational technology or instructional technology. The philosophy of educational technology will still continue to enhance learning environments, with design and programming, in the field of education. Conventional ID approaches, with new ID models, based on learning theories and approaches, will still be in use for developing instructional materials, procedures and performances in industry, business and military. As a result, epistemology, artificial intelligence, and philosophies in instructional design

process will make vital sense for the development of future learning environments in schools, or outside of classrooms, with the latest technologies in the educational technology field. They also enrich the development of future classrooms values, concerning learning and teaching theories, for both the learners and the users. Thus, instructional design never stops when it comes to developing learning and teaching strategies, and it also creates new, effective and efficient digital and virtual learning materials in learning environments, for training in all sectors around the World.

References

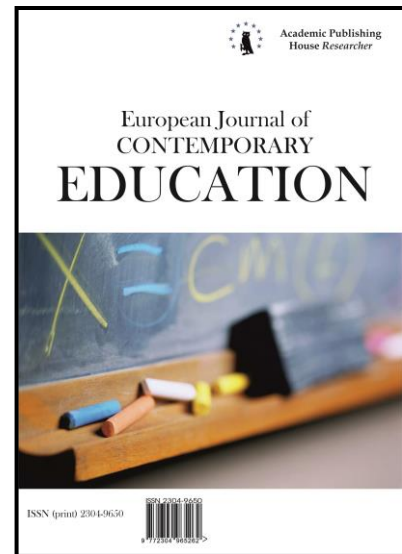
- Coffey, 2017** – Coffey, T. (2017). 2017 Instructional design trends compass: Your accu-learningcast. Adapted from <https://elearningindustry.com/2017-Instructional-design-trends-compass-accu-learningcast>
- Dewey, 1975** – Dewey, J. (1975). Democracy and education: An introduction to the philosophy of education. New York: Free Press.
- Glaser, 1962** – Glaser, R. (1962). Psychology and instructional technology, In R. Glaser (Ed.), *Training research and education*. Pittsburgh: University of Pittsburgh Press.
- Gustafson, Branch, 2007** – Gustafson, K. L. & Branch, R. (2007). What is instructional design. In R. A. Reiser and J. V. Dempsey (Eds.), *Trends and Issues in Instructional Design and Technology* (2nd ed.), Columbus Ohio: Pearson Education, Inc.
- Hannafin, Hill, 2007** – Hannafin, M. J. & Hill, J. R. (2007). Epistemology and the design of learning environments. In R.A. Reiser and J. V. Dempsey (Eds.), *Trends And Issues In Instructional Design And Technology* (2nd ed.), (p.53-61) Columbus Ohio: Pearson Education, Inc.
- Ipek, Izciler, Baturay, 2008a** – Ipek, I., Izciler, M. & Baturay, M. H. (2008). Considerations for integrated E-Learning courseware design and instructional design & technology (IDT) approach. In A. Kuzu, F. Odabasi, A. A. Kurt, I. Kabakci & S. D.Eristi (Eds.). VIII. International Educational Technology Conference, Proceedings, (pp. 508-512). Anadolu University, Eskisehir-TURKEY.
- Ipek, Izciler, Baturay, 2008b** – Ipek, I., Izciler, M. & Baturay, M. H. (2008). New trends and approaches in instructional design and technology: From schools to industry. In A. Kuzu, F. Odabasi, A. A. Kurt, I. Kabakci & S. D. Eristi (Eds.). VIII. International Educational Technology Conference, Proceedings, (pp. 513-517). Anadolu University, Eskisehir-TURKEY.
- Jacobs, Dempsey, 2007** – Jacobs, W. J. & Dempsey, J. V. (2007). Emerging instructional technologies: The near future. In R. A. Reiser. & J. V. Dempsey, (Eds). *Trends and issues in instructional design and technology*. (2nd ed.) New Jersey: Pearson Education, Inc.
- Januszewski, Molenda, 2008** – Januszewski, A. & Molenda, M. (Eds.). (2008). *Educational Technology: A definition with commentary technology*. New York: Lawrence Erlbaum Associates.
- Jonassen, Cermussa, Lonas, 2007** – Jonassen, D., Cermussa, D. & Lonas, G. (2007). Constructivism and instructional design: The emergency of the learning sciences and design research. In R. A. Reiser. & J. V. Dempsey, (Eds). *Trends and issues in instructional design and technology*. (2nd ed.) New Jersey: Pearson Education, Inc.
- Kring, 2015** – Kring, S. (2015). How heavy is your student's backpack? The rise of digital textbooks. eTechTalk. Retrieved 27 November 2015, from <http://blog.etechcampus.com/2015/04/02howheavy-isyour-students-backpackthe-rise-of-digital-textbooks/>
- Morrison, Ross, Kemp, 2004** – Morrison, G., Ross, S. & Kemp, J. (2004). *Designing effective instruction* (4th. Ed.). Hoboken, NJ: J. Wiley & Sons.
- Phillips, 2008** – Phillips, D.C. (2008). Philosophy of education, The Stanford encyclopedia of philosophy (Spring 2009 Edition), In Edward N. Zalta (Ed.), Adapted from <http://plato.stanford.edu/archives/spr2009/entries/education-philosophy/>.
- Reiser, 2007** – Reiser, R. A. (2007). What field did you say you were in? In R.A. Reiser and J. V. Dempsey (Eds.), *Trends and Issues in Instructional Design and Technology* (2nd ed.), Columbus Ohio: Pearson Education, Inc.
- Reiser, Dempsey, 2007** – Reiser, R. A. & Dempsey, J. V. (2007). *Trends and issues in instructional design and technology*. (2nd ed.) Upper Saddle River, New Jersey: Pearson Education, Inc.
- Richey, 2008** – Richey, R. (2008). Reflections on the 2008 AECT Definitions of the Field. *TechTrends*, 52(1), 24.

- Richey, Morrison, Foxon, 2007** – Richey, R. C. Morrison, G. R., & Foxon, M. (2007). Instructional design in business and industry. In R.A. Reiser and J. V. Dempsey (Eds.), *Trends And Issues In Instructional Design And Technology* (2nd ed.), Columbus Ohio: Pearson Education, Inc.
- Seels, 1989** – Seels, B. (1989). The instructional design movement in educational technology. *Educational Technology*, 29(5), 11-15.
- Seels, Glasgow, 1998** – Seels, B. & Glasgow, Z. (1998). *Making instructional design decisions* (2nd ed.). Upper Saddle River, NJ: Merrill/Prentice Hall.
- Seels, Richey, 1994** – Seels, B. B. & Richey, R. C. (1994). *Instructional technology: The definition and domains of the field*. Washington, DC: Associations for Educational Communications and Technology
- Sharples, 2016** – Sharples, M. (2016). Digital education: Pedagogy online. Adapted from <http://www.nature.com/nature/journal/v540/n7633/full/540340a.html>
- Smith, Ragan, 2005** – Smith, P. L., & Ragan, T. J. (2005). *Instructional design* (3rd ed.). Hoboken, NJ: John Wiley & Sons.
- Tennyson, 2010** – Tennyson, R. (2010). Historical reflection on learning theories and instructional design. *Contemporary Educational Technology*, 1(1), 1-18.
- Thorndike, 1913** – Thorndike, E. L. (1913). *The psychology of learning* (Vol. 2). Teachers College, Columbia University.
- University of Europe Laureate Digital, 2017** – University of Europe Laureate Digital. (2017). What do the next 10 years hold for digital education? Adapted from <https://www.uedigital.com/magazine/en/what-do-the-next-10-years-hold-for-digital-education>
- Varis, 2017** – Varis, T. (2017). Education for a new humanism and ICT. EduAkcji, *Magazyn edukacji elektronicznej*, 1(13), 4-13.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.
All rights reserved.
Published in the Slovak Republic
European Journal of Contemporary Education
ISSN 2304-9650
E-ISSN 2305-6746
2017, 6(3): 390-400
DOI: 10.13187/ejced.2017.3.390
www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



Innovative Methods in Teaching Programming for Future Informatics Teachers

Janka Majherová ^a, Václav Králík ^{a,*}

^a Department of Computer Science, Faculty of Education, Catholic University in Ružomberok, Slovakia

Abstract

In the training of future informatics teachers the students obtain experience with different methods of programming. As well, the students become familiar with programming by using the robotic system Lego Mindstorms. However, the small number of Lego systems available is a limiting factor for the teaching process. Use of virtual robotic environments seems to be a suitable alternative for dealing with an insufficient quantity of hardware tools. The resulting programs are created and tested in the virtual laboratory and can be subsequently implemented into a real robot model. In such cases, teaching no longer depends on the available number of hardware kits and the form of teaching can be changed from group to individual. This paper describes our experiences with students' learning with the robotic system Lego Mindstorms, programming environments Bricx and virtual educational environment ROBOTC. One approach to making teaching programming language attractive is the use of robotic kits and virtual environments in the classroom.

Keywords: programming of robot, secondary education, future teacher, Lego Mindstorms, Robot Virtual World, ROBOTC.

1. Introduction

In the current education system we can see visible efforts to modernise the education process. Teachers are becoming more interested in continuing their education and implementing projects with the use of digital technology (DT). Schools are refurbishing teaching facilities with modern educational equipment (technology) so that teachers can implement DT support for teaching various disciplines. The advent of interactive technology enhances research in all

* Corresponding author

E-mail addresses: janka.majherova@ku.sk (J. Majherová), vaclav.kralik@ku.sk (V. Králík)

disciplines and levels of education. However, technology alone is not enough. Quality digital content is needed and it is currently available, among other means, via the Internet.

An essential component of the younger generation's digital literacy is the ability to understand information and use it in different formats from the different sources presented by DT. According to the study conducted by the Institute for Public Affairs (Velšic, 2013), the average value of the digital literacy index in Slovakia increased from 0.33 points (on a scale from 0 to 1) in 2005 to 0.47 points in 2013. The study shows that schools have the highest impact on the improvement of digital literacy. In this research the young people of Slovakia had results approximately 60 per cent better than the overall population average, and during the past decade they have improved their skills and abilities in the most commonly available DT. An improvement of 50 per cent is seen in the ability to work with hardware and peripheral devices such as computers, tablets, smart phones, scanners, printers and portable media. On the other hand, slower growth has been observed in the ability to work with software (editing text, tables and graphics, multimedia and web browsers).

The research of e-skills for the job market in Slovakia has shown that the younger generation still lacks many skills and abilities in DT (Velšic et al., 2016). Among the respondents aged 18 to 26 only 14 per cent claimed that they lacked nothing in this respect. Fifty-seven per cent of young people claimed that they lacked such skills as application programming, system design, website development and multimedia. This problem is closely related to the inadequate preparation for problem solving and inadequate development of algorithmic and logical thinking reported by the other 42 per cent of respondents.

Therefore, we focus on preparing future teachers, as well as practising teachers in continuing education programs, for working with the new developments in modern DT. Extending learning objectives to the digital dimension with the appropriate use of ICT increases the effectiveness of teaching (Nagyová, 2015; Hubwieser et al., 2015; Jacková, 2008).

In order to facilitate the continuing and effective integration of DT and increase the quality of learning processes we can explore and observe potential ways to promote and encourage innovation. The use of educational robotic kits stimulates and motivates students. Motivation in this form of education is based on the method in which students, according to their own proposals, use kits to create a device (a robot, a vehicle, etc.). They program certain features, procedures, behaviour or actions to be performed by the device. Such an interconnection of software and hardware shows how the knowledge of a programming language can be applied in practice (in fields such as automation and process control). The price of educational robotic kits is the factor that determines the quantity of such kits in schools. The solution can be the use of virtual laboratories that can simulate a hardware device and real environment.

2. Teaching programming in real and virtual environments

Teaching programming language in secondary school education has certain specific features which are determined by many factors. One of the factors that influences learning is the complexity of the language. This is the moment to ask oneself: when is the best time to start teaching programming and which language is most appropriate for the specific age group of the students? Our requirement for language selection was the facilitation of continuing education for students, taking into account the intellectual development of students within the scope of secondary school education, as well as the possibility of combining the use of these programming resources for both the lower and upper levels of education.

Interactive environments for teaching programming reinforce the role of visualisation. According to Musa et al. (2015), visualisation in educational environments can provide a simple and effective approach to obtaining results, to problem-solving and to discovering the structure of the model during the process of students learning new information. The visualisation of relations and logical connections within a single model allows us to support students' digital and basic competencies in science and technology. Modelling on the lessons of informatics is not only an instrument, but even the very subject of education, when the students, based on gained knowledge and with the help of digital tools, create a model of a certain part of the real world (Majherová, 2007; Gunčaga et al., 2015).

Educational robotic systems offer several possibilities for teaching programming. According to Saleiro et al. (2013) and Benedettelli (2014), the LEGO Mindstorms building kit has proven to be

an appropriate tool. In addition to various hardware accessories, it also contains basic software that allows teaching programming to students from the age of 8 years. The development and programming environment NXT-G is an iconic type. Students are not directly confronted with the syntax of the language, but the environment allows students to create an algorithm for a simple program (Fig. 1).

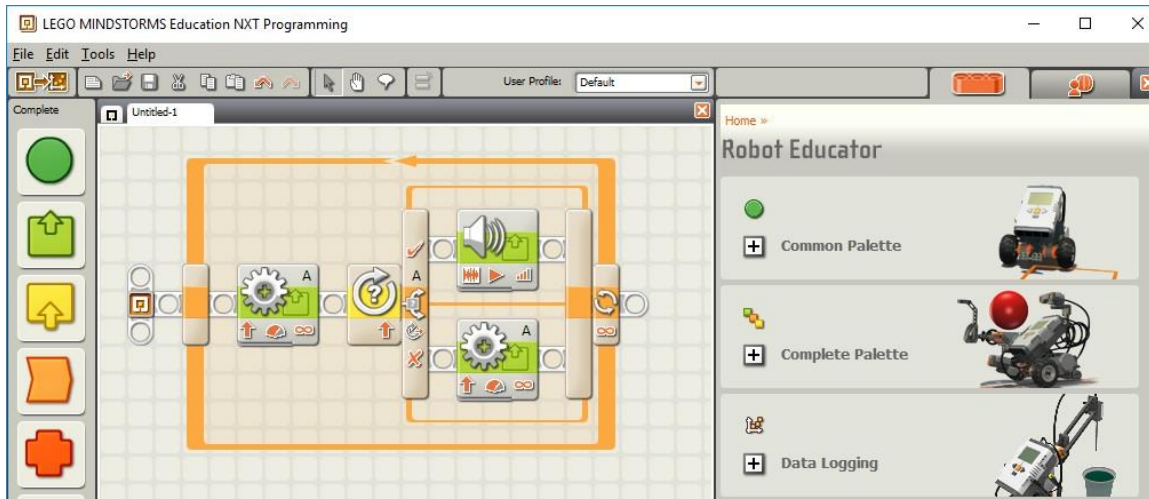


Fig. 1. The Lego Mindstorms NXT environment

Using Lego Mindstorms at a higher level of secondary school education, one can work in the Bricx Command Center (Bricx, 2016) programming environment, which supports multiple programming languages. The advantage of this teaching method is that a student, who was able to create a program in the iconic language and understood the function of iconic commands, can work then with the equal building kit in C language (Fig. 2). The visual connection of brands with the icons of the NXT-G program and commands in the Bricx environment allows the student to assimilate graphical information about the link between the theoretical registration of the solved problem and the icons of commands.

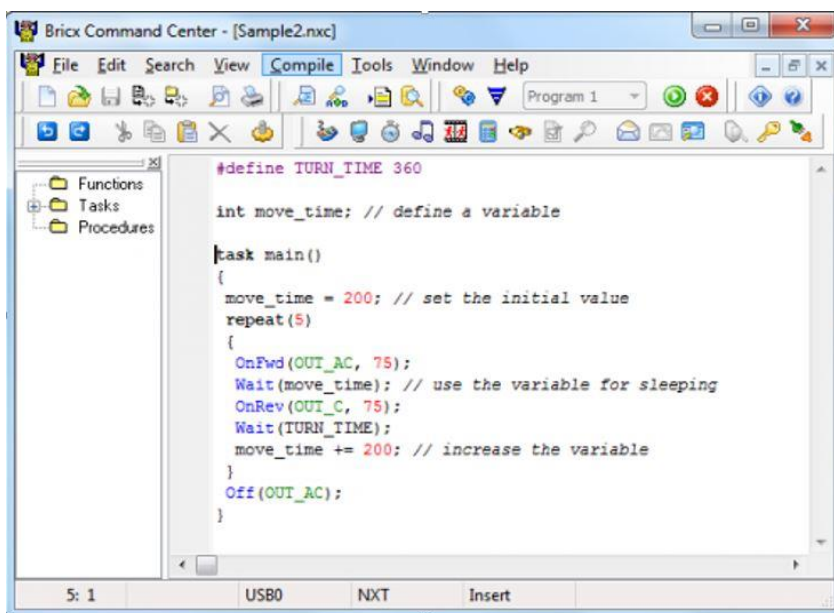


Fig. 2. The Bricx Command Center environment

For programming of microcontrollers it is recommended to make the structure of a programming language as similar as possible to the programming language used in the development of software applications in PC platforms. C language contains libraries for programming sensors and a compiler that will convert the program into the language of a given type of microcontroller. For teaching programming we can use programming language ROBOTC (ROBOTC, 2016). This language is for writing and debugging programs and at software level it offers a comprehensive compiler (real-time debugger).

Liu et al. (2013a), conducted experiments with the ROBOTC and the Robot Virtual Worlds environment (RVW). They wanted to verify how RVW could be used to teach novice programming skills. Students used a combination of the RVW tabletop simulations and the fantasy-based Palm Island programming environment to learn basic programming. One class completed a ROBOTC programming course using physical VEX robots (the Physical class), while the other class completed a ROBOTC programming course using virtual VEX robots (the Virtual class).

According to Liu et al. (2013b), both the Physical class and the Virtual class showed equal learning gains. The type of learning did not differ between the two classes either, as was evidenced by the equal learning gains. The Virtual class did show a time reduction benefit, as they completed the course earlier than the Physical class, with no effect on their overall learning. This suggests that working with the virtual robots allowed students to learn more efficiently in this context, as compared to working with physical robots. The students in the Physical class had to deal with the daily robot setup, additional mechanical issues and the clean-up required when working with a physical robot. Consequently, the teacher spent much more of his time in the Physical class helping students with robot communication and mechanical and class organisation issues. In the Virtual class, the teacher and his students were able to focus 100 per cent of their time on learning programming.

3. The experience

We were looking for tools to support the teaching of programming robots for bachelor degree students who specialise in computer science teaching. The students have the opportunity to familiarise themselves with this technology and way of teaching it, and apply their knowledge in their teaching practice after graduation (Králík, Majherová, 2016).

The content of the robots programming course is adjusted to this goal (Table 1). The course takes place in a computer lab. During the introduction students will explore the history of the development of robotic kits from Lego as well as from other producers. They will become familiar with software tools (languages) used for programming.

Table 1. Content of the course Programming of robot

| Topics | Number of hours Full time/ external form | Goals |
|---|---|--|
| Robotic kits, software tools | 2/1 | Introduction to robot programming |
| NXT-G environment | 4/2 | to solve basic programming tasks |
| Bricx environment | 6/1 | to solve basic programming tasks |
| Construction of robot | 4/1 | to construct a robot |
| ROBOTC language RVW virtual laboratory | 4/2 | to use a virtual environment for robot programming |
| Tutorials and instructions | 4/1 | to use tutorials |

Students are gradually introduced to the NXT-G environment and to a higher-level programming language in the Bricx development environment. Students are divided into groups and program a robot constructed from the LEGO Mindstorms kit. In this part of the course students will become familiar with the general requirements of virtual labs as well as with the

possibility of using virtual laboratories in teaching programming languages. In the practical part of the course they will become familiar with the ROBOTC language and with the RVW virtual laboratory. From the perspective of a teacher, it is very important to motivate students to study programming. To provide this motivation, games and competitions may be considered. Therefore, students will receive information about the scope and rules of national and international competitions in programming robots, for example First Lego League (FLL, 2016) or Istrobot (2016).

The last part of the robots programming course is focused on working with tutorials and instructions. Prospective teachers will become familiar with video tutorials for teaching support from Lego and free guides on the web. Students acquire teaching methodology and working practices for the programming of robots with the help of various manuals.

4. Experimental Setup

The experiment lasted for 1 academic year 2015/2016 and involved 13 participants. The students were divided into two groups: a full-time students group (8 students) and a group of external students (5 students). We tried to compare two approaches to teaching robot programming. In a full-time form of education we taught programming with the use of a physical model of a robot and the NXT-G programming language, as well as the advanced Bricx Command Centre language. In the distance course we used the virtual robotic environment RVW, as well as the ROBOTC program (Table 2). We tried to observe the sequence of key tasks from simple to complex: from the simple iconic programming language up to the programming of a virtual robot.

Table 2. Methods for the robot programming

| | Full-time form | External form |
|-----------------|-------------------------------|-----------------------------|
| hardware | a physical model of a robot | virtual robotic environment |
| software | NXT-G Bricx Command Centre | ROBOTC program |

In order to compare the two approaches, we used a robot constructed according to the instructions designated as “BASE”. This robot has a chassis with two engines and one supporting wheel, and therefore we are dealing with a differential control. The basic sensors from the Lego Mindstorms kit are placed on the robot: touch sensor, light sensor, ultrasound sensor and microphone. This robot can be constructed from the NXT or EV3 Lego kits (Fig. 3). For experiments in the process of teaching programming we use algorithms for the management of a differential gear.



Fig. 3. LEGO Robot “Base” (tutorial NXT-G)

In the context of teaching robots programming in physical environments we use different types of tasks for students. The goal of the project is to compile a program that uses automatic control of the robot’s movements based on values measured by sensors. In this task two sensors are

used for the robot's motion control. The first sensor counts the engine turns; the second sensor provides an ultrasonic measurement of the distance.

Task A: Robot with ultrasonic sensor

Construct a robot that can move forward and stop according to a distance measured by the ultrasonic sensor. Attach an ultrasonic sensor to the robot that points forward. Write a program which makes the robot move towards the wall and then turn back, so it stops at the same place it started.

Important note: The program should function properly regardless of the robot's distance from the wall. The robot's distance from the wall is measured as a variable. The correct solution in the NXT-G environment is shown in Fig. 4.

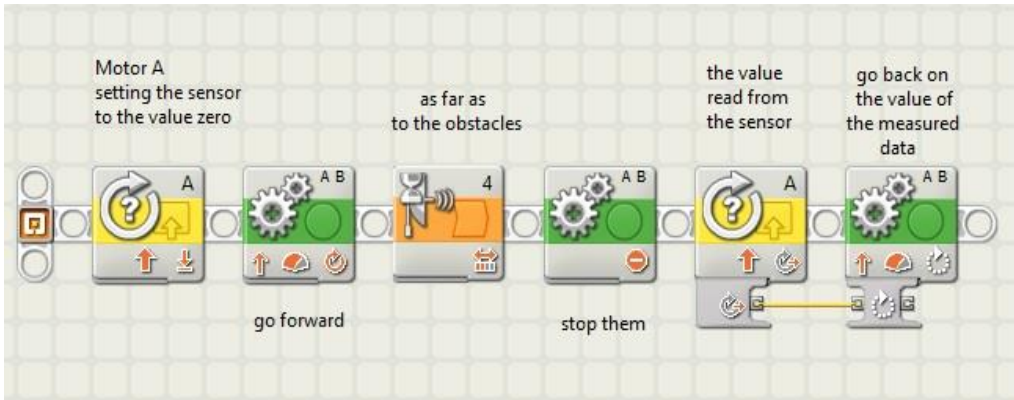


Fig. 4. Correct solution for task A

Task B: Counting lines

For this task we use the already-created chassis from the robot in task A. To the chassis that can move forward and has an ultrasonic sensor that allows measurement of the distance, attach the sensor of light. Its location is important. The measuring part of the sensor has to point downwards. The distance between the measuring part and the pad must be up to 0.5 cm above the pad.

Create a surface with lines according to Fig. 5 to the white paper, measure values for white and black colours using the “View” menu on the NXT brick and write them down.

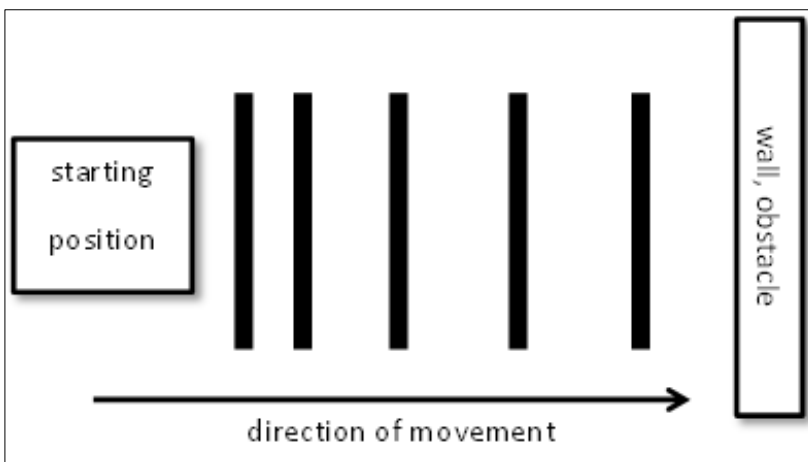


Fig. 5. Drawing of the area

Write a program in which the robot moves forward; with each crossing of the black line the robot should beep, and when it comes to the wall it should stop. Modify the program, so that after stopping it will whistle how many crossed black lines it has recorded.

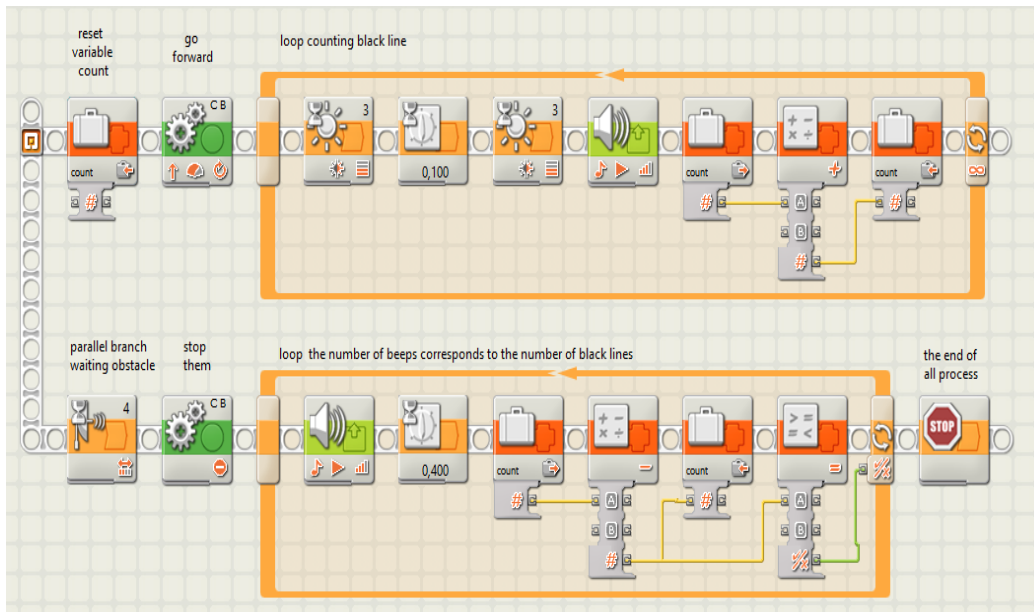


Fig. 6. Solution for task B

Solutions for the tasks A and B (Fig. 4 and 6) are easier to find in a graphical environment. For learning programming it is important to understand by which algorithm the specific task can be solved and through which sequence of commands. The NXT-G environment is graphical and facilitates understanding of the solution. If the assignment is understood in this way, it can then be programmed in a higher-level programming language in the Bricx Command Centre environment. For teaching of programming we use a combination of development environment NXT-G and a higher-level programming language. The advantages of this approach are the visualisation of order sequence and the graphical display of work with variables in the program. Ultimately, this can lead to an effective understanding of work with a higher-level programming language and a faster understanding of the assigned task.

For the second approach to teaching robots programming we used the ROBOTC programming language and a virtual robotic laboratory. ROBOTC, the higher-level programming language, is derived from C++ language, has an online compiler and the capacity to transfer the created program to the robot.

The great advantage of the program ROBOTC is its link to a virtual environment. The virtual model of a robot is identical to the real robot, called BASE. The visualisation of the motion and interactions of the robot in the virtual laboratory take place according to the control programs developed by the students. The visualisation of the motion takes place in the 3D environment and the mutual interactions between the robot and its environment can be observed from different angles.

The advantage to this way of teaching is that we do not need a physical model of the robot, because the verification of the correct operation of the program is performed by using the 3D model of the robot in a virtual environment (Fig. 7).

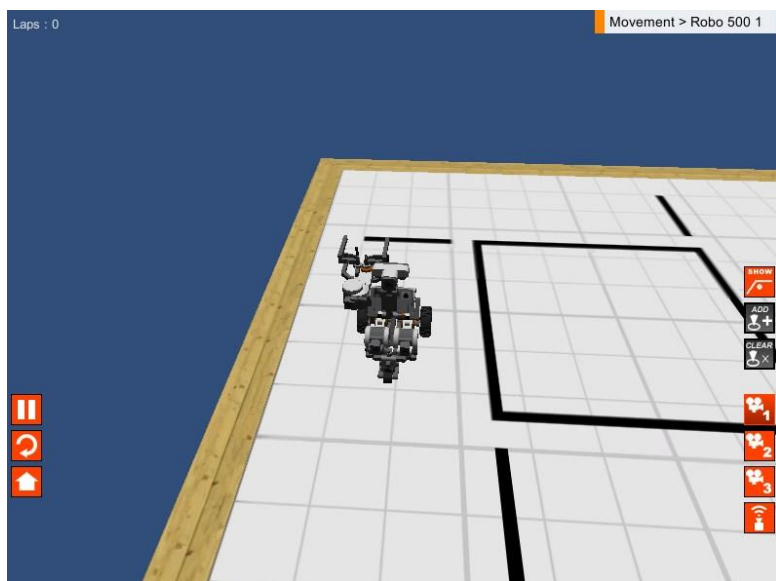


Fig. 7. ROBOTC virtual environment

Programming within a virtual environment is divided into several separate parts which are focused on the movements of the robot, programming the robot sensors and working with variables as well as on controlling the robot. The different programming tasks were prepared in each part of the virtual environment. The correct sequence of the algorithm can be always determined by the interaction between the virtual robot and the virtual environment. Students received visual information about the fulfilment of the task.

5. Results

Full-time students worked only with physical Lego Mindstorms kits in the NXT-G or Brick Command Center environments in the classroom 2 hours per week. The external students worked with physical models of robots in the classroom 4 to 6 hours, as well as conducting self-directed learning outside the classroom with the use of the virtual environment. In the experiment, we verified two approaches for teaching the programming of robot models in the preparation of future teachers of informatics. We examined their advantages and disadvantages. In a small group of students we assessed qualitative results on the basis of observation and the use of a questionnaire.

In the robot programming course we worked with 8 full-time students and 5 external students. At the end of the course the students completed a form with the following questions:

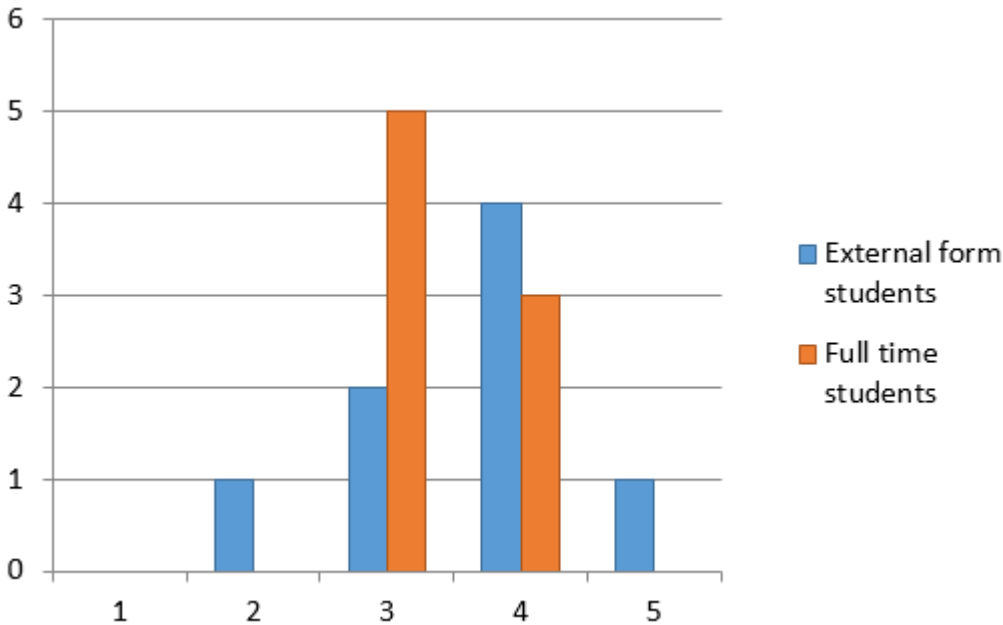
- In which programming environment do you know how to work?
- Have you already programmed a robot?
- Did you work with real robot model during the course?
- Did you work in LEGO Mindstorms during the course?
- Did you work in a virtual environment during the course?
- How do you evaluate your skill in creating a program for the robot? (1 – no skill, 5 – excellent skill)
- How do you evaluate your skill in creating a model of a robot?
- How do you evaluate your skill in working in a virtual environment?
- The final question was open: Assess the benefits of working in a virtual environment compared to the real environment for programming robot models.

Before this course all students have worked in Pascal and C languages; some also knew the children's programming languages Imagine Logo or Scratch. They had encountered robot programming mainly in college; only 5 students reported experience with robots from secondary school.

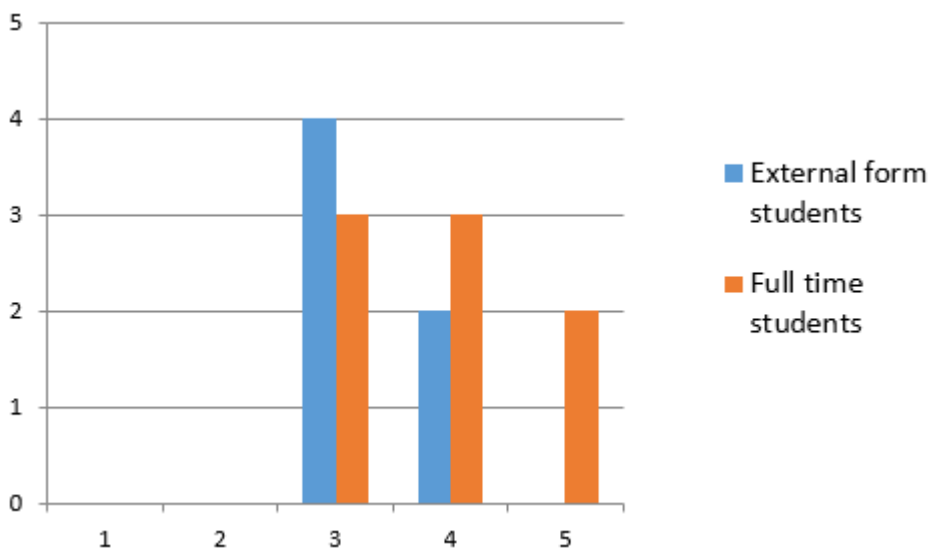
Full-time students had to divide the study time allowed for this subject into two parts. The first part dealt with the construction of a physical model of a robot and the second part was devoted to the creation of a program. In most cases, the students focused more on building a robot

than on creating a program. Full-time students rated their skills for the robot programming with an average score of 3.4 on a scale from 1 – no skills to 5 – excellent skill (Graph 1). Skills in making robot models were rated with an average score of 4.5 (Graph 2).

External students, with a shorter study time allowed for the subject, had fewer opportunities to work with physical models, so a greater emphasis was placed on work in the virtual environment. They rated their skills in constructing a model of a robot with an average score of 3.3 (Graph 2). But the skills for programming the robot were reported as higher, with an average score of 3.75 (Graph 1).



Graph 1. Skills to Create a Robot Model Program (1 – no skill, 5 – excellent skill)



Graph 2. Skills to Create a Robot Model (1 – no skill, 5 – excellent skill)

In the questionnaire we asked students how they see the benefits of working with a robot model in a virtual environment compared to a physical model. These are examples of their responses:

“...in a virtual environment, we can simulate the movement of the robot before we put it into action in a real environment. Working in a virtual environment is time-efficient and financially more profitable”

“...there is a reduction of cost associated with the production of robots, there is also a free access to the virtual laboratory (anytime, anywhere), there is no risk of injury, the virtual environment provides diagnosis of the source code that controls a particular source or combination of sources, simulates various alternatives, there is a compatibility with a wide range of programming languages”

“...we have the opportunity to participate in robotics exercises without direct access to the robot, the automatic online correction of errors in handling the robots in virtual environment is available”

“... new skills in the area of programming”

“...the virtual environment is simpler and takes less time, each can work independently, can work at home via the network at any chosen time”

6. Discussion and conclusion

From an analysis of learning outcomes, we can make several conclusions about the advantages and disadvantages of using physical and virtual approaches to programming robots.

If we use a method consisting of a combination of the NXT-G environment, a higher-level programming language and a real robot, we observe an excellent visibility of a commands sequence for building a program. This is due to the fact that in the NXT-G environment the orders are created with the help of icons. This method is suitable for simple robot motion-control programs, as in tasks A and B mentioned above. In a more complex program the number of commands increases and they take up space as icons on the screen. At some point, if the program becomes too complicated, the advantage of good visibility is lost. Verifying the proper operation of the program is performed on a physical model of a robot in real life conditions. We consider this method of teaching programming to be time-consuming because it is necessary to create and verify tasks prior to their application in educational practice.

Studying with the LEGO Mindstorms kits is motivating for students due to their interaction with the robot that they have to build. However, we are also concerned by the situation in which the mechanical building of a robot takes up the greater part of the teaching time compared to the time allowed for creating a program. The fact that the kits require regular maintenance, as well as taking up storage space after the end of the course, may also be considered a disadvantage.

We also see benefits in the method of teaching programming with the use of the virtual environment, because it provides a substitute for a physical kit. The use of the programming environment is intuitive. The virtual board on which the robot moves is a standard for all experiments; the parameters do not change. The view of the virtual board can be switched between different appearances. Students learn to program a virtual robot as if they had available a physical robot assembled from a kit. Programming takes place in a higher-level programming language. The program created by students can be sent to a teacher as a text file.

The Robot Virtual World programming environment supports only C language. From this perspective, the program appears to be unsuitable for use in grades K4 to K6. We consider this software to be suitable for the higher grades: K7 to K12. The virtual environment allows students to fully concentrate on the tasks associated with programming. Mistakes caused by faulty parts of the robot (sensors, batteries, etc.) are avoided. In addition to direct instruction, it is possible to use this method for distance learning or for other forms of learning. The virtual environment is the software that fully replaces the Lego kit.

In our future research we will explore programming robotic kits connected Lego with module Arduino and Raspberry. According to Polčín et al. (2016), Šnajder and Guniš (2016), in preparing future teachers of computer science it is important to implement new knowledge, methods and forms within the teaching of programming languages, in such a manner that the teaching is made attractive and is interconnected with application outcomes.

7. Acknowledgements

This work is supported by the Research Grant **KEGA 009KU-4/2017** Innovative methods in teaching informatics in secondary education and by the Grant **KEGA 002UJS-4/2014** Interactive electronic learning materials to support implementation of modern technology in teaching mathematics and informatics.

References

- Benedettelli, 2014** – *Benedettelli, D.* (2014). The Lego Mindstorms EV3 Laboratory. San Francisco: No Starch Press. Retrieved from <http://robotics.benedettelli.com/publications>
- Bricx** – Bricx Command Centre. Retrieved from <http://bricxcc.sourceforge.net/>
- Firstlegoleague** – URL: <http://www.firstlegoleague.org/>
- Gunčaga et al., 2015** – *Gunčaga, J., Janiga, R. and Žilková, K.* (2015). Supporting of simulation and visualization through ICT in the educational process. *Information and Communication Technology in Education 2015*. pp. 25-33. Ostrava: University of Ostrava.
- Hubwieser et al., 2015** – *Hubwieser P., Giannakos M. N., Berges M., Brinda Torsten, Diethelm I., Magenheim J., Pal Yogendra, Jacková J. and Jasute E.* (2015). A global snapshot of computer science education in K-12 schools. In: ITiCSE-WGP' 15: proceedings of the 2015 ITiCSE on Working Group Reports, July 4–8, 2015, Vilnius, Lithuania. New York: ACM, 2015. pp. 65-83.
- Jacková, 2008** – *Jacková, J.* (2008). Learning for Mastery in an Introductory Programming Course. In ITiCSE '08 Proceedings of the 13th annual conference on Innovation and technology in computer science education. pp. 352-352. New York: ACM.
- Králík, Majherová, 2016** – *Králík, V. and Majherová, J.* (2016). Virtual Robotic Laboratories Robot C in the Informatics Teachers Training. In *DidMatTech 2016*. Budapest: Eötvös Loránd University.
- Liu et al., 2013** – *Liu, A., Newsom, J., Schunn, Ch. and Shoop, R.* (2013). Students Learn Programming Faster Through Robotic Simulation. *Techdirections*. Vol. 72, n.8.
- Liu et al., 2013a** – *Liu, A.S., Schunn, Ch., Flot, J. and Shoop, R.* (2013). The role of physicality in rich programming environments. *Computer Science Education*. Retrieved from <http://education.rec.ri.cmu.edu/educators/research/>
- Majherová, 2007** – *Majherová, J.* (2007). Virtual plants in high school informatics - L-systems. In *Auer, M. (ed.): International Conference Interactive Computer Aided Learning 2007, ePortfolio and Quality in e-Learning*. CD. Kassel: Kassel University Press.
- Musa et al., 2015** – *Musa S., Ziatdinov, R., Sozcu, O. F. and Griffiths, C.* (2015). Developing Educational Computer Animation Based on Human Personality Types. *European Journal of Contemporary Education*, Vol. 11, Issue 1, pp. 52-71.
- Nagyová, 2015** – *Nagyová, I.* (2015). Analysis of Students' Behaviour in eLearning Course "Educational Technologies". *European Conference on e-Learning*. pp. 428-434. Hatfield: ACPI.
- Polčín et al., 2016** – *Polčín, D., Petrušková, H. and Stando, J.* (2016). Support and Improvement of the Educational Process in Regional Education in Slovakia Through Tablet Classrooms. In *The Third International Conference on Computer Science, Computer Engineering, and Education Technologies*. pp. 71-78. Łódź: Łódź University of Technology.
- ROBOTC** – ROBOTC a C Programming Language for Robotics. Retrieved from <http://www.robotc.net/>
- Robotika** – URL: <http://www.robotika.sk/mains.php>
- Saleiro et al., 2013** – *Saleiro, M., Carmo, B., Rodrigues, J.M.F. and Buf, J. M. H.* (2013). A Low-Cost Classroom Oriented Educational Robotics System. In *Social Robotics: 5th International Conference, ICSR 2013*. LNAI 8329. pp. 74-83.
- Šnajder, Guniš, 2016** – *Šnajder, L. and Guniš, J.* (2016). Analysis of results in inquiry based informatics education of selected topics. *Information and Communication Technology in Education 2016*. pp. 169-180. Ostrava: University of Ostrava.
- Velšic, 2013** – *Velšic, M.* (2013). Digitálna gramotnosť optikou mladej generácie. [Digital literacy view of the young generation]. Bratislava: IVO – Microsoft.
- Velšic, Janotík, 2016** – *Velšic, M. and Janotík, T.* (2016). E-skills a trh práce na Slovensku. [E-skills and job market in Slovakia]. Bratislava: IVO.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.

All rights reserved.

Published in the Slovak Republic

European Journal of Contemporary Education

ISSN 2304-9650

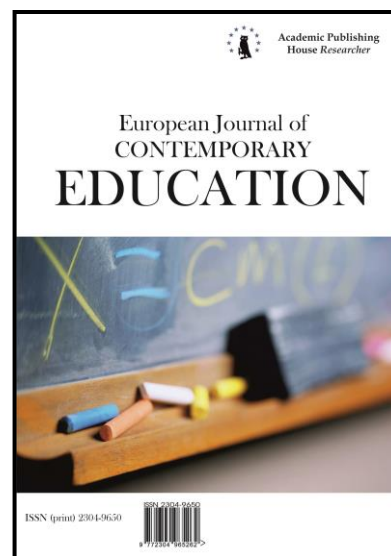
E-ISSN 2305-6746

2017, 6(3): 401-413

DOI: 10.13187/ejced.2017.3.401

www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



mSciences: an Affinity Space for Science Teachers

Jorge Mota ^a, Carla Morais ^{b,*}, Luciano Moreira ^c, João C. Paiva ^b

^a CIQUP, Faculdade de Engenharia, Universidade do Porto, Porto, Portugal

^b CIQUP, UEC, DQB, Faculdade de Ciências, Universidade do Porto, Porto, Portugal

^c CIQUP, DEI, Faculdade de Engenharia, Universidade do Porto, Porto, Portugal

Abstract

The project 'Multimedia in science teaching: five years of research and teaching in Portugal' was successful in featuring the national research on multimedia in science education and in providing the community with a simple reference tool – a repository of open access scientific texts. The current work aims to describe the theoretical background that may allow creating and sustainably developing an online community on science teaching. The community should be capable of appropriating and generating scientific peer review and validation processes, which would allow reflections on teaching practices in science areas using information and communication technologies (ICT) and improvements from a participatory science perspective. Through an action-research process, the current platform is being adjusted in the sense of implementing strategies able to attract and engage an interested public and progressively to create a community of peers. The project is particularly relevant with respect to the gap between academic production and pedagogical practice and the avenues that it opens for comparing affinity spaces across different locations and domains of interest.

Keywords: Multimedia education; science teaching; community of practices; affinity spaces

1. Introduction

Learning, teaching, and communicating science very often implies the use of technology. During recent decades, researchers have tried to understand how people learn using information and communications technology (ICT). Several approaches to teaching have emerged from

* Corresponding author. Adress: Faculdade de Ciências da Universidade do Porto, Rua do Campo Alegre, s/n, 4169-007 Porto.
E-mail addresses: cmorais@fc.up.pt (C. Morais)

different theoretical perspectives, such as behaviourism, constructivism, and cognitivism (Pange et al., 2010).

Instead of considering the different learning theories as discordant, the attention should be directed to the role of the teacher in the selection and articulation of these theories with the pedagogical practice, placing the teachers as pedagogical engineers or designers, with the responsibility to plan classroom activities with the most effective approaches and technologies available (Hung, 2001).

This may seem easy, as the new generation of teachers is said to be increasingly knowledgeable about and skilled in the use of ICT. According to Martinovic and Zhang (2012), new teachers not only are willing to try different kinds of ICT, but they also seek opportunities to do so, with their students' interests as a priority. However, this is not always the case or one free from difficulties, as some problem areas have been detected. Hurdles include the lack of modelling of the pedagogical approaches of ICT; misconceptions about the use of some ICT; restricted access and comfort in the use of ICT among pre-service teachers; and the expectations of these future teachers regarding ICT learning and teaching opportunities (Martinovic, Zhang, 2012). Subject-specific pedagogical uses of technology are also difficult to provide, as there is a separation of content knowledge learning from educational methods in teacher training programs (Han et al., 2013). What thus can be done to persuade teachers to adopt multimedia in their teaching in a critical way, reflecting and sharing the results of their practices and commenting on and assessing their peers' practices?

In this paper, we aim to address the growing need of closing the gap between scholars and practitioners by describing the path that, through an action-research process, allowed us to develop an ongoing online project named mSciences. We will start by framing the reflection on the international policies for a knowledge-driven society that acknowledges the centrality of scientific literacy. This will lead us to the concept of communities of practices explored in Section 3, as an ideal model of horizontal sharing of knowledge. As communities of practice are organic and spontaneous, and, consequently, less suitable for top-down projects such as ours, the paper evolves into the analysis of the affordances of the affinity spaces in Section 4. Section 5 provides a brief description of the characteristics of the affinity space mSciences. The paper concludes with Section 6, presenting the significance of the present and future research on affinity spaces.

2. A knowledge-driven society

Policy actions suggested from the ET2020 Working Group on Schools Policy to improve Initial Teacher Education state the need to improve practice through links with research (Commission, 2015). In Europe, although the infrastructure and a solid research base exist, the potential of new technologies is not being achieved, as few information and communications technology-enabled learning innovations (ICT-ELI) are transmitted from research to educational practice (Brecko et al., 2014).

The Europe 2020 strategy recognized the need for a change in education to achieve new skills and competencies, thus establishing innovation as a key priority in several of its initiatives. This report, involving around three hundred stakeholders in the field of education, sets out several recommendations, including the need to exchange knowledge on the application of innovative ICT-dependent practices, as well as the promotion of research on the ICT-ELI, focused on learning advantages. It also encourages the participation of teachers in professional networks for the dissemination of pedagogical innovation (Brecko et al., 2014).

The gap between research and practice, which is more strongly felt by teachers than by school leaders or researchers, should be reduced (Vanderlinde, van Braak, 2010), therefore allowing science education research findings to be incorporated into teacher preparation, curriculum development, as in teaching and learning (Hazelkorn et al., 2015).

In fact, according to Reich, Gemino, and Sauer (2012), in an organization, high-quality results are not necessarily obtained with the most competent workers, but with elements that, besides being competent, are motivated for effective practices of knowledge and knowledge sharing. Only if knowledge becomes explicit in perceptible forms can it be internalized and applied by other individuals, who will use, extend, and reframe it in their own tacit knowledge (Nonaka, 1991).

To facilitate the sharing of knowledge and good practices, many have turned to information technology, but found that, despite its advantages, IT alone was not enough for this sharing to succeed (Brazelton, Gorry, 2003). Ipe (2003) asserted that the nature of knowledge, the motivation to share, the opportunities for sharing, and the culture of the work environment were the main factors that influenced the dynamics of knowledge sharing in an organization. Moreover, Tseng and Kuo (2014) stated that performance expectation and self-efficacy belief are relevant in knowledge-sharing between teachers.

Open access to publicly funded research results is one important mechanism that could decrease this gap and facilitate new research and innovation (Hazelkorn et al., 2015), as this open and easy access to scientific knowledge would allow for the wider sharing of knowledge (Communities, 2007). All this work, freely available, would also profit from the pronouncement of teachers, researchers, and experts on the science, technology, engineering, and mathematics (STEM) teaching practices (Paiva et al., 2015; 2016) because it would allow the establishment of genuine links between scientists and science educators in a two-way communication (Hazelkorn et al., 2015).

The project 'Multimedia in science teaching: five years of research and teaching in Portugal' was successful in analysing Portuguese research on multimedia in science education and, in addition, in making available a simple query tool associated with a repository of open-access scientific texts (Paiva et al. 2015; 2016). In theory, this query tool would allow access to the beneficial integrative knowledge about technology uses that is pedagogically appropriate and could work in subject specific contexts (Han et al., 2013), but the results of its use thus far have been discouraging.

The results of Kuo and Young (2008) evidenced that in fact people do not always behave consistently in knowledge sharing, confirming that to manage knowledge we also need to manage people. So, how can we drive researchers and teachers toward knowledge sharing to close this gap?

Brazelton and Gorry (2003) stated that there needs to be a common purpose to make people use the collaborative tools for knowledge sharing. Smith (2001), although referring to organizations, suggested the implementation of communities of practice—a community of elements involved in a collective learning process in a common domain (Wenger-Trayner, Wenger-Trayner, 2015). These communities could informally tie people who share expertise, thus enhancing learning and the dissemination of tacit and explicit knowledge (Smith, 2001). In the next section, we will precisely examine the concept of communities of practice.

3. Communities of practices

A community of practice can be seen as a simple social learning system that can achieve complexity by interrelating different communities of practice (Wenger, 2010). We must, however, use some caution, for all that glitters is not gold, and not everything that is referred as a community is a community of practice.

Naturally existing communities of practice (CoPs) are groups of people informally bound together through shared expertise and passion who engage in a process of collective learning, with or without an explicit agenda. Learning may not be the main focus of the community; instead, learning can be an incidental outcome (Wenger-Trayner, Wenger-Trayner, 2015; Wenger, Snyder, 2000), in the sense that participating in a CoP inevitably affords some sort of knowledge (Nistor, Fischer, 2012).

There are three crucial dimensions that shape a community of practice, namely, (i) a domain, (ii) a community, and (iii) a practice (Snyder, Wenger, 2010; Wenger-Trayner, Wenger-Trayner, 2015). The strength of these dimensions ensures the CoP's effectiveness as a social learning system (Snyder, Wenger, 2010). In Figure 1, the larger circle represents the domain of interest and the smaller circle represents the community. Little black dots represent individuals, whereas interaction, represented by the links among them (within the community), establish practices.

Membership in a CoP implies a commitment to a shared domain of interest that, in turn, reflects the identity of the community itself, but may not be recognized as a knowledge area outside of the community (Snyder, Wenger, 2010; Wenger-Trayner, Wenger-Trayner, 2015).

The sense of community is essential. In pursuing their interest in their domain, members engage in joint activities and build relationships that enable learning from each other, even if they do not necessarily work together (Snyder, Wenger, 2010; Wenger-Trayner, Wenger-Trayner, 2015).

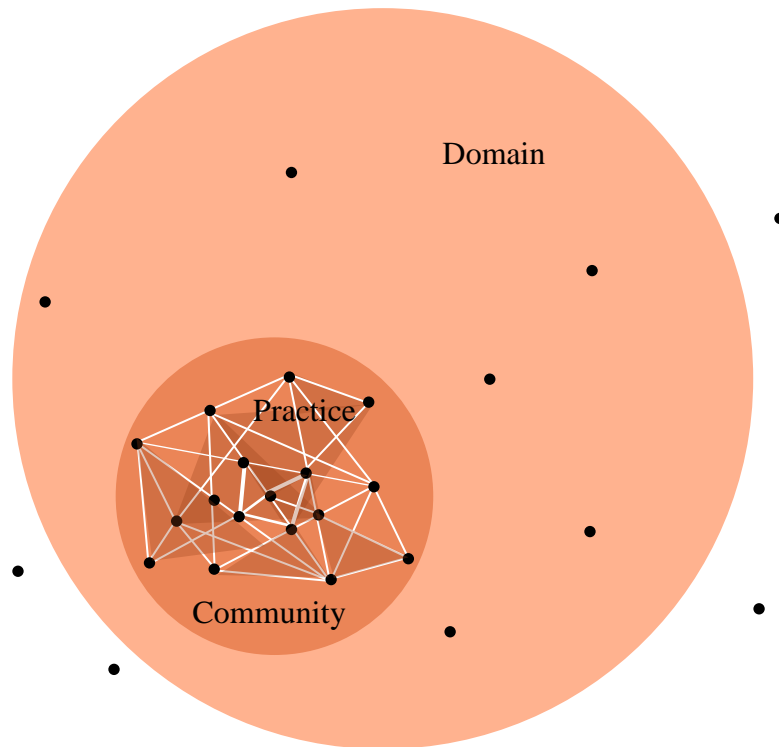


Fig. 1. Dimensions of a community of practice

The practice is developed through time and sustained interaction. As the members interact, they develop, in a more or less self-conscious way, a shared repertoire of resources for addressing problems (Snyder, Wenger, 2010; Wenger-Trayner, Wenger-Trayner, 2015).

CoPs can be found in different areas, such as business, government, or health. When they develop among educational actors, specifically, they can be a suitable tool for professional development (Wenger, 2010).

Although their results cannot be generalized, Tseng and Kuo (2014) demonstrated that through online professional CoPs, teachers were involved in the creation, application, and distribution of knowledge. Their membership in an online professional CoP contributed to their willingness to share resources and help other members to solve problems (Tseng, Kuo, 2014). In line with these results, a Portuguese case study of a CoP of teachers and researchers, with previous experience working together, contributed to the acknowledgement of teachers' CoPs as a potentially effective way to achieve professional pedagogical development (Marques et al., 2016).

Although communities of practice have been around for a long time (Snyder, Wenger, 2010; Wenger, Snyder, 2000), they are not particularly easy to build, due to their organic, spontaneous, and informal nature, which makes them resistant to supervision and interference (Wenger, Snyder, 2000). A healthy CoP is dynamic (Polin, 2010) and, in contrast to natural communities, intentional communities need to rely on invitations to interact, since many of them collapse because they lack the energy to sustain themselves (Wenger et al., 2002). Thus, a good community design needs to identify the direction of the community, emphasize its character, and provide the energy necessary to its growth (Wenger et al., 2002), as informal learning activities and personal relationships are at the basis of communities of practice (Snyder, Wenger, 2010).

The activities of a CoP can differ across modalities and rhythms. In addition to creating knowledge, activities also increase the sense of belonging (Snyder, Wenger, 2010), leading to the establishment of distinct boundaries between those who belong and those who do not (Wenger, 2010).

Wenger et al. (2002) presented, based on their experience, seven principles that reflect their understanding of how different design elements should work:

1. *Design for evolution.*
2. *Open a dialogue between inside and outside perspectives.*
3. *Invite different levels of participation.*

4. Develop both public and private community spaces.
5. Focus on value.
6. Combine familiarity and excitement.
7. Create a rhythm for the community". (p. 51)

Harvey, Cohendet, Simon, and Dubois (2013), on the other hand, have stated that CoPs cannot be deliberately planned and configured, further suggesting that they should rather be considered as a social phenomenon and not as a learning tool. We should further note that the relationships among the fundamental notions of CoPs have been mainly described based on results from qualitative studies and are not yet sufficiently validated based on quantitative evidence (Nistor, Fischer, 2012). In fact, there are very few records of CoPs projected by organizations, and, of the existing records, none provide enough data to analyse the process (Harvey et al., 2013).

Adding to this, the fact that a community of practice relies so deeply on a concept of membership that has different meanings in different contexts (Gee, 2004, 2005) makes it necessary to stimulate a sense of belonging among the various individuals within a collective environment to feed the development of the community, since it should remain alive by the activities of its members and not by external imposition (Harvey et al., 2013).

In their research involving 57 organizational CoPs, Probst and Borzillo (2008) identified three of the five main reasons of failure: the lack of a core group, the low level of interaction between members, and the lack of identification with the CoP. These results led us toward another social configuration where participation, interaction, and learning take place—affinity spaces (Gee, 2004, 2005).

4. Affinity spaces

Approaching affinity spaces differs from examining communities of practice in the sense that, at least initially, we should address the space and not the groups of people; we first explore the limits of these spaces and the interactions that occur there, and later, if necessary, define the community that develops there (Gee, 2004, 2005).

These affinity spaces are, according to Arnone, Small, Chauncey, and McKenna (2011, p. 184), “experimental, innovative, having provisional rather than institutional structures, adaptable to short-term and temporary interests, ad hoc and localized, easy to enter and exit on demand and very generative”. Studies conducted on three online affinity spaces verified transformative works associated with the specific fan culture of each of these spaces by taking an artefact and giving it a new function or expression through a variety of methods and means (Curwood et al., 2013).

The use of the term ‘affinity space’ rather than ‘affinity group’ is thus intentional. Groups are often defined by the space in which people associate rather than on an immediate criterion of affiliation (Gee, Hayes, 2012). From this perspective, the aim of people’s affinity in these spaces is not the other people, but the endeavour or interest around which the space is organized (Gee, 2004). The organization of the space is as important as the organization of people, and the interaction between people and space has its own relevance (Gee, Hayes, 2012).

Affinity spaces may have a physical or a virtual location (Gee, 2004). Nonetheless, Gee and Hayes (2012) have stated that the Internet is a conducive medium for the generation of these spaces. Affinity spaces are included in what Gee (2004) called ‘semiotic social spaces’ (SSS), due to his concern about signs and meanings in these locations (Gee, 2005). They are defined by (i) content, (ii) generators, and (iii) portals. The content (i) refers to something about which this space is developed; the generators (ii) represent everything that can generate content; and the portals (iii) allow access to the space (not the group), being everything that makes possible the contact with the content, as the ways of interacting with this content, individually or with other people (Gee, 2004).

Gee (2004) also lists a set of eleven features that exist in an affinity space, which may eventually be used as a checklist to verify approximation of an SSS to an affinity space. Hayes and Gee (2010), on their view on public pedagogy through video games, later reduced the list to ten items:

1. People relate primarily in terms of common interests and not in terms of race, gender, or age;
2. There is a *continuum* of new to experienced, and everything in between, in the same space, as there is no segregation from unskilled to highly skilled.

3. Everyone can generate material that changes the space;
4. Intensive and extensive knowledge is enabled and encouraged;
5. Individual and distributed knowledge is enabled and encouraged;
6. Dispersed knowledge is encouraged and enabled;
7. Tacit knowledge is encouraged, enabled, and honoured;
8. There are different forms, degrees, and routes to participation;
9. Different routes to status exist in the space;
10. Leadership is porous and leaders are resources'. (p. 188)

As seen in these principles, there are different degrees of participation, allowing everyone to be in the affinity space. According to Gee and Hayes (2012), it seems that the majority of people in the affinity space produces the minority of content, and a minority of people produces the majority of the content. This means that a person can be a high contributor in one affinity space and a low contributor on another, if they wish, according to their passions.

There may be different types of affinity spaces, some of which may be inclusive or supportive, giving people a sense of belonging and cooperation, but they can also stimulate competition for status (Gee, Hayes, 2012).

Gee and Hayes (2012), during their study of different sites associated with *The Sims* game, reported that different sites work in different ways, but some are organized in a way that favours learning, with these spaces being firstly referred to as nurturing affinity spaces. Currently, they are referenced as passionate affinity spaces (PAS) (Gee, 2015).

The list below shows the set of features seen in PAS (Gee, 2015), although it should be noted that the creation of a space that has all the features is indeed difficult and its maintenance involves work (Gee, 2013; Gee, Hayes, 2012):

1. The space is defined by members' passion for a common endeavour, not their race, gender, age, disability, or social class;
2. Participants share a common space regardless of age, experience, expertise, or goals;
3. Participants can produce—not just consume—content; new content is judged by the standards of the space;
4. Social interaction transforms content;
5. The space encourages the development of broad, specialist, individual, and distributed knowledge—creating a new view of expertise as collective;
6. The space facilitates dispersed knowledge through access to off-site sources;
7. The space honours tacit knowledge (such as knowledge attained through trial and error) and encourages explicit knowledge (such as the codified knowledge found in tutorials and forums);
8. The space offers different ways to participate, and different routes to status;
9. Leaders are resources; roles shift frequently, as leaders become learners, learners become leaders, producers become consumers, and consumers become producers;
10. The space supports and encourages producers by providing peer feedback and/or a consumer audience;
11. The space promotes an idea of learning as a proactive, self-propelled process that may require group resources and may involve failure'. (Gee, 2015: 196–197)

According to Krutka, Bergman, Flores, Mason, and Jack (2014), 77 pre-service teachers considered that they evolved as teaching candidates through interactions with peers, in a digital space that presented some of the main characteristics of an affinity space.

We, as Jones, Stephens, Branch-Mueller, and de Groot (2016), instead of seeing affinity spaces and CoPs as separate concepts, see them strongly overlapped, recognizing the space as a strong determiner of community. In fact, Lammers, Curwood, and Magnifico (2012) have stated that social media is now an intrinsic part of participating in these spaces, which are in constant flux, as portals to affinity spaces arise, change, and disappear.

In this way, Lammers et al. (2012), starting on the affinity space concept, presented nine features of an expanded notion, where socializing plays an important role, as not all participation is solely focused on the common endeavour, but contributes to build the community within the space:

1. A common endeavour is primary;
2. Participation is self-directed, multifaceted, and dynamic;
3. Portals are often multimodal;
4. Affinity spaces provide a passionate, public audience for content;

5. Socializing plays an important role in affinity space participation;
 6. Leadership roles vary within and among portals;
 7. Knowledge is distributed across the entire affinity space;
 8. Many portals place a high value on cataloguing content and documenting practices;
 9. Affinity spaces encompass a variety of media specific and social networking portals'.
- (pp. 48–50)

Are these spaces of learning, where knowledge is not restricted to a core of experts, where true innovation is more likely to occur due to high heterogeneity of skills and backgrounds (Gee, Hayes, 2012), providing the conditions of genesis and sustainable development of an online community? Are these spaces capable of challenging teachers to adopt and generate scientific peer review and validation processes? Will these spaces be able to reduce the gap between researchers and teachers?

5. mSciences: A brief description

Among other objectives, the first phase of a project entitled ‘Multimedia in science teaching: five years of research and teaching in Portugal’ aimed to understand what academic studies publicly released and made available in Portugal between 2010 and 2014 had to tell us about the usage of multimedia in science teaching (for complete results, see Paiva et al., 2015; 2016).

The systematic review of literature was based on a corpus consisting of 75 works (Table 1). These academic studies were organized in an open online repository that allowed visitors to upload and revise other academic works.

Table 2. ‘Multimedia in science teaching: five years of research and teaching in Portugal’ corpus of study.

| Field | Percentage of works |
|------------------|---------------------|
| Mathematics | 49 % |
| Physics | 15 % |
| Natural Sciences | 14 % |
| Chemistry | 11 % |
| Biology | 7 % |
| Geology | 4 % |

Through an action-research process, the current platform (Mota et al., 2017) is the object of pertinent modifications to implement features based on the Lammers et al. (2012) expanded notion (Table 2) of creating a dynamic community that surpasses the difficulties of transmitting and sharing knowledge among science teachers and researchers.

Table 2. Modifications to implement features based on the Lammers et al. (2012) expanded notion on the affinity space concept.

| Feature | Notion | Action |
|---|---|---|
| 1. A common endeavour is primary. | The common endeavour aggregates participants in affinity spaces and not other social factors. | <ul style="list-style-type: none"> ▪ Project Name and Identity. ▪ Project public presentations. |
| 2. Participation is self-directed, multifaceted, and dynamic. | There are different modes and ways of participation, as well as different paths to status within affinity spaces. | <ul style="list-style-type: none"> ▪ Social Networks connection ▪ Comment section ▪ Forums |
| 3. Portals are often multimodal. | Despite the importance of discussion panels as key portals when the | <ul style="list-style-type: none"> ▪ Social Networks connection |

| Feature | Notion | Action |
|---|--|--|
| | concept was developed, many online portals encourage now multimodal participation, using different media. | <ul style="list-style-type: none"> ▪ Comment section ▪ Forums ▪ Enable Work uploading ▪ Open Repository Restructuration |
| 4. Affinity spaces provide a passionate, public audience for content. | Social status can be gained by sharing knowledge within the space, making the affinity space participants an audience for content that they can respond to, as active members or even collaborators. | <ul style="list-style-type: none"> ▪ Social Networks connection ▪ Comment section ▪ Forums ▪ Rating ▪ Status display (Subscriber, Collaborator, Author) |
| 5. Socializing plays an important role in affinity space participation. | The endeavour is not the only focus of all participation, as other practices, designed to build community within the space, play an important role. | <ul style="list-style-type: none"> ▪ Internal social network |
| 6. Leadership roles vary within and among portals. | Portals have leaders that can fill different roles within a portal as they can be moderators, administrators, designers, and facilitators, or any other role existing in the affinity space. | <ul style="list-style-type: none"> ▪ Available leadership roles (Author, Administrator) |
| 7. Knowledge is distributed across the entire affinity space. | Knowledge and content are distributed, broadening the affinity space. | <ul style="list-style-type: none"> ▪ Comment section ▪ Forums ▪ Open Repository Restructuration ▪ How to Section |
| 8. Many portals place a high value on cataloguing content and documenting practices. | Knowledge is explicitly distributed and organized. | <ul style="list-style-type: none"> ▪ Forums ▪ Open Repository Restructuration |
| 9. Affinity spaces encompass a variety of media specific and social networking portals. | Often affinity spaces are connected to existing social networks that contribute to the growth and to a dynamic participation of the spaces. | <ul style="list-style-type: none"> ▪ Social Networks connection |

In this way, an effort is being made to create a project name and identity (Fig. 2), as well as the presentation of the project to the target audience, because ‘*the common endeavour, and not other social factors, brings participants together in affinity spaces*’ (Lammers et al., 2012: 48).



Fig. 2. Home page interface

The repository search was limited, being dependent on a reduced number of filters and on not allowing associations between similar contents, nor on the sharing of knowledge and the feedback of the participants regarding the quality and application of the available works in a learning environment.

To enable the exchange of knowledge, the open repository was restructured into several categories (namely, scientific content area, multimedia, and pedagogical perspective) (Fig. 3) and new functionalities were applied, such as evaluation and comments, allowing information feedback to researchers regarding the application of their work (Fig. 4).



Fig. 3. Repository interface and restructuration into several categories



Fig. 4. New functionalities applied, such as evaluation and comments, to the repository interface

The connection to social networks has also been established, through the integration of existing platforms and sharing buttons (Fig. 5). An internal social network was also integrated, allowing registration, establishment of public profiles, internal roles, comments, friendships, and participation in the forums.

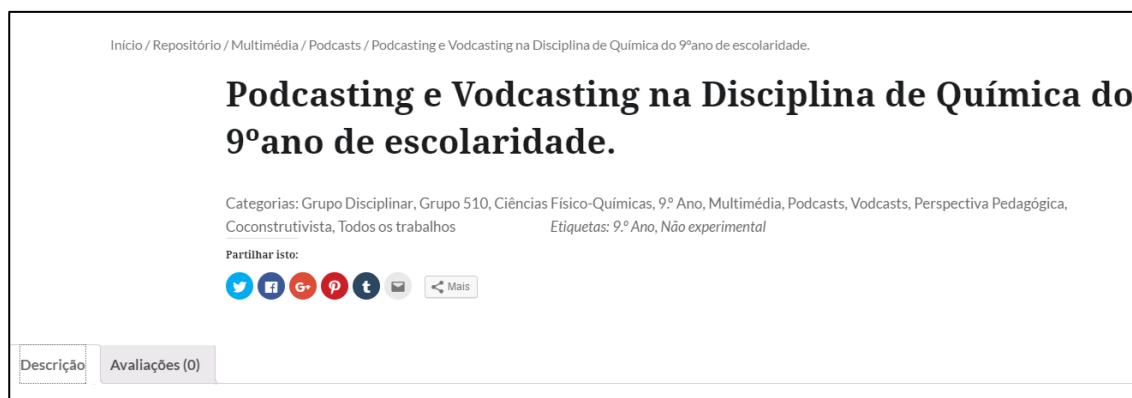


Fig. 5. Connection to existing social networks.

Articles showing ‘how to’ or disseminating other projects or multimedia were also produced and disseminated through the platform, social networks, and e-mail. Researchers have also been invited to present their work on our platform. Existing social network portals related to science teaching were also used to disseminate the project. These changes were made to not only to attract but also to maintain an interested public to progressively create a peer community that would smooth the gap between academic practice and teaching practice.

6. Conclusions

In this paper, we examined the concepts of community of practices (CoPs) and affinity spaces to guide and support the transformation of an open access repository into a participated space could reduce the gap between researchers and educators by allowing knowledge sharing and the dissemination of best practices.

Science education is fundamental to society, for economic, utilitarian, cultural, democratic, and moral reasons. Literate citizens are more likely to understand the world around them, and to thus make informed decisions about the social challenges and their own well-being. However, there is a gap between scholars and educators prevents science teachers from having easy access to best practices, new pedagogical proposals based on multimedia, and information about critically adopted pedagogical and communicational strategies in their formal and informal practices. Recent changes in the labour market that have made education more unstable, as have changing social expectations on teachers’ roles; these may affect teachers’ identity status and inhibit them to move beyond curriculum or classroom contexts. Because of these hurdles, we are wasting opportunities and resources to promote citizens’ scientific literacy, qualify teachers, and challenge researchers.

Affinity spaces may contribute to feed a knowledge-driven society, taking the best out of its human resources and devising opportunities to educate citizens towards a greater understanding of science.

Keeping in mind that there are scarce empirical accounts for the process of development of an affinity space and of the significance that such spaces assume for their users—not to mention its impact in their practices—the detailed accounts made in this paper may enlighten future research, establishing the conditions for comparative results on the medium term.

Knowledge sharing, work dissemination, and update of information to improve real, day-to-day teaching activities are some of the advantages afforded by the mSciences affinity space through interaction with the platform. The space was also built to allow different levels of participation and interaction, as well as to enable the production and consumption of content, although, as seen in other affinity spaces, most participants are consumers and the minority are producers.

It also relevant to state that this is not meant to be an exclusively qualitative study. In fact, at this moment, we are handling data from primary and science teachers gathered through a questionnaire developed upon the theory of planned behaviour (Ajzen, 1991, 2006). Also, platform statistics as to number of views, visitors, registered users, comments, publications, and social networks integration, gathered through such metrics as the number of page likes, followers, reactions, and shares, are being monitored.

We hope that this combined approach will contribute to an empirically based analysis of the principles behind affinity spaces that can be useful to enable systematic comparisons across different locations and domains of interest.

Future work will be needed on the evaluation of the capability of appropriating knowledge, generating scientific peer review, and validation processes by mSciences participants.

7. Acknowledgement

Luciano Moreira is supported by the FCT grant: PD/BD/114152/2015.

References

- Ajzen, 1991 – Ajzen, I. (1991). The theory of planned behavior. *Organizational behavior and human decision processes*, 50(2), 179-211.
- Ajzen, 2006 – Ajzen, I. (2006). Constructing a theory of planned behavior questionnaire: Amherst, MA.
- Arnone et al., 2011 – Arnone, M. P., Small, R. V., Chauncey, S. A., & McKenna, H. P. (2011). Curiosity, interest and engagement in technology-pervasive learning environments: a new research agenda. *Educational Technology Research and Development*, 59(2), 181-198.
- Brazelton, Gorry, 2003 – Brazelton, J., & Gorry, G. A. (2003). Creating a knowledge-sharing community: if you build it, will they come? *Communications of the ACM*, 46(2), 23-25.
- Brecko et al., 2014 – Brecko, B., Kampylis, P., & Punie, Y. (2014). Mainstreaming ICT enabled Innovation in Education and Training in Europe-Policy actions for sustainability, scalability and impact at system level. Luxembourg: Publications Office of the European Union: Institute for Prospective Technological Studies, Joint Research Centre.
- Commission, 2015 – Commission, E. (2015). Shaping career-long perspectives on teaching: a guide on policies to improve initial teacher education.
- Communities, 2007 – Communities, E. (2007). The European Research Area: New Perspectives - Green Paper.
- Curwood et al., 2013 – Curwood, J. S., Magnifico, A. M., & Lammers, J. C. (2013). Writing in the Wild: writers' motivation in fan-based affinity spaces. *Journal of Adolescent & Adult Literacy*, 56(8), 677-685.
- Gee, 2004 – Gee, J. P. (2004). Situated language and learning: A critique of traditional schooling: Psychology Press.
- Gee, 2005 – Gee, J. P. (2005). Semiotic social spaces and affinity spaces. Beyond communities of practice language power and social context, 214-232.
- Gee, 2013 – Gee, J. P. (2013). Our New Out-of-School "Schools of Choice and Passion" Good video games and good learning: Collected essays on video games, learning, and literacy (Second Edition ed., pp. 125-140): Peter Lang.
- Gee, 2015 – Gee, J. P. (2015). Accountable talk and learning in popular culture: the game/affinity paradigm. Socializing intelligence through academic talk and dialogue. New York, NY: Routledge, for AERA books.
- Gee, Hayes, 2012 – Gee, J. P., & Hayes, E. (2012). Nurturing affinity spaces and game-based learning. In C. Steinkuehler, K. Squire, & S. Barab (Eds.), Games, learning, and society: Learning and meaning in the digital age (pp. 129-155). Cambridge: Cambridge University Press.
- Han et al., 2013 – Han, I., Eom, M., & Shin, W. S. (2013). Multimedia case-based learning to enhance pre-service teachers' knowledge integration for teaching with technologies. *Teaching and Teacher Education*, 34, 122-129.
- Harvey et al., 2013 – Harvey, J.-F., Cohendet, P., Simon, L., & Dubois, L.-E. (2013). Another cog in the machine: Designing communities of practice in professional bureaucracies. *European Management Journal*, 31(1), 27-40.

- Hazelkorn et al., 2015 – Hazelkorn, E., Ryan, C., Beernaert, Y., Constantinou, C. P., Deca, L., Grangeat, M., . . . Welzel-Breuer, M. (2015). Science Education for Responsible Citizenship. Report to the European Commission of the Expert Group on Science Education.
- Hung, 2001 – Hung, D. (2001). Theories of learning and computer-mediated instructional technologies. *Educational Media International*, 38(4), 281-287.
- Ipe, 2003 – Ipe, M. (2003). Knowledge sharing in organizations: A conceptual framework. *Human resource development review*, 2(4), 337-359.
- Jones et al., 2016 – Jones, K. M., Stephens, M., Branch-Mueller, J., & de Groot, J. (2016). Community of practice or affinity space: A case study of a professional development MOOC. *Education for Information*, 32(1), 101-119.
- Krutka et al., 2014 – Krutka, D. G., Bergman, D. J., Flores, R., Mason, K., & Jack, A. R. (2014). Microblogging about teaching: Nurturing participatory cultures through collaborative online reflection with pre-service teachers. *Teaching and Teacher Education*, 40, 83-93.
- Kuo, Young, 2008 – Kuo, F. Y., & Young, M. L. (2008). A study of the intention–action gap in knowledge sharing practices. *Journal of the Association for Information Science and Technology*, 59(8), 1224-1237.
- Lammers et al., 2012 – Lammers, J. C., Curwood, J. S., & Magnifico, A. M. (2012). Toward an affinity space methodology: Considerations for literacy research. *English Teaching*, 11(2), 44.
- Marques et al., 2016 – Marques, M. M., Loureiro, M. J., & Marques, L. (2016). The dynamics of an online community of practice involving teachers and researchers. *Professional Development in Education*, 42(2), 235-257. doi:10.1080/19415257.2014.997396
- Martinovic, Zhang, 2012 – Martinovic, D., & Zhang, Z. (2012). Situating ICT in the teacher education program: Overcoming challenges, fulfilling expectations. *Teaching and Teacher Education*, 28(3), 461-469.
- Mota et al., 2017 – Mota, J., Morais, C., & Moreira, L. (2017). Social learning systems: closing the gap between scholars and science educators. In M. Gomes, A. Osório & L. Valente (Eds.), X Conferência Internacional de TIC na Educação - Challenges 2017 - Learning in the clouds (pp.1039-1044). Braga.
- Nistor, Fischer, 2012 – Nistor, N., & Fischer, F. (2012). Communities of practice in academia: Testing a quantitative model. *Learning, Culture and Social Interaction*, 1(2), 114-126.
- Nonaka, 1991 – Nonaka, I. (1991). The Knowledge-Creating Company Harvard business review, November-December, 96-104.
- Paiva et al., 2015 – Paiva, J. C., Morais, C., & Moreira, L. (2015). Multimédia no ensino das ciências: cinco anos de investigação e ensino em Portugal [Multimedia in science teaching]. Lisboa: Fundação Francisco Manuel dos Santos.
- Paiva et al., 2016 – Paiva, J. C., Morais, C., & Moreira, L. (2016). Multimedia in science teaching: pedagogical designs and research options in the Portuguese education between 2010-2014. L. Gómez Chova, A. López Martínez, & I. Candel Torres, Proceedings of EDULEARN16 Conference (pp. 7690-7698). Barcelona: IATED.
- Pange et al., 2010 – Pange, J., Lekka, A., & Toki, E. I. (2010). Different learning theories applied to diverse learning subjects A pilot study. *Procedia - Social and Behavioral Sciences*, 9, 800-804. doi:10.1016/j.sbspro.2010.12.237
- Polin, 2010 – Polin, L. G. (2010). Graduate Professional Education from a Community of Practice Perspective: The Role of Social and Technical Networking. In C. Blackmore (Ed.), *Social learning systems and communities of practice*: Springer.
- Probst, Borzillo, 2008 – Probst, G., & Borzillo, S. (2008). Why communities of practice succeed and why they fail. *European Management Journal*, 26(5), 335-347.
- Reich et al., 2012 – Reich, B. H., Gemino, A., & Sauer, C. (2012). Knowledge management and project-based knowledge in it projects: A model and preliminary empirical results. *International Journal of Project Management*, 30(6), 663-674. doi:http://dx.doi.org /10.1016/j.ijproman.2011.12.003.
- Smith, 2001 – Smith, E. A. (2001). The role of tacit and explicit knowledge in the workplace. *Journal of knowledge Management*, 5(4), 311-321.
- Snyder, Wenger, 2010 – Snyder, W. M., & Wenger, E. (2010). Our World as a Learning System: A Communities-of-Practice Approach. In C. Blackmore (Ed.), *Social learning systems and communities of practice*: Springer.

[Tseng, Kuo, 2014](#) – *Tseng, F. C., & Kuo, F. Y. (2014). A study of social participation and knowledge sharing in the teachers' online professional community of practice. Computers and Education, 72, 37-47. doi:10.1016/j.compedu.2013.10.005*

[Vanderlinde, van Braak, 2010](#) – *Vanderlinde, R., & van Braak, J. (2010). The gap between educational research and practice: Views of teachers, school leaders, intermediaries and researchers. British Educational Research Journal, 36(2), 299-316.*

[Wenger-Trayner, Wenger-Trayner, 2015](#) – *Wenger-Trayner, E., & Wenger-Trayner, B. (2015). Introduction to communities of practice - A brief overview of the concept and its uses.*

[Wenger, 2010](#) – *Wenger, E. (2010). Communities of Practice and Social Learning Systems: the Career of a Concept. In C. Blackmore (Ed.), Social learning systems and communities of practice: Springer.*

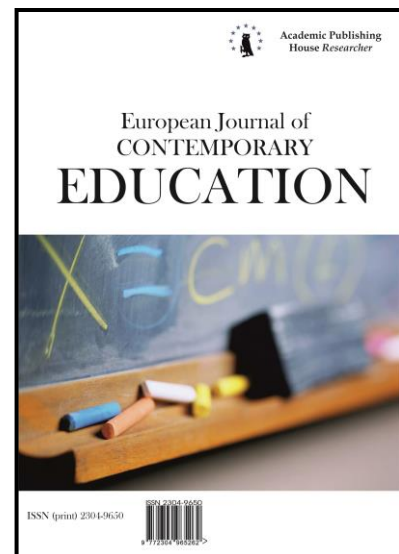
[Wenger et al., 2002](#) – *Wenger, E., McDermott, R., & Snyder, W. M. (2002). Seven principles for cultivating communities of practice Cultivating Communities of Practice: a guide to managing knowledge (pp. 49-64).*

[Wenger, Snyder, 2000](#) – *Wenger, E., & Snyder, W. (2000). Communities of practice: The organizational frontier. Harvard business review, 78(1), 139-146.*



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.
All rights reserved.
Published in the Slovak Republic
European Journal of Contemporary Education
ISSN 2304-9650
E-ISSN 2305-6746
2017, 6(3): 414-431
DOI: 10.13187/ejced.2017.3.414
www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



Lower-Order Mathematical Thinking Skills in Finance, from the Viewpoint of Financial Employees in the Iranian Bank of Industry and Mine

Seyedeh Zahra Aboalhasani Kumleh ^a, Fereydon Rahnamay Roodposhti ^{b,*}, Ahmad Shahvarani ^a, Farhad Hosseinzadeh Lotfi ^a

^a Department of Mathematics, Science and Research Branch, Islamic Azad University, Tehran, Iran

^b Department of Finance and Accounting, Science and Research Branch, Islamic Azad University, Tehran, Iran

Abstract

In this paper, lower-order mathematical thinking skills within finance were studied from the viewpoint of financial employees in the Iranian Bank of Industry and Mine. To conduct this research, a questionnaire was developed after reviewing lower-order mathematical thinking skills in finance. In accordance with the revised Bloom's taxonomy, the skills considered in the questionnaire were "remembering mathematics in finance", "understanding mathematics in finance", and "applying mathematics in finance". In order to develop the questionnaire, we conducted interviews with employees and scholars, then a suitable sample familiar with mathematics and finance, consisting of 141 bank employees, was studied. Descriptive and inferential statistics were used for data analysis. Our findings show a hierarchical relationship between the first three mathematical thinking skills in finance, which confirms the revised Bloom's taxonomy. In addition, the attitudes of participants were positive concerning the importance of these skills. Participants believed that, in order to achieve proper functioning, it is essential to improve the skills of financial employees. The results were analysed with a T-test and ANOVA. This showed that the gender, position, experience, department, degree, and field of study of participants did not affect their attitudes. This research indicates that, for the successful utilisation of skills, it is essential to form an effective relationship between mathematical science and its practical application in the banking world. It is recommended to hold on-the-job training courses for financial employees in banks to empower them to use their computational skills.

* Corresponding author

E-mail addresses: rahnama.roodposhti@gmail.com (F. Rahnamay Roodposhti),
zaboalhasani93@gmail.com (S. Z. Aboalhasani Kumleh)

Keywords: lower order mathematical thinking skills, finance, Bloom, mathematics at work, bank employees.

1. Introduction

Mathematical thinking is an issue that has attracted many mathematics educators. There is a large body of varied literature including various conceptions of mathematical thinking, but there is a general agreement among researchers that the most important goal of mathematical education is to develop the ability to think correctly (Polya, 1969). Some scholars also studied mathematical skills in the workplace (Bakker et al., 2011; Hoyles et al., 2002). So far, very little attention has been paid to the role of mathematical thinking skills in financial affairs. In this paper, we are particularly interested in examining the hierarchical relationship between the first three levels of mathematical thinking skills (based on the revised Bloom's taxonomy), due to the mathematical nature of the topics and financial affairs. We focus on identifying skill gaps in financial affairs in one of the banks in Iran, the Bank of Industry and Mine (a developmental bank), statistically comparing the means of demographic characteristics of the samples. The aim of this study is to survey the views of the bank's employees on lower-order mathematical thinking skills in financial affairs, in order to better identify a curricula framework for learning in schools and banks. Another aim of this study is to survey the significant difference between demographic characteristics of participants regarding the importance of lower-order mathematical thinking skills in finance, based on the revised Bloom's taxonomy.

The literature study begins with information on adult mathematics education and proceeds to theories of lower-order mathematical thinking skills (Bloom, 1956; Anderson et al., 2001; Tukuram, 2013), then mathematical skills especially in finance and banking, ending with lower-order mathematical thinking in finance how to enhance professional skills of those in banking and finance. We use descriptive and inferential statistics to describe the results, and identify guidelines for lower-order mathematical thinking skills at work in order to satisfy the educational needs of bank employees.

Two stages were considered, lower-order and higher order mathematical thinking skills, which were based on the revised Bloom's taxonomy (Anderson et al., 2001). Here, we only address lower-order thinking skills in a bank. A separate paper addresses higher-order mathematical thinking skills in the bank. As one of the main tasks of banks is to have good consistency across levels, we used the revised Bloom's taxonomy integrated with Stacey's view for developing a questionnaire. Question 1: Is there a hierarchical relationship between the constructs of lower-order mathematical thinking skills in finance? In order to examine finance-related employees' acceptance/ resistance attitudes toward the lower order mathematical thinking skills in the Iranian Bank of Industry and Mine, we asked Question 2: How much does remembering mathematics need to be improved to enhance the calculation skills of financial users in the banking industry? Also, Question 3: How much does understanding mathematics need to be improved to enhance understanding and financial problem-solving skills of financial users in the banking industry? And Question 4: How much does applying mathematics need to improve to increasing work problem-solving skills of financial users in the banking industry? Then, in order to test for significant differences between the means of demographic characteristics of the samples, we tested further questions, starting with Question 5: Is there a significant difference between the means of viewpoints of female and male participants regarding the importance of lower-order mathematical thinking skills in finance? Also, Question 6: Is there a significant difference between the means of the viewpoint of participants in different positions (managers or experts) regarding the importance of lower-order mathematical thinking skills in finance?; Question 7: Is there a significant difference between the means of participant viewpoints with different levels of education on the importance of lower-order mathematical thinking skills in finance?; Question 8: Is there a significant difference between the means of viewpoints of participants from different fields of study on the importance of lower-order mathematical thinking skills in finance?; Question 9: Is there a significant difference between the means of viewpoints of participants with different work experience on the importance of lower-order mathematical thinking skills in finance?; and Question 10: Is there a significant difference between the means of viewpoints of participants in different departments regarding the importance of lower-order mathematical thinking skills in finance?

2. Literature review

In this paper, the literature study indicates the importance of interdisciplinary research in the sciences of mathematics and finance.

Mathematical thinking

Several authors have attempted to define mathematical thinking, but at the time of writing, there was still no accepted definition. Har's (2011) definition offers a good start to understanding the nature of mathematical thinking – "A good critical thinker (a) raises vital questions and problems, formulates them clearly and precisely; (b) gathers and assesses relevant information, using abstract ideas to interpret it effectively comes to well-reasoned conclusions and solutions, testing them against relevant criteria and standards; (c) thinks open-mindedly within alternative systems of thought, recognizing and assessing, as need be, their assumptions, implications, and practical consequences; and (d) communicates effectively figuring out solutions to complex problems" with supporting evidence and proofs (Tularam, 2013). Some general approaches to mathematical thinking can be distinguished. In one approach, educators such as Stacey (2006) believe in using mathematical thinking skills in relation to other scientific fields such as science, technology, and economics. They see these skills in the context of their relationship with everyday life, in communication with ideas and phenomena, and in certain kinds of modeling. These educators believe that applying maths in real-life problem-solving has a key role in improving conceptual learning, and can be used as a special tool for fostering understanding and developing human control (Burton, 1984). From such a perspective, there will be good headway made towards reality-based mathematics and mathematical literacy. In another approach, "problem-solving" is considered as the heart of mathematics (Halmos, 1980). Schoenfeld (1987) investigated the nature of mathematical thinking after a book, "How to solve it?", was written by Polya (1957). In Schoenfeld's view, analysis, abstraction and composition of phenomena from the perspective of mathematics are known as mathematical thinking. In her idea, categories of: "core knowledge, problem solving strategies, effective use of one's resources, having a mathematical perspective, and engagement in mathematical practices" are fundamental aspects of thinking mathematically. Schoenfeld (1992) stated a principled explanation of how the varied aspects of mathematical thinking and problem-solving fit together; there does appear to be an emerging consensus about the necessary scope of inquiries into mathematical thinking and problem solving.

Some scholars, such as Rahimi (2016), believe that, although mathematical thinking skills are not seen as unrelated to the use of mathematics in everyday life and problem-solving skills, an attempt is made to educate students who are mathematical thinkers rather than good problem-solvers. In one of the more important approaches, Bloom's taxonomy (1956) provided a classification of "lower" and "higher" elements of thinking. As with all taxonomies, it is hierarchical. The taxonomy organised the elements of thinking in descending order (Stratton, 1999).

Bloom's taxonomy helps educators not only to understand the levels of learning, but also to determine the educational goals of lessons and the depth of lesson discussions. Bloom studied cognition and meta-cognition using cognitive, psychomotor, and affective domains. The cognitive domain includes knowledge, comprehension, and application, as well as analysis, synthesis, and evaluation. In the cognitive domain, knowledge and the other primary elements of thinking are themselves divided into sub-elements. According to the taxonomy, we think in different levels of complexity.

Using the general term 'knowledge', Bloom's Taxonomy refers to the sorting involved in memorisation. The taxonomy refers to knowledge as "lower-order" thinking, to distinguish it from the "higher order" thinking involved in analysis, synthesis, and evaluation. Comprehension and application are classified as "lower-order" thinking skills. We comprehend when we can recite material we have memorised. Comprehension is a step up the hierarchy from mere memory; when we comprehend we grasp all the details of what we remember in a whole. Comprehension is a gestalt of what we have memorised. Application, too, is regarded as a lower-order thinking skill by the taxonomy. Application is the use of abstract ideas in concrete situations (Stratton, 1999). The higher-order thinking skills are the abilities to analyse, synthesise, and evaluate, which also includes a number of reflective thinking skills. In Bloom's taxonomy, analysis refers to recognising patterns suggested by facts, while synthesis involves producing something new, and evaluation includes judging the quality of a solution or theory.

The names of six major categories were later changed from noun to verb forms; thus, the terms of the revised Bloom's taxonomy (Anderson et al., 2001) include remembering, understanding, applying, analysing, evaluating, and creating mathematics in finance. According to the taxonomy, we think in different levels of complexity.

In this paper, the thinking levels based on the revised Bloom's taxonomy (Anderson et al., 2001) are as follows:

Table 1. Revised Bloom's Taxonomy of Lower-Order Mathematical Thinking

| Level | Cognitive domain | Description | Sub-scales |
|-------|------------------|---|---|
| 1 | Remembering | This category consists of memories that were obtained from previously learned information by recalling facts, terms, basic concepts and answers. Basically, the person has to input and store into the mind with appropriate information. | collect, read, name, state, select, identify |
| 2 | Understanding | This category emphasises the ability to demonstrate understanding of facts and ideas by organising, comparing, translating, interpreting, giving descriptions and stating the main ideas. The main elements in an understanding category must allow a person to state a problem in one's own terms. | contrast, compare, explain, interpret, summarise, distinguish |
| 3 | Applying | This category emphasises the ability to use new knowledge or concepts and solve the problems in new situations, or unprompted use of an idea by applying acquired knowledge, facts, techniques and rules in a novel way. | apply, solve, determine, compute, use, demonstrate |

It can be said with high probability that the above thinking skills are almost "routinely" practised during mathematical learning in each classroom, university lecture or during tutorials and workshops around the world. The 2007 global crisis has concentrated on financial thinking, generally, and mathematical teaching of finance, particularly, for the lack of skills in financial personnel (Tularam, 2013). This research considers mathematical thinking in finance through teaching mathematics on the basis of Bloom's taxonomy integrated with Stacey's view.

The role of lower order mathematical thinking skills in banking and finance

In the present century, employment status and economic competition have a direct relationship with general literacy and mathematical literacy, science and technology (Milgram, 2007). There is also a gap between problem-solving approaches, based on the application needed on the job, and the traditional basic set of skills in the educational curriculum (Buckingham, 1997; Strasser, 1998; FitzSimons, 1998). According to the National Research Council (1999, cited in Lesh, Zawojewski, 2006), technological changes will continue to alter skills and eliminate jobs, although skill requirements for some jobs can be re-used, the changes in technology are more likely to increase skill requirements and modify them in ways to give greater emphasis to cognition, communication, and interaction. There is a difference between school mathematics and workplace mathematics that is critical to a new perspective on problem solving (MSEB, 1998; Oakes et al., 2003; Magajna, Monaghan, 2003, cited in Lesh, Zawojewski). According to Steen (2003), school mathematics is complex but used in simple problems, whereas workplace mathematics is simple but used in complex problems.

Whilst content is still essential in engineering education, Cardella (2008) states the importance of "mathematical thinking". The curriculum documents of the SEFI Mathematics Working Group have changed from contents to outcomes to competencies.

Banks often recruit graduates from disciplines such as accounting, economics, finance, engineering, and mathematics. Here, the fields of economics finance, accounting and banking are briefly reviewed. Examining the literature so far; it is seen that investigations have been generally

focused on "applying mathematics" in economics (Debreu, 1986; Alizadeh et al., 2014; Dusek, 2008; Alpha C. Chiang, 1984; Pourkazemi, 2002), in finance (Rahnamay Roodposhti et al., 2010, 2016; Alexander, 2008; Abdoh, 2007 and Abolhasani et al., 2015), and in accounting (Hendriksen and Berda, 1992; Rahnamay Roodposhti et al., 2012; Amani, Davani, 2013; Kabir, 2005; Verrecchia, 1982).

Computers are able to process non-intellectual operations exactly as planned, but cannot recognise the suitability of different solutions. Employees can then understand the applications of mathematical operations (Rahnamay Roodposhti et al., 2010). Bakker et al., (2011) examined the challenges of communication between a mortgage company and its customers in terms of crossing boundaries between communities. They developed software to model or reconstruct actual practice, using data drawn from a current account mortgage (CAM), which integrated a regular current account with the property mortgage. Their research suggested that the intervention with the technology enhanced boundary objects (TEBOs), helped employees to develop a better understanding mathematics behind the loans given to mortgage customers and, as a result, helped to improve the company's communication with customers. Hoyles et al. (2010) focused on two pension companies and a mortgage company in the United Kingdom, all dealing with annuities-based scenarios. They identified several gaps in the knowledge of sales and service employees, including inadequate understanding of the growth of money and the notion of present-value of money, of the key variables and of their relationships in mortgage scenarios.

Two main tasks of banks in Iran are monetary resource mobilisation and giving loans deployed with the cooperation of all executive departments in banks (Behmand, Bahmani, 2007). Banks are always trying to create a competitive advantage to obtain additional resources through bank deposits. When banks lend facilities to customers, credit reviews ensure that a project has sufficient justification (technical, financial and economic), with the economic activity of the specific project being autonomously responsible for repayment or settlement of obligations (Hedayati et al., 2003). In many financial affairs, financial employees need mathematical data and equations in the field of arithmetic and algebra. Financial issues can be modelled for banks by using algebraic equations and mathematical symbols (Abolhasani et al., 2015), so mathematical thinking skills in finance would require an extensible domain of mathematical knowledge and its conceptual comprehension. Studies show the importance of mathematical applications in the financial field and the necessity of attention to mathematical thinking in financial affairs, especially in banking. Some think that more attention into mathematical learning is necessary in financial affairs (especially in banking).

Niss (2003) identified the mathematical categories of thinking mathematically; posing and solving mathematical problems; mathematical modelling; mathematical reasoning; representing mathematical entities; handling mathematical symbols and formalism; communicating about mathematics; and making use of aids and tools. Kent and Noss (2002) distinguish two approaches as "doing" and "understanding" mathematics. Context and the activity in which mathematical understanding takes place are essential to this, as employees must make mathematical sense of situations quite different from their formal mathematical education (Bakker et al., 2006). Computers perform most calculations, but decisions based upon output are prone to serious errors if the user does not understand the underlying mathematics (Gravemeijer, 2012). On the one hand, it seems that less mathematical knowledge is needed as computers take over a growing number of mathematical tasks; on the other hand, for "mathematics consumers", there is an increased need to be able to handle and understand quantitative information (Gravemeijer, 2013; Levy, Murnane, 2007). Bialik and Kabbach (2014) agree with this view and state it is most likely that higher-order thinking skills support mathematical skills, and not the reverse. Huang, Ricci, Mnatsakanian (2016) recommend "thinking through math", with meaningful mathematical experiences to enhance critical thinking.

The banking research here presented two challenges. The first was to understand what kind of mathematics was at stake for the bank employees. The second was to find a valid and effective way to run a training programme for employees to enhance their understanding of the relevant mathematics, as it was widely recognised that some kind of formal 'banking mathematics' would not adequately achieve this goal (For a full account of this work, see Noss, Hoyles, 1996b). Reich (1992) described professional workers as 'symbolic analysts', compared with 'routine producers'

who follow a standardised, repetitive set of procedures for the manufacture of a product or the delivery of a service. According to Reich (1992), more and more professional workers tend toward being symbolic analysts, who solve, identify and broker problems by manipulating symbols.

Hoyles et al. (2002) did a survey in financial companies (three case studies) where they identified the key mathematical skills required of a large number of employees as: multi-stage calculations including percentages; the ability to understand relationships between variables; the ability to read, interpret and transform data from charts and spreadsheets; the ability to create formulae; confidence in identifying, appreciating and using concepts of risk and probability; and the ability to use approximations, estimates and formal probabilities to model likely events. One case study (Kent et al., 2007), designed experiments set in the financial services sector, focused on the annual pension statement, using a boundary object designed to facilitate boundary crossing between the company and customers. Although the mathematics involved in finance is superficially similar to secondary school mathematics, Kent et al. (2007) observed that in the workplace context, every mathematical procedure, no matter how simple, is part of a whole range of decisions and judgments about complex processes or products. Employees must be able to mathematically appreciate computer outputs, interpret them in their context, and recognise which components are hidden by the IT system. They also need to be able to reason about the mathematical models embedded in the system in terms of the key relationships between product variables (e.g., percentage rates, management fees, and sales commissions) and their affect on outputs presented in the form of graphs or tables. FitzSimons (2013) showed how contextual knowledge of finance links with mathematical knowledge and knowledge of learners' thinking in the modelling of time in financial scenarios. The modelling conventions greatly simplify the complexity of dealing with time in financial scenarios; however, students and learners who do not yet know these conventions, and thus work from an everyday understanding of banking processes, are likely to produce their own models that do not fit with convention and may therefore be disregarded by teachers. Solutions need to be accompanied by knowledge that the models do not take into account the daily workings of the world of banking. The evidence found by Jappelli, Mario (2013) showed that improving mathematical skills early in life will eventually raise a households' financial literacy and wealth accumulation. They also showed that the current level of financial skills and wealth are strongly correlated with a measure of mathematical skills at school age available in SHARELIFE. They treat aggregate data in a similar way and find that PISA scores in mathematics are strongly correlated with country-wide indicators of financial literacy supplied by business leaders as well as national savings.

In fact, in many occupations, learned knowledge and skills rapidly become out of date. This has created a requirement for continuous professional development, i.e., the process of identifying previous learning and training needs (Cartwright, 2003). Timothy (2011) mentioned that the credit crisis had an effect on banking affairs. Some banks, like J.P. Morgan, make good decisions in a credit crisis because they employ mathematicians, while others do not and then suffer from the crisis. The development of mathematical knowledge in banking is not an exception and teaching mathematical knowledge is essential in banking. The subject "competence programs" has been receiving attention in developing different educational fields. In the latest edition of Alpers et al. (2013), the main message is that, "although contents are still important, they should be embedded in a broader view of mathematical competencies". In such a program, one should favorably show their competence on jobs, in addition to achieving knowledge, in accordance with national or international standards. The skills-gap is the difference between the required skills to perform determined tasks and skills that employees actually have (Fig. 1). If this gap is determined, it can be resolved using educational methods (Cartwright, 2003).

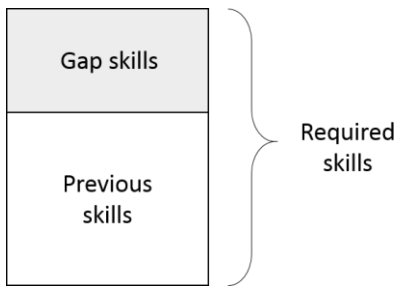


Fig. 1. Required skills

The items considered as lower-order mathematical thinking skills in finance, based on the revised Bloom’s taxonomy, include remembering mathematics in finance, understanding mathematics in finance and applying mathematics in finance (Fig. 2).

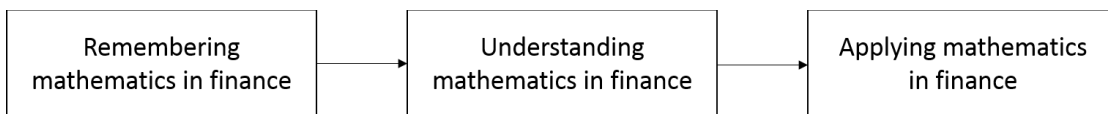


Fig. 2. Conceptual Framework

3. Method

In the present study, according to the views of employees, we investigated the relationship between the first three levels of mathematical thinking skills in finance, the gaps in lower-order mathematical skills in financial affairs, and any significant relationships between demographic characteristics of participants, based on the revised Bloom’s taxonomy.

Participants

The data was obtained from a bank providing financial services to special customers in sections of the Iranian Bank of Industry and Mine. The sample was selected purposively (those familiar with mathematical and financial knowledge) based on the questionnaire, to assess the extent of individuals’ familiarity with and acceptance of a modern mathematics education regardless of their situation. Anonymous questionnaires were filled by the participants in 2016. Six returned questionnaires were discarded because they did not answer most of the questions and finally 141 acceptable responses were received. In order to increase the accuracy of the tests, weighting of observed data was performed according to demographic characteristics (See Appendix1). Weighting participants was accomplished by considering positions, work experience, departments, education degree and their field of study.

Questionnaire

The questionnaire was developed in accordance with standard questionnaires in this field. We developed this questionnaire according to literature, with a purpose to examine the hierarchical relationship of the three lower-order mathematical thinking skills, and also to evaluate lower-order mathematical skill-gaps in finance from the view of the banking industry. Finally, we compared significant differences between demographic characteristics of participants.

The items pool was refined through the expert opinion of seven Iranian academics following the analysis of the pilot data and a seminal questionnaire was further refined. Content validity of this questionnaire was confirmed by several professors in mathematics and finance.

We depicted three latent variables of mathematical thinking skills in finance, based on the revised Bloom’s taxonomy (2001). The questions were ordered for evaluating staff’s attitudes towards lower-order mathematical thinking skills in finance, as detailed in Appendix 2. Based on the questions, the items were specified and analysed, as in Table 2.

Table 2. Items of the questionnaire

| Construct | Item | Description |
|--------------------------------------|------|---|
| Remembering mathematics in finance | KN1 | Mental calculations of 4 basic arithmetic operations |
| | KN2 | Remembering mathematics knowledge in regulating financial data |
| | KN3 | Remembering mathematics knowledge in resolving Bank likely reconciliation |
| | KN4 | Remembering mathematics knowledge for determining relationships among financial variables |
| | KN5 | Remembering mathematics knowledge in finding reasonable solutions when encountering financial problems |
| Understanding mathematics in finance | CO1 | Better understanding the calculations in computing applications |
| | CO2 | Understanding mathematical applied problems in finance for improving the quality of financial operations |
| | CO3 | Understanding math calculations in finance to improve communications with customers |
| | CO4 | To better understand relationships among financial indices through the relationships among mathematical variables |
| | CO5 | Understanding mathematical applied problems in finance to improve employees' decision-making |
| Applying mathematics in finance | AP1 | Application of mathematics in finance to do financial calculations of investment plans |
| | AP2 | Application of mathematics in finance to be able to solve complicated financial problems |
| | AP3 | Application of mathematics in Finance to discount future prices |
| | AP4 | Application of mathematics in Finance to reduce operational risk |
| | AP5 | Application of mathematics in Finance to improve financial information monitoring |

The finance-related employees were asked to respond to an anonymous questionnaire containing 15 useful and short questions, each with five response choices using a Likert scale. The respondents were asked to comment on each of the specified expressions using the Likert scale (including the five choices: very much, much, average, little, and very little) as both the “status quo” and “importance value”. Then Cronbach's alpha was used for the reliability test with 65 participants; its values were observed to be more than 0.7 for all inquiries.

Analysis method

In order to identify employees' attitudes toward the importance of each criterion, their responses were evaluated. First, factor analysis of lower-order mathematical thinking skills indicated that all factor loadings were greater than 0.4, which was statistically significant (at an error level of 0.05, T-values were greater than 1.96); thus, there was no need to eliminate any of the items.

Second, the method of descriptive statistics was employed in order to determine skills-gaps in mathematical thinking in finance, according to participants' attitudes. Research data were statistically processed using SPSS_{21.0} and Microsoft Excel. Descriptive statistics, means and standard deviations, were calculated. Skewness and kurtosis coefficients were calculated to assess univariate normality. We calculated the reliability of each dimension given by the index of Cronbach's alpha for internal consistence. Here, the weighted responses for each respondent were thus specified (weighting calculations made with Microsoft Excel). Next, the mean values of weighted responses were obtained. The responses were skewed towards very much or very little, which demonstrates that the mean is an appropriate variable to use in analyses for this study.

Third, the student t-test for independent samples was used to compare the means of the group of female participants with the group of male participants, and the group of manager participants with the group of expert participants, regarding the importance of lower order math thinking skills in finance, with the aim of checking whether the two groups were homogeneous.

A one-way ANOVA was then used to compare the means of groups with different levels of education degree, field of study, and work experience regarding the importance of lower-order mathematical thinking skills in finance, with the aim of checking whether these several groups were homogeneous.

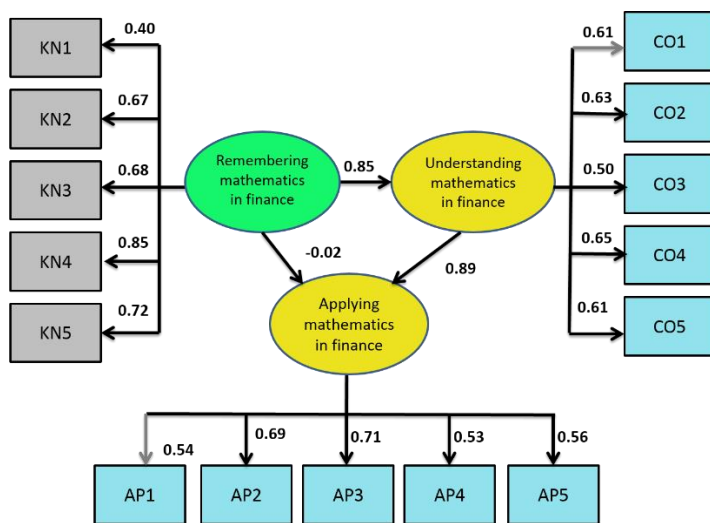
4. Findings

This section contains an overview of the responses of financial staff in the banking industry to the questionnaire, with the questionnaire items analysed in three phases.

Phase 1. Structural equation modeling (SEM)

Validity of this questionnaire is estimated using structural equation modelling (SEM), through confirmatory factor analysis (CFA), which showed that the expected factor structure is correct: $\chi^2(87) = 125.21, p=0.00459$; non-normed fit index (NNFI) = 0.97; comparative fit index (CFI) = 0.98; root mean square of approximation (RMSEA) = 0.056. All subscales demonstrated acceptable levels of internal consistency ranging from 0.40 to 0.85.

In addition, *factor loadings* for observable variables (dimensions) and path coefficients between the constructs are illustrated in Fig. 3.



Chi-Square=125.21, df=87, p-value=0.00459, RMSEA=0.056

Fig. 3. Structural model with standardised path estimates from the asymptotic method.

As seen in the above Figure, fitness indices of the model are found to be acceptable; thus, the compatibility in the conceptual model is confirmed by the gathered data. Except for the effect of remembering mathematics in finance on understanding mathematics in finance (T-value of -0.06), other effects were statistically very significant (T-values of more than 1.96).

Phase 2. The Results of the Questionnaire Items (Based on the Items)

In this section, the mathematical thinking skills needed in the banking industry (the lower-order mathematical thinking skills in financial affairs, based on the revised Bloom’s taxonomy) are closely investigated based on the views of the expert employees. For this purpose, efforts were made to identify what mathematics are required for this group of employees at work.

In order to become familiar with the views of participants, weighted means of their responses to the questions are presented in Table 3, based on means for each item (the "status quo" and "importance value" of each criterion). The weighted Standard deviation and Cronbach’s alphas for the items are also shown in Table 3.

Table 3. Weighted Means & Standard deviation & Cronbach’s alpha for the questionnaire items

| Items | Mean (M) | | | Standard deviation (SD) | | Cronbach’s alpha | |
|-------|------------|------------|------|-------------------------|------------|------------------|------------|
| | Importance | Status que | Gap | Importance | Status que | Importance | Status que |
| KN1 | 4.00 | 3.05 | 0.95 | 0.98 | 1.15 | .887 | .935 |
| KN2 | 3.92 | 2.79 | 1.13 | 0.85 | 0.87 | .873 | .928 |
| KN3 | 3.87 | 2.81 | 1.06 | 0.92 | 0.92 | .872 | .930 |
| KN4 | 4.00 | 2.81 | 1.19 | 0.77 | 0.93 | .867 | .927 |
| KN5 | 4.09 | 2.77 | 1.32 | 0.8 | 0.99 | .872 | .928 |
| CO1 | 4.27 | 3.02 | 1.25 | 0.76 | 0.93 | .874 | .927 |
| CO2 | 4.07 | 2.84 | 1.23 | 0.79 | 0.88 | .873 | .927 |
| CO3 | 3.49 | 2.57 | 0.92 | 1.03 | 0.88 | .880 | .932 |
| CO4 | 4.12 | 2.81 | 1.30 | 0.79 | 0.92 | .873 | .928 |
| CO5 | 3.84 | 2.63 | 1.21 | 0.91 | 0.86 | .875 | .931 |
| AP1 | 4.18 | 3.09 | 1.09 | 0.75 | 0.91 | .879 | .932 |
| AP2 | 3.96 | 2.71 | 1.26 | 0.82 | 0.92 | .874 | .931 |
| AP3 | 4.06 | 2.96 | 1.10 | 0.85 | 0.93 | .873 | .931 |
| AP4 | 3.86 | 2.74 | 1.13 | 0.89 | 0.84 | .877 | .931 |
| AP5 | 4.00 | 2.83 | 1.17 | 0.8 | 0.85 | .876 | .929 |

The reliabilities of the items were identified using Cronbach’s alpha method, with values over 70 % for all the questions which were thus confirmed.

The employees' responses to the question of "remembering mathematics in finance" show that, in their view, mental calculations using four basic arithmetic operations are effective for doing financial calculations (4.00). They know that remembering mathematical knowledge will help financial employees in regulating financial data (3.92) and resolving bank reconciliation (3.87). They expect that remembering mathematics provides them with a reasonable frame in which to determine the relationship between financial variables (4.00) and help employees to find reasonable solutions for financial problems (4.09). Participants believe that their mathematical knowledge needs to be strengthened in order to improve at financial calculations. The employees' responses to questions of "understanding mathematics in finance" indicated that they believed understanding applied to problems of mathematics promoted staff’s understanding in computing applications (4.27), quality of financial operations (4.07), and understanding how mathematical computations affect improvements in communication with customers (3.49). They are well aware that understanding the relationships of mathematical variables is effective in understanding the relationships of financial indicators (4.12). They know that understanding mathematics is effective in improving the decision-making of financial employees (3.84). The employees' responses to question of "applying math in finance" indicate the fact that, from their viewpoint, applying mathematics is effective in financial calculations for investment plans (4.18), the ability to solve complicated financial problems (3.96), calculations of discounted future prices (4.06), reducing operational risk (3.86), and monitoring financial information (4.00).

Under this methodology, the average level of importance of lower-order mathematical thinking ranges from 3.49 to 4.27 points. Also under this methodology, the average level of the status quo of lower-order mathematical thinking ranges from 2.57 to 3.09 points.

The overall schema on three levels of lower-order mathematical thinking skills based on the revised Bloom’s taxonomy is shown in Figure 4, according to the means of responses.

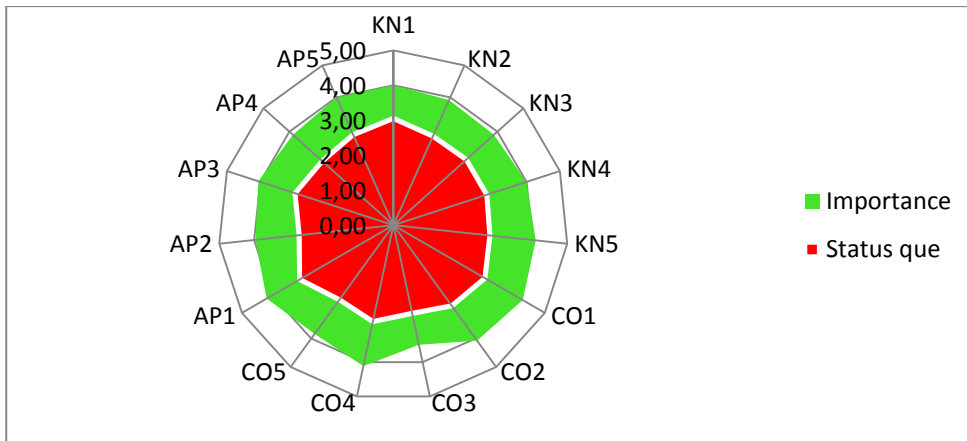


Fig. 4. The overall schema on lower-order mathematical thinking skills

It revealed that, regarding financial personnel, there are skills-gaps for all items of lower-order mathematical thinking skills in finance.

Results of the Questionnaire Items (Based on lower-order mathematical thinking)

The questions could be an appropriate representation of financial personnel's opinions in the banking industry, their familiarity with mathematical thinking skills, and the role of lower-levels of mathematical thinking skills in empowering them in their financial affairs. In Table 4, the means of the items related to lower-order mathematical thinking levels are shown based on the weighted means of personnel's responses at each of these levels.

Table 4. The second weighted means of staff responses to the questionnaire

| Mean 2 | KN | UN | AP |
|----------------------------|------|------|------|
| Importance | 3.98 | 3.96 | 4.01 |
| Status que | 2.85 | 2.84 | 2.85 |
| Need for improvement (Gap) | 1.13 | 1.12 | 1.16 |

Above Table demonstrates the fact that, from the participants' point of view, skills-gaps for lower-order mathematical thinking in finance are 1.13 at the level of understanding mathematics in finance, 1.12 at the level of remembering mathematics in finance, and 1.16 at the level of applying mathematics in finance. The results indicate that from the point of view of financial employees, the largest skills-gap is in applying mathematical thinking skills in finance, while they believe that the smallest skills-gap is in understanding mathematical thinking skills in finance.

Phase 3. The results of the INDEPENDENT SAMPLES T-TEST and ANOVA are shown in Table 5.

According to the Table 5, we found that:

- There are no significant differences (Sig= 0.49>0.05) between the Groups (men, woman) regarding the importance of lower-order mathematical thinking skills in finance.
- There are no significant differences (Sig= 0.87>0.05) between the Groups (manager, expert) regarding the importance of lower-order mathematical thinking skills in finance.
- There are no significant differences (Sig= 0.72>0.05) among the Groups (bachelor, master, Phd) regarding the importance of lower-order mathematical thinking skills in finance.
- There are no significant differences (Sig= 0.48>0.05) among the Groups (Finance-related, Accounting, Economy, Management, Mathematics, Engineering, Law, Other) regarding the importance of lower-order mathematical thinking skills in finance.
- There are no significant differences (Sig= 0.41>0.05) among the Groups (Less than 5 years, 5 to 10 years, 10 to 15 years, 15 to 20 years, 20 to 25 years, More than25 years) regarding the importance of lower-order mathematical thinking skills in finance.

• There are no significant differences (Sig= 0.99>0.05) among the Groups (Financial affairs, Branch, related financial affairs, Other) regarding the importance of lower-order mathematical thinking skills in finance.

Table 5. Results of INDEPENDENT SAMPLES T-TEST and ANOVA

| INDEX | DIMENSION | N | Mean | Sig. | Method |
|-----------------|---------------------------|----|---------|------|----------------------------|
| Gender | Woman | 43 | 61.3953 | .492 | T TEST-INDIPENDENT SAMPLES |
| | Man | 96 | 58.8958 | | |
| Position | Manager | 77 | 59.6753 | .871 | |
| | Expert | 63 | 59.4762 | | |
| Degree | Bachelor | 33 | 60.4242 | .718 | |
| | Master | 93 | 59.5806 | | |
| | PHD | 15 | 58.4667 | | |
| Field of study | Finance-related | 4 | 63.5000 | .481 | ANOVA |
| | Accounting | 16 | 57.9375 | | |
| | Economy | 18 | 59.7778 | | |
| | Management | 41 | 58.6829 | | |
| | Mathematics | 10 | 64.3000 | | |
| | Engineering | 46 | 59.9565 | | |
| | Law | 3 | 61.0000 | | |
| | Other | 2 | 55.5000 | | |
| Work experience | Less than 5 years | 5 | 58.4000 | .412 | |
| | 5 to 10 years | 33 | 59.1515 | | |
| | 10 to 15 years | 55 | 59.5091 | | |
| | 15 to 20 years | 22 | 58.0000 | | |
| | 20 to 25 years | 7 | 59.8571 | | |
| | More than 25 years | 19 | 63.1579 | | |
| Departments | Financial affairs | 49 | 59.8776 | .990 | |
| | Branch | 31 | 59.8387 | | |
| | Related financial affairs | 60 | 59.4833 | | |

5. Discussion

In Phase 1, the study of the data implies that the personnel believe that the remembering mathematics in finance affects understanding of mathematics in finance, remembering mathematics in finance affects applying mathematics in finance, but remembering mathematics in finance is not effective when applying mathematics in finance using the asymptotic method. The results indicate that the relationship between the constructs of lower-order mathematical thinking in finance is hierarchical.

In Phase 2, analysis shows staff believe that, in order to better the performance of employees in doing calculations quickly and accurately, resolving bank reconciliation, regulating financial data, and providing a reasonable frame to determine the relationships among financial variables and thus finding a reasonable solution when encountering financial problems, skills-gaps in the field of "remembering mathematics in finance" need to be improved. They believe that financial employees should be able to express a financial problem as a mathematical problem.

With remembering mathematical knowledge, one could be successful in carrying out computational problems.

The results show that from the employees' perception, the effects of the skill of "understanding mathematics in finance affairs" for improving the ability for understanding and solving problems are important. From the viewpoint of employees, it is essential that this skill is improved to foster financial understanding and employees' problem-solving. They know that understanding mathematics is effective for improving understanding of computations in computing applications, the quality of operations in banks, communication with customers, and a better understanding of relationships between financial indicators as a result of their decision-making. They believe that the skills-gap would be covered.

The results show that participants believe in applying the lower-order mathematical thinking skills to improve the financial performance of employees and think that, broadly, the employees' skills in financial affairs need to be improved.

The results show that participants were well aware of the effects of applying mathematics in improving skills at work through problem solving. They believe that in order to improve an employees' performance, it is necessary to strengthen the third level of mathematical thinking skills in such a way that they can improve their ability to carry out financial calculations for investment plans, the complicated problem-solving of finance, calculations of discounted future prices, reducing operational risk, and monitoring financial information.

In Phase 3, the results show no significant differences between the Groups, according to demographic characteristics regarding the importance of lower-order mathematical thinking skills in finance.

Overall, this study confirms the hierarchical relationship between the first three mathematical thinking skills in finance, based on the revised Bloom's taxonomy (2001), in banking. The results also show that, in the viewpoint of participants, lower-order mathematical thinking skills in finance need to be strengthened. Results are compatible with other studies which show a gap between the application-based method and problem-solving approach required in employment and the traditional basic set of skills in the educational curriculum (Buckingham, 1997; FitzSimons, 1998; Strasser, 1998); we cannot expect high school graduates who were taught pure mathematics to be able to solve real-world problems using mathematical knowledge (Niss et al., 2007).

This study has revealed the importance of understanding and applying mathematics in finance. Previous studies have also argued the importance of the understanding mathematics in finance in the accounting and auditing professions (Rahnamay Roodposhti et al., 2012; Hoyles et al., 2010; Amani, Davani, 2013) and the importance of applying mathematics in finance (Abdoh, 2007, 2014; Rahnamay Roodposhti et al., 2010, 2016; Tularam, 2013; Johnson, 2010).

The views of participants in this study, regarding the need for improving their lower order mathematical thinking skills in financial affairs, lend support to previous findings by Jappelli et al. (2013), which showed that improving mathematical skills early in life will eventually raise households' financial literacy and wealth accumulation, and that the current level of financial skills and wealth are strongly correlated with a measure of mathematical skills at school age.

This study is in line with Hoyles et al. (2002) who identified multi-stage calculations including percentages, the ability to understand relationships between variables, and interpret and transform data from charts and spreadsheets to model likely events as some of the key mathematical skills required of a large number of employees.

On the other hand, Beiker et al., (2010, 2011) found that communication between agents and potential customers was mostly concerning symbolic artefacts. They showed that a better understanding the mathematics which hindered mortgage loans was developed by employees by intervening with technology-enhanced boundary objects. It is recommended the educational system be modified with the mathematical curriculum, especially for vocational courses, tailored to the needs of the workplace (especially in finance).

6. Conclusion

The results helped to answer the question "Is there a hierarchical relationship between the constructs of lower-order mathematical thinking skills in finance?" According to the SEM results, "mathematical thinking skills in finance" affect "understanding mathematics in finance", and

“understanding mathematics in finance” affects “applying mathematics in finance”; this implies that there is a hierarchical relationship between the constructs of lower-order mathematical thinking skills in finance.

Results helped to answer the question “How much does remembering mathematics need to be improved to enhance calculation skills in financial users in banking?” Data analysis shows that, from the viewpoint of the participants, remembering mathematics to enhance their computational skills (doing quick and accurate calculations in finance, regulating financial data, determining relationships among financial variables, resolving bank probable reconciliation, and finding reasonable solutions when encountering financial problems) needs to be improved. The current research addressed the question of “to what extent does understanding mathematics need to be improved to increase the ability of understanding and problem-solving in financial users in banking?” Employees believe that understanding mathematics in financial affairs needs to be improved to better understand computations in computational software and relationships between financial indicators, in order to promote the quality of banking operations, to foster the communication with customers, and to empower employees in making decisions. Finally, the question is answered of “to what extent does applying mathematics in financial affairs need to improve to increasing work problem-solving skills in financial users in banking?” The financial employees who answered the aforesaid question expect that applying mathematics in financial affairs needs to be improved when doing financial computations of investment plans, solving complicated problems of finance, calculating discounted future prices, reducing operational risk, and monitoring financial data.

The results helped to compare the differences between the means of demographic characteristics of the samples. According to the results of the T-test and ANOVA, we find no significant differences between the Groups (Gender, Position, Experience, Department, Degree, Field of Study) regarding the importance of lower-order mathematical thinking skills in finance; this is reasonable because all participants were aware of the items of lower-order mathematical thinking and were educated during their degrees.

Generally, the results show that employees have positive attitudes towards using lower-order mathematical thinking skills in financial affairs and believe that there are skills-gaps in all items of lower-order mathematical thinking in financial affairs. The lower-order mathematical thinking skills should be strengthened in financial affairs. Considering current rapid changes in technology, it seems essential to integrate the current mathematical curriculum with mathematics at work (financial affairs) in order to determine a suitable educational content for schools in such a way that future school graduates can properly apply mathematics in financial affairs. The results are useful in identifying the intended items for these skills and, in fact, can produce a guideline for the provision of educational content in studying for a financial career so that learning resources will improve. The results also show that lower-order mathematical thinking skills in financial affairs need to be improved in the Iranian Bank of Industry and Mine, as indicated by the viewpoints of employees. A programme for teaching mathematics at work is suggested, as well as establishing laboratory and virtual workshops for creating a learning environment tackling the skills-gaps in lower-order mathematical thinking skills in financial affairs (especially, banks). It seems that one of the biggest reasons for skills gaps among financial employees is a lack of education related to mathematics at work during their study; therefore, it is suggested that the educational content of mathematics in the school curriculum be customised and adjusted in accordance with mathematics at work in Iran’s educational system, ideally by employing researchers who are completely familiar with applications of these skills. Finally, it seems that student learning and teaching needs to be changed in such a way that financial mathematics courses are developed in finance and business programs over time. In fact, this research reveals that it is essential to notice adult math education and its integration with application fields in society, especially in the world of banking. Finally, for further research, it is recommended to investigate topics such as “evaluating lower-order mathematical thinking in financial affairs for financial employees and students” and “improving the effect of educational programs for mathematical thinking in financial affairs on learners’ educational progress and employees’ professional progress”.

7. Limitations

One of the limitations of this study is its cross-sectional nature; to account for technological changes and their effects on mathematical thinking skills in the workplace (situational needs), it is necessary to perform longitudinal research. Our time limitation meant we only studied a cross-sectional sample. To outline some potential avenues for further research, it would be of great interest to conduct a study wherein the data from the present study is used as reference data to acquire new information, to aid in the application of longitudinal research.

Appendixes

Appendix 1. Demographic characteristics of participants

| | |
|--------------------|--|
| Participants | 141 people (100 %) |
| Gender (%) | Woman (31 %), man (69 %) |
| Position (%) | Manager (45 %), Expert (55 %) |
| Experience (%) | Less than 5 years (4 %), 5 to 10 years (23 %), 10 to 15 years (39 %), 15 to 20 years (16 %), 20 to 25 years (5 %), More than 25 years (13 %) |
| Department (%) | Financial affairs (36 %), Branch (22 %), Related financial affairs (42 %) |
| Degree (%) | Bachelor (23 %), Master (66 %), PHD (11 %) |
| Field of study (%) | Finance& banking (2 %), Accounting (11 %), Economy (13 %), Management (30 %), Math (7 %), Engineering (34 %), Law (2 %), Other (1 %) |

Appendix 2. Questions

| | |
|---------------------------------------|---|
| Remembering math knowledge in finance | Mental calculations of 4 basic arithmetic operations will help financial employees in the quick and accurate calculation. |
| | Remembering mathematical knowledge will help financial employees in regulating financial data. |
| | Remembering mathematical knowledge will help financial employees in resolving bank likely reconciliation. |
| | Mathematical knowledge provides a logical framework for determining the relationships among financial variables by employees. |
| | Mathematical knowledge will help financial employees in finding reasonable solutions when encountering financial problems. |
| Understanding math in finance | Understanding the practical problems in mathematical finance by employees improves to understand the calculations in computing applications (such as Excel, Camfar). |
| | Understanding practical problems in financial mathematics by employees improves the quality of financial operations. |
| | Understanding mathematical calculations in finance by financial employees effects on improving communication with customers (by explanation financial computations to customers in the banking system). |
| | Financial employees better understand relationships among financial indicators through mathematical relationships among variables. |
| | Understanding mathematical applied problems in financial matters is effective in improving employees' decision-making. |
| Applying math in finance | Application of mathematics in finance effects on financial calculations for investment plans by financial employees. |
| | Application of mathematics in finance provides the ability to solve complicated financial problems by financial employees. |

| | |
|--|--|
| | Application of mathematics in finance contributes to the calculations of discounting future prices by financial employees. |
| | Application of mathematics in finance contributes to reducing operational risk (through reducing the bobble) by financial employees. |
| | Application of mathematics in finance by finance employees improves monitoring financial information. |

References

- Abdoh Tabrizi, 2007** – *Abdoh Tabrizi, H.* (2007). Financial career opportunities for mathematicians: a lecture at the Faculty of Mathematics. Proceeding of the lecture of Mathematics, University of Tahsilat Takmili Zanjan, Iran, 17 Feb. Retrieved from <http://www.iranfinance.net>.
- Abdoh Tabrizi, Raadpoor, 2014** – *Abdoh Tabrizi, H., Raadpoor, M.* (2014). The field of application of mathematical knowledge in financial affairs, Mathematics and Humanities. Proceeding of the 3th Conference of Mathematics and Humanities. Tehran, Iran.
- Abolhasani et al., 2016** – *Abolhasani, Z., Rahnamay Roodposhti, F., Shahvarani, A., Hosseinzade Lotfi, F.* (2016). Balance-Sheet Management in a Development Bank Based on Math Word Problems. Proceeding of the 4th National Conference of Financial Engineering: Asset and Liability Management. Tehran, Iran.
- Alexander, 2008** – *Alexander, C.* (2008). Quantitative methods in finance: Wiley.
- Alpers et al., 2013** – *Alpers, B. A., Demlova, M., Fant, C. H., Gustafsson, T., Lawson, D., Mustoe, L., Olsen-Lehtonen, B., Robinson, C.L., & Velichova, D.* (2013). A framework for mathematics curricula in engineering education: A report of the mathematics working group. Brussels, Belgium: European Society for Engineering Education (SEFI).
- Amani, Davani, 2013** – *Amani, A., Davani, G.H.* (2013). The notions/accounting and auditing at the crossroads of science. *Journal of Chartered Public Accounting*, 10(34), 59-70.
- Bakker et al., 2011** – *Bakker, A., Kent, P., Hoyles, C., & Noss, R.* (2011). Designing for communication at work: A case for technology-enhanced boundary objects. *International Journal of Educational Research*, 50(1), 26-32.
- Behmand, Bahmani, 2007** – *Behmand, M., Bahmani, M.* (2007). Domestic banking 1: resource mobilizing. Tehran, Iran: Iran Banking Institute.
- Bialik, Kabbach, 2014** – *Bialik, M., & Kabbach, A.* (2014). Does mathematics education enhance higher-order thinking skills? Mathematics for the 21st Century. Retrieved from <http://curriculumredesign.org>.
- Buckingham, 1997** – *Buckingham, E.* (1997). Specific and generic numeracies of the workplace: How is numeracy learnt and used by workers in production industries, and what learning/working environments promote this? Melbourne, Australia: Deakin University.
- Burton, 1984** – *Burton, L.* (1984). Mathematical thinking: The struggle for meaning. *Journal for Research in Mathematics Education*, 15(1), 35-49.
- Cartwright, 2003** – *Cartwright, R.* (2003). Training and Development Express- Training and Development 11.1. London, United Kingdom: John Wiley & Sons.
- Debreu, 1986** – *Debreu, G.* (1986). Theoretic models: mathematical form and economic content. *Econometrica. Journal of the Econometric Society*, 54(6), 1259-1270.
- Dusek, 2008** – *Dusek, T.* (2008). Methodological monism in economics. *Journal of Philosophical Economics*, 1(2), 26-50.
- FitzSimons, 1998** – *FitzSimons, G. E.* (1998). Economic change and new learning demands: A case study from the pharmaceutical industry. Proceeding of the CEET Conference, Rapid Economic Change and Lifelong Learning.
- FitzSimons, 2013** – *FitzSimons, G. E.* (2013). Doing Mathematics in the Workplace: A Brief Review of Selected Literature. *International Journal of Adults Learning Mathematics*, 8(1), 7-19.
- Gal, 2000** – *Gal, I.* (2000). The numeracy challenge. In I. Gal (Ed.), *Adult numeracy development* (p. 9). New York, NY: Hampton Press.
- Ginsburg et al., 2006** – *Ginsburg, L., Manly, M., & Schmitt, M. J.* (2006). The Components of Numeracy. NCSALL Occasional Paper. Boston, MA: National Center for the Study of Adult Learning and Literacy (NCSALL).

[Gravemeijer, 2012](#) – *Gravemeijer, K.* (2012). Aiming for 21st century skills. Proceedings of the Commission Internationale pour l'Etude et L'Amelioration de l'Enseignement des Mathematiques (CIEAEM 64): Mathematics education and democracy: Learning and teaching practices.

[Gravemeijer, 2013](#) – *Gravemeijer, K.* (2013). Mathematics education and the information society. In A. Damlamian, J. F. Rodrigues & R. Sträßer (Eds.), Educational interfaces between mathematics and industry (pp. 279–286). London, United Kingdom: Springer.

[Hedayati et al., 2003](#) – Hedayati, S.A.A., Safari, A.A., Kalhor, H., & Bahmoni, M. (2003). The banking operations 2 (allocation of resources). Tehran, Iran: Iran Banking Institute.

[Hendriksen, van Breda, 1992](#) – *Hendriksen, E. S., & van Breda, M. F.* (1992). Accounting theory, 5th edition. Homewood, Il: Irwin.

[Hoyles et al., 2002](#) – *Hoyles, C., Wolf, A., Molyneux-Hodgson, S., & Kent, P.* (2002). Mathematical skills in the workplace: final report to the Science Technology and Mathematics Council, London: Institute of Education, University of London.

[Hoyles et al., 2010](#) – *Hoyles, C., Noss, R., Kent, P., & Bakker, A.* (2010). Improving mathematics at work: The need for techno-mathematical literacies: Routledge.

[Huang et al., 2016](#) – *Huang, H. F., Ricci, F. A., & Mnatsakanian, M.* (2016). Mathematical teaching strategies: Pathways to critical thinking and metacognition. *International Journal of Research in Education and Science*, 2(1), 190-200.

[Johnson, 2010](#) – *Johnson, T. C.* (2010). What is financial mathematics. The Best Writing on Mathematics, 43-46.

[Jappelli, Padula, 2013](#) – *Jappelli, T., & Padula, M.* (2013). Investment in financial literacy and saving decisions. *Journal of Banking & Finance*, 37(8), 2779-2792.

[Khadem Alizadeh et al., 2016](#) – *Khadem Alizadeh, A., Pourkazemi, M.H., & Keshavarz, M.* (2016). The application of mathematics in Islamic economics: benefits and limitations. *Journal of Islamic Economic Studies*, 8(1), 57-90.

[Lesh, Zawojewski, 2007](#) – *Lesh, R. A., & Zawojewski, J.* (2007). Problem solving and modeling. In F. Lester (Ed.), Second handbook of research on mathematics teaching and learning: A Project of the national council of teachers of mathematics (pp. 763-804). Charlotte, NC: Information Age Publishing.

[Levy, Murnane, 2007](#) – *Levy, F. & Murnane, R.* (2007). How computerized work and globalization shape human skill demands. In M. M. Suárez-Orozco (Ed.), Learning in the global era: International perspectives on globalization and education (pp. 158–174). Los Angeles, CA: University of California Press.

[Milgram, 2007](#) – *Milgram, R.J.* (2007). What is mathematical proficiency? In Alen H. Schonfeld (editor), Assessment mathematical proficiency (pp.31-58). New York, NY: Cambridge university press.

[National Council of Teachers of Mathematics \(NCTM\), 2000](#) – National Council of Teachers of Mathematics (NCTM). (2000). Principles and standards for school mathematics. Reston, VA: NCTM.

[National Council of Teachers of Mathematics \(NCTM\), 2010](#) – National Council of Teachers of Mathematics (NCTM). (2010). Common core state standards. Reston, VA: NCTM.

[Niss, 2003](#) – *Niss, M.* (2003). Mathematical competencies and the learning of mathematics: The Danish KOM project. In A. Gagatsis & S. Papastravidis (Eds.), 3rd Mediterranean Conference on Mathematics Education (pp. 115–124). Athens, Greece.

[Niss et al., 2007](#) – *Niss, M., Blum, W. & Gulbraith, P.* (2007). Introduction. In W. Blum, P. Galbraith, H. W. Henn and M. Niss (Eds), Modeling and applications in mathematics education. Proceeding of the 14th ICMI study (pp. 3-32). New York: Springer.

[Plaza, 1996](#) – *Plaza, P.* (1996). Materials from the adult's school in Madrid. Poster Presented at Working Group 18 (Adults Returning to Mathematics Education). Proceeding of the 8th International Congress on Mathematics Educatio. Seville, Spain.

[Polya, 1957](#) – *Polya, G.* (1957). How to solve it. Princeton, NJ: Princeton University Press.

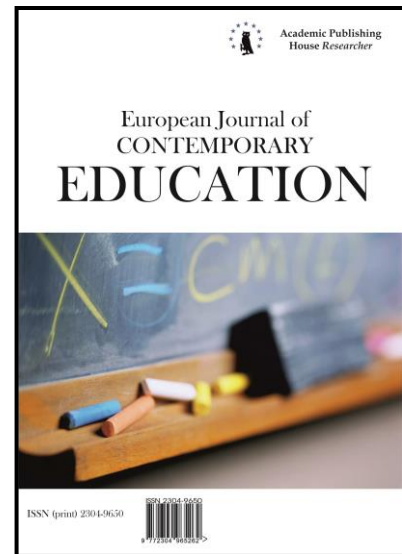
[Pourkazemi, 2002](#) – *Pourkazemi, M.H.* (2002). The role of mathematics in Management and Economics. *Journal of Management Message*, 2(2), 5-28.

- [Rahimi, 2016](#) – *Rahimi, Z.* (2016). Designing teaching model based on multiple solutions for the realization of mathematical thinking in high school students (PHD's thesis). Educational Science, Curriculum Planning, Tarbiat Modarres University, Tehran, Iran.
- [Rahnamay Roodposhti et al., 2010](#) – *Rahnamay Roodposhti, F., Jalili, M., & Hosseinzadeh Lotfi, F.* (2010). Financial mathematics and investment. Tehran, Iran: Termeh Press.
- [Rahnamay Roodposhti, Ehyaaei, 2012](#) – *Rahnamay Roodposhti, F., & Ehyaaei, H.* (2012). Accounting Engineering. *Journal of Management Accounting Research*, 5(13), 97-112.
- [Rahnamay Roodposhti et al., 2016](#) – *Rahnamay Roodposhti, F., Jalali, S., & Mohamadi, V.* (2016). Foundations of Banking based on Risk approach, Tehran, Iran: Nora Press.
- [Ross, 2011](#) – *Ross, S. M.* (2011). An Elementary Introduction to Mathematical Finance (third Edition). London, England: Cambridge University Press.
- [Schoenfeld, 1987](#) – *Schoenfeld, A. H.* (1987). A brief and biased history of problem solving. In F. R. Curcio (Ed.), *Teaching and learning: A problem-solving focus* (p. 27). Reston, VA: National Council of Teachers of Mathematics.
- [Schoenfeld, 1992](#) – *Schoenfeld, A. H.* (1992). Learning to think mathematically: Problem solving, metacognition, and sense making in mathematics. In D. A. Grouws (Ed.), *Handbook of research on mathematics teaching and learning* (p. 334). New York: Macmillan.
- [Scientific Assessing, 2006](#) – *Scientific Assessing.* (2006). Reading and Mathematical Literacy: A Framework for PISA. Organization for Economic Co-operation and Development (OECD).
- [Stacey, 2006](#) – *Stacey, K.* (2006). What is mathematical thinking and why is it important. Progress report of the APEC project: collaborative studies on innovations for teaching and learning mathematics in different cultures (II) - Lesson study focusing on mathematical thinking. University of Melbourne, Australia.
- [Strasser, 1998](#) – *Strasser, R.* (1998). Mathematics at work: A didactical perspective. In C. Alsina, J. M. Alvarez, B. Hodgson, C. Labored & A. Perez (Eds.). *Proceeding of the 8th international congress on mathematical education: Selected lectures* (p. 427). Seville, Spain.
- [Stratton, 1999](#) – *Stratton, J.* (1999). Critical thinking for college students: Rowman & Littlefield.
- [Tall, 1991](#) – *Tall, D.* (Ed.). (1991). *Advanced mathematical thinking* (Vol. 11). Springer Science & Business Media.
- [Tularam, 2013](#) – *Tularam, G. A.* (2013). Mathematics in finance and economics: importance of teaching higher order mathematical thinking skills in finance. *E-Journal of Business Education & Scholarship of Teaching*, 7(1), 43.
- [Van der Wal et al., 2017](#) – *Van der Wal, N. J., Bakker, A., & Drijvers, P.* (2017). Which Techno-mathematical Literacies Are Essential for Future Engineers? *International Journal of Science and Mathematics Education*, 15(1), 87-104.
- [Verrecchia, 1982](#) – *Verrecchia, R. E.* (1982). The use of mathematical models in financial accounting. *Journal of Accounting Research*, 20(1), 1-42.
- [Wake, Williams, 2001](#) – *Wake, G. D., & Williams, J. S.* (2001). Using College mathematics in understanding workplace practice. Summative Report of Research Project Funded by the Leverhulme Trust, Manchester University, Manchester.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.
All rights reserved.
Published in the Slovak Republic
European Journal of Contemporary Education
ISSN 2304-9650
E-ISSN 2305-6746
2017, 6(3): 432-447
DOI: 10.13187/ejced.2017.3.432
www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



The Prediction of the Students' Academic Underachievement in Mathematics Using the DEA model: A Developing Country Case Study

Fatemeh Moradi ^{a,*}, Parvaneh Amiripour ^a

^a Department of Mathematics, College of Basic Science, Yadegar-e-Imam Khomeini (RAH) Shahre Rey Branch, Islamic Azad University, Tehran, Iran

Abstract

In this study, an attempt was made to predict the students' mathematical academic underachievement at the Islamic Azad University-Yadegare-Imam branch and the appropriate strategies in mathematical academic achievement to be applied using the Data Envelopment Analysis (DEA) model. Survey research methods were used to select 91 students from the Faculties of Engineering, Science, and Humanities for the analysis using the DEA model, along with the SBM method. This study had shown that the mean and the sum of the pre-university math score rankings were higher than the university's math scores. Therefore, it was concluded that the Islamic Azad University (Rey branch, Tehran province) students had displayed academic underachievement in the math exam. Moreover, "the economic, social, and educational factor" did not have any significant relationship with the students' "math scores." Also, forming the regression equation proved meaningless indicating economic, social, and educational factors did not impact on their mathematical academic underachievement. It was shown that the low level of performance was indicative of the students' negligence and reluctance concerning the math lessons, and it revealed that the economic, social and educational factors had no involvement or impact on their math scores. The results of this research will be for the benefit of the professors, administrators, and presiding officers of colleges in the field of mathematics.

Keywords: Academic underachievement, mathematics, academic achievement, Islamic Azad University, DEA model.

* Corresponding author

E-mail addresses: F_moradi71@yahoo.com (F. Moradi), parvaneh.amiripour@gmail.com (P. Amiripour)

1. Introduction

One of the branches of science that have always played a significant role in the development of human technology is mathematics. Humans have always been engaged in using the inspiration gained from his natural surroundings and modeling them when creating artifacts and had been aware of the fact that, without having a firm mathematical basis, the creation of anything functional would be impossible. It must be acknowledged that the traditional practices and attitudes of the individuals whose collective mathematical endeavors are doomed to fail, especially those aimed at the direct evaluation of high-level human skills, such as patterns of thought and cognition, reasoning and conceptual understanding, problem solving and the ability to communicate both within and outside of the world of mathematics. In this domain, new approaches based on the cognitive-behavioral analysis of the learners' mathematical behavior should be invented and developed. The fact that, in the past, some researchers considered mathematical knowledge and content as the only determining factor in teaching mathematics, is no longer accepted as a relevant scientific perspective. Many learners faced educational failure and underachievement due to reasons that vary, based on the type of respective society involved. While this failure will be the basis for many of their cultural, mental, economic, social, and family problems and because of the importance of the reasons for the failure, it will directly affect their educational future. Therefore, through the accurate and comprehensive understanding of these factors, we should prevent the emergence of such problems for the individuals, families, and communities and also the loss of the used expenses (Masoumi et al., 2007). Mathematics an important role, given the characteristics of modern society, in providing such skills, since mathematics deals with observation, calculation, analysis, inference, deduction, proof and prediction, and as a communication system, helps learners to obtain the precise and correct understanding of the information (Chamanara, 2011). The primary objective of mathematics, in the first place, is enhancing the problem-solving abilities in students and is a tool for understanding the surrounding phenomena and gaining the capacity to analyze complex situations. The importance of paying attention to academic courses, especially to math, shows that through paying attention to the objectives of this course, we can create the conditions for fostering logical thinking and problem-solving skills in learners, and provide the basis for the learners' applicability of mathematical concepts in real-life (Behrangi, 2001). Mathematics is a science with abstract intellectual concepts; that is to say, many of the mathematical concepts are the visions of objects cannot be interpreted by the real world in the same intellectual way. The fact that mathematics is an abstract science has made the possibility of understanding its concepts difficult and, as a result, it has made its teaching and learning hard. Subsequently, mathematics requires special teaching methods (Latifi and Karachi, 2006) to teaching it effectively. Mathematical underachievement has long been among the concerns of experts in this field. The educational performance of students is indirectly under the influence of their poor achievement in math. Investigating the factors that have roles in the mathematical underachievement of the students seems necessary, due to the results of the international studies done by academics, such as Lax (1990), Douglas (1998), Borba (2005), and Gynnild et al. (2005), which indicate some mathematical underachievement. Students' cultural backgrounds and learning-teaching methods are the factors influencing the students' mathematical performance. These influential teaching methods include the type of homework or tasks assigned to the students, learner-centered teaching methods and teacher-centered teaching methods. Learning methods include ones where the students' individual work is done as provided in their books, or by their teacher, and additional learning methods include group or class discussions regarding classroom problem-solving tasks. According to Sitko (2013), the students' mathematical performance might be influenced by the way teachers punish the students, the teacher-student relationship, and the kind of homework assigned by their teachers. On the other hand, the students' concentration in schools is affected by their learning environment.

2. Definition of Underachievement

In defining the term "Achievement," Smith (2003) points out that the notion of "underachievement" is broadly used by journalists, academics, and politicians to refer to a rather poor educational performance, but based on the literature review, there is little agreement on its measurement and definition. She believes that the term "underachievement" is mostly mixed and

combined with the notion of poor achievement, especially in media reports. She refers to the definitions proposed by researchers for the term "underachievement", which largely appears in the literature, as "class performance, usually measured by scores, that is significantly below what is expected based on the student's mental ability, usually measured by aptitude or standardized educational texts" (p. 290). Jones and Myhill (2004) maintain that the term "underachievement," as used in the context of the underachieving boys, suggests that boys are underachievers, not poor achievers and that compared to girls, boys are more likely to perform below their potential. In point of fact, the present underachievement dispute has become almost entirely a discussion about boys. Jones and Myhill made a distinction between noteworthy and poor achievers on the one hand, as well as underachievers, on the other hand. Poor and noteworthy achievers refer to those students whose performance concurs their ability, while the term underachiever refers to one whose ability does not match his performance.

3. Socio-Economic Factor

Socio-economic status acts as a predictor of mathematical achievement. It is recurrently found by studies, such as those conducted by Hochschild (2003) and Eamon (2005), that there are a positive relationship and correlation between the students' mathematical achievement scores and their parents' income. According to Ma and Klinger (2000), primary science and math achievement scores, socio-economic status plays an important role. In another study by Hull (1990), poor educational achievement of the Canadian students was due to their low socio-economic status. As reported by the Council of Ministers of Education Canada, Statistics Canada, and Human Resources Development Canada, 2001, and according to the Program for International Student Assessment, socio-economic status is considered to be one of the main predictors of educational achievement discrepancy of 15-year-old Canadian students in science, mathematics, and reading. Some of the studies revealed that parents with higher socio-economic status play more effective roles in their kids' education, compared to the parents with lower socio-economic status. According to Stevenson and Baker, (1987), this more effective role raises the positive attitude of the student toward the classes and the educational center, and enhances their educational achievement. As asserted by Jeynes (2002), due to the creation of a stressful atmosphere at home by raising conflict in the family, and facilitating potential interferences in parenting and due to it causing the prevention of the students' access to different educational resources and materials, low socio-economic status is believed to have a negative impact on students' educational achievement. That is why the students' socio-economic status is considered a common determining factor for educational achievement. It begins with a brief discussion, emphasising the distinctions between socio-economic factors that have influences on the quality of education, and the financial concerns pertaining to education. This thesis reviews some of the relevant studies that had dealt with the topic at hand. In the literature concerning education economics in developing countries, multiple and varying relations between educational outcomes and student socio-economic status have been well-reported. A series of compound and interconnected factors, both outside and inside the school system, lead to poor results at school level. Thomas and Stockton (2003) addressed the impact of the three factors of gender, ethnic, and socio-economic status on the students' achievement in mathematics. After Coleman's (1966) claim about the important impact of students' backgrounds on their school activities, socio-economic status came to be considered as an important predictor of students' educational achievement. As Payne and Biddle (1999) asserted in their study, which worked on the data gathered from the Second International Mathematics Study (SIMS), for the USA to be ranked second out of twenty-three participating countries, they would need to represent only the scores of the schools in the regions with low levels of poverty, but in only considering the school regions with high levels of poverty, USA would have ranked in a higher position than Nigeria and Swaziland. Poverty interacts with other factors, such as ethnicity as a significant predictor of educational achievement. As the findings of Harkreader and Weathersby (1998) show, ethnicity has less of an influence than economic factors do. Contrariwise, Bankston and Caldas (1998) found that there is a stronger relationship between minority status and educational achievement than the relationship between socio-economic status and educational achievement. The influences related to ethnicity and culture are significant and may be combined with gender influences for the purpose of predicting educational achievement. According to Lee and Madyun (2009), the students who grow up in deprived districts are more likely to be in the position of general, self-perpetuating

underdevelopment, compared to their peers who grow up in economically / socially stable districts, as a result of the more important social factors, far beyond the students' influence alone. Many different regional features influence the region's disadvantage and, consequently, the ability of a community to retain social control. These regional characteristics include factors such as neighborhood poverty, high residential mobility, crime, family composition, and ethnic diversity. As Lee and Madyun (2009) stated, there is a correlation between socio-economic status and the students' cognitive ability and educational attainments due to the fact that the students from families with high socio-economic status are supported by their families for their parents are apt to socialise their kids in a way that enhances their performance in IQ tests, which also indicates how they perform educationally. In a study conducted by Lee and Madyun (2009), it was found that students living in regions with low rates of poverty and crime, displayed higher educational attainment in both reading and mathematics, compared to the students in other regions. On the contrary, students living in regions with high rates of poverty and crime, compared to the students in other regions, lagged behind in reading and mathematics. Moreover, they found an important interface effect between ethnic and region type on the students' educational achievement. Wheaton (1985) argued that the presence of regional disadvantage may, ironically, encourage the students to mobilise or organise socio-economic resources to address their social marginalisation.

4. Educational Factor

In the literature, many concerns have been highlighted in the current math curricula as educational factors that underscore"not so much a form of thinking as a substitute for thinking. The process of calculation or computation only involves the deployment of a set routine with no room for ingenuity or flair, no place for guess work or surprise, no chance for discovery, no need for the human being, in fact" (Scheffler, 1975: 184). The concerns proposed in the literature are not saying that students should not learn to compute, but rather that they are emphasizing that students should learn how to produce effective solutions through learning the ways of analyzing the mathematical problems critically. In order to do so, according to Cobb et al. (1992), they need to learn how to think in a mathematical way and how to understand difficult math concepts. Many mathematics curricula overstress the facts memorization and understate the comprehension and use of these facts for the purpose of realizing, connection makings, and testing the math concepts. For students, in order to successfully use what they learn, memorization must be elevated to realization, use and problem-solving. As mentioned by Warren and Rosebery (1996), Bransford et al. (2000), and Schauble et al. (1995), a great deal of research indicates that educational factors (in the form of a curriculum), which consider learners to be unable to meet cognitive activities, such as complex reasoning, should be exchanged with the curriculum which considers students capable of higher-order reasoning and thinking, when supported with relevant and required activities and knowledge. According to Lehrer and Chazan (1998), research has also shown proof that educational factors leading to growth in students' skills and knowledge, are significantly linked to their learning, and consequently their achievement.

5. Educational Strategies

The factors involved in mathematical success include the ability to comprehend one's current knowledge, build upon this knowledge, enhance it, and decide based on it or make changes when confronting the conflicts. For this purpose, according to Romberg (1983), we need inventing, problem solving, proving, and abstracting. These are the essential cognitive processes that students are required to develop and apply in math classes. Thus, teaching-learning methods and strategies that present learning situations to the learners, in which they can create and use higher-order operations, are necessary for mathematical achievement. In the literature, according to Wilson (1996), it is stated that teachers must provide authentic and meaningful learning tasks to make students build their knowledge and understanding in the field of mathematics so that they can accomplish learning. Moreover, as Bloom (1976) highlighted, the teaching strategies that students actively apply in their own learning is important for their success. Teaching strategies form the students' development in learning and their mathematical achievement.

6. Teacher/Professor Competency in Mathematics Education

Many studies in the literature suggest that teachers' knowledge and beliefs concerning mathematics is directly associated with their teaching procedures and choices (National Council of Teachers of Mathematics, 1989; Brophy, 1990). Moreover, Gellert (1999) stated that "in mathematics education research, it seems to be undisputed that the teacher's philosophy of mathematics has a significant influence on the structure of mathematics classes" (p. 24). Teachers are required to have knowledge and skills to use their teaching philosophy and teaching decisions. One changing educational pattern in the 21st century is about teachers' skills and roles. Research results concerning teacher skills suggest that, "If teachers are to prepare an ever more diverse group of students for much more challenging work – for framing problems; finding, integrating and synthesizing information; creating new solutions; learning on their own; and working cooperatively – they will need substantially more knowledge and radically different skills than most now have and most schools of education now develop" (Darling-Hammond, 1997: 154). According to Bransford et al. (2000), teachers need to have three types of knowledge, namely: knowledge of their students, pedagogical knowledge, and knowledge of a specific issue. Teacher proficiency in these domains is closely related to student learning, understanding, and thinking in mathematics. Undoubtedly, according to Grossman et al. (1989), for students to reach mathematical achievements, teachers are needed to have an epistemology that guides them in math teaching and a well-founded understanding of the subject matter, and also a similarly thorough understanding of different types of teaching activities that enhance the student's achievement. Experienced mathematics teachers make a careful plan to lead their students' critical thinking, to a systematized understanding of mathematical concepts, to reflective learning, and finally to mathematical attainment.

7. Educational Center Facilities

Facilities and context of the educational centers are the potential main factors in student achievement. In point of fact, educational experts have begun to focus on identifying factors related to the environment of the educational centers. For example, Reynolds et al. (1996) propose that student achievement is related to the organized and safe atmosphere in educational centers. Some factors have also been found by researchers to have a negative impact on student achievement, including deficiencies in the educational center's components or features like lighting, age, the budget for buying equipment. Considering the condition of the educational center's building, Cash (1993) found that compared to the students in above standard buildings, the students in standard buildings achieved lower achievement scores. Moreover, Rivera-Batiz and Marti (1995) worked on examining the relationship between student achievement and the overcrowded buildings of the educational centers. The study revealed the negative effect of a dense population of students in overcrowded buildings, on student achievement.

Examples of the research done similarly in this area are as follows: In eight Johannesburg public primary schools, Ndebele (2015) found the negative influence of socio-economic factors on the involvement of the parents in their children's homework assignments during the foundation phase. The study was carried out on more than 600 parents from schools in various socio-economic and geographical areas, such as townships, suburbs, and the inner city areas. Based on the results of the study, it may be concluded that the parents with higher socio-economic backgrounds and incomes are more likely to be involved in their children's homework than the parents of poorer socio-economic status. Khan (2016) examined the goals of his study to explore the influences of socio-economic background, and also the influences of gender differences in study habits of the grade seven students (100) of Government Colleges of the Amroha region. Two psychological tests, called the Socio-economic Status Scale, were used to investigate the impact of the two independent variables on study habits of the above-mentioned students. The findings revealed that the factor of gender had a significant impact on the students' study habits. However, it was found that the impact of socio-economic background on the study habits of the students was insignificant. Moreover, the interactive effect of socio-economic background and gender difference was also not significant. Scholar failure as a complex phenomenon, as stated by Romana (2014), depends on different factors – including biophysical, scholar-related, or social factors. However, scholar failure in secondary and primary education systems has different roots,

in comparison to those found in tertiary education systems. In a study that had addressed and analyzed a specific case of university student, the main causes of student failure were found to be external factors (economic pressure, social pressure, and family situation) and internal (personal) factors, as well as factors which include economic and pedagogical difficulties, teacher's needs, and disciplines difficulty (many technical disciplines).

Now, one of the concerns that many fields of study have (especially engineering fields), is academic underachievement of students in mathematics, and many of the professors in engineering faculties face this problematic issue, and they repeatedly ask this fundamental question: which reasons have caused the students' academic underachievement, and what are the appropriate strategies to be used, in order to improve academic achievement. Creating an appropriate educational setting and the extent of effective learning has always been one of the concerns of educational authorities in each country. In Iran, in recent years, students are no longer willing to take some courses, such as mathematics. Unfortunately, many factors affect the process of efficient teaching and learning of mathematics and cause the academic underachievement in these courses. Understanding these factors could help the planning required to better this problem. The teaching methodologies in universities should be modified, and provide the sociability basis of them, according to the change in social conditions and the appropriate recognition of its target group, namely students.

Understanding these factors is of paramount importance since the ministry of science, and the universities are the educational authorities for the upbringing of new generations, and if they do not revise the structure, course content and the definition of goals and educational products at the university level, they will provide grounds for the academic underachievement. When a learner changes his grade or academic level, it seems that some changes are made in the environment around him. If the changes can be effective in his learning environment, it can be an obstacle in his academic achievement or can be a factor that affects his academic progress. Educational, social, and economic factors can affect learning and academic achievement. But intra-organisational factors, that is, factors within the educational center - whether school or university - might also have an impact on this issue; factors, such as teaching methods, problem-solving skills, educational quality, sufficient resources and budget for equipment procurement, etc. In recent years, it seems that factors, such as social, economic and educational factors, collectively had an impact on the students' learning and academic achievement in mathematics. This study, with a new approach, attempts to create appropriate strategies through the creation of an efficient educational model to develop and motivate students to continue studying math, as well as effective learning of math as the basis of the courses in each field of study. Therefore, in this study, we are currently looking at investigating general, economic, social and educational factors that affect the students' academic failure. Then, the real question is, "which of the factors, such as economic, social, and educational, have more impact on their academic performance in math?"

8. Methods and Material

This study is a case of descriptive-survey research. Survey study, as a branch of descriptive research, is a data-collection method in which a particular group, of people, is asked to respond to many specific questions. In this type of research, the information is directly obtained from the study group, and the sample chosen in this study is usually extensive. The purpose of this type of research is mostly focused on areas, facts, beliefs, and behaviours, and the variables under the study are limited, and what is being studied is relevant to the present. In the survey research, a questionnaire was used for data collection purpose.

The population of the study involved all the students studying at the Faculty of Science, Humanities, and Engineering at Islamic Azad University (Rey Branch, Tehran) during the academic year 2013–2014. Considering that the total population of the students was 120 students, using simple random sampling methods and, according to the Cochran table, 91 students were selected from the faculties of technical-engineering, basic sciences, and humanities. Therefore, 91 selected samples were considered.

Since no questionnaire was designed on the social, economic, and educational factors involved in students' educational failure in developing countries, the researchers designed and developed a questionnaire with a total of 33 items after a one-year study period. This questionnaire

was implemented in several stages, at different periods of an academic year, the first and the second semesters, and the summer semester on a sample group of students. The questionnaire included 33 questions in the Likert scale with three options of "yes", "no" and "to some extent", respectively. The content of this questionnaire was as follows:

- Review of the Economic factor: The data related to the students' occupation (in the demographic data)
- Review of the Social factor: The data related to the students' marital status (in the demographic data)
- Review of the Academic underachievement: The students' pre-university and university math scores (in the demographic data)
- Review of the Educational factor: The data related to the sections of students', professors', deans', and each university's status (in the 33 items of the questionnaire).

The researcher-made questionnaire was reviewed by the experts, especially in the field of teaching mathematics, and its validity and reliability were proven. The reliability of the questionnaire was confirmed using Cronbach's alpha and content validity of the questionnaire was estimated by the use of the content validity ratio (CVR) index. According to the opinions of 11 experts in the field of mathematics, teaching and educational management, the acceptable amount of CVR was shown to be 0.70. Therefore, the researcher-made questionnaire was reviewed from the viewpoints of professional experts, especially in the field of mathematics teaching, and its content validity was proven. Cronbach's alpha method was used to check the reliability of the researcher-made questionnaire. For this purpose, SPSS software was used for Cronbach's alpha. Cronbach's alpha, with the value of 0.79, showed that the researcher-made questionnaire had an appropriate degree of reliability. Therefore, all 33 modified items were eventually used.

9. Findings

In this section, the results of the descriptive statistics will be described first. Therefore, using the data collected by the questionnaire, their central tendencies and dispersion was measured, and the results are described in [Tables 1](#) and [2](#):

Table 1. Results of the Scores' Descriptive Statistics

| Grade \ Index | N | Mean | Std | Mode |
|---------------------------|----|-------|------|------|
| University math score | 91 | 10.69 | 2.96 | 10 |
| Pre-university math score | 91 | 15.09 | 2.83 | 15 |

According to [table 1](#), it is clear that there is a significant difference between the means of pre-university math score and the university math score. Moreover, the frequency of score, 15, among pre-university math scores, had been more than university math scores.

Table 2. Results of the Factors' Descriptive Statistics

| Factors \ Index | Mean | Std | Mode |
|--------------------|-------|------|------|
| Educational factor | 2.09 | 0.25 | 2.12 |
| Social factor | 1.11 | 0.31 | 1 |
| Economic factor | 1.59 | 0.74 | 1 |
| Math score | 10.69 | 2.96 | 10 |

According to [table 2](#), it is clear that no significant difference is observed between the mean of university math score, economic factor, social factor and educational factor. In order to examine the significant difference between pre-university and university scores in mathematics, it was first found with the K-S test that, since the obtained P-values only in the pre-university math score is less than 0.05, therefore, the data related to the pre-university mathematics scores were not normal. Hence, following that, we used the non-parametric U-Mann-Whitney test to analyze the

data. Based on the result of the P-value obtained for the averages less than 0.05 ($p < 0.05$), we conclude that the means of the pre-university and university math scores are not the same.

Since, in reviewing the data correlation and regression, normality is initially considered to be important, therefore first, residuals were evaluated in terms of normality by the use of K-S and Shapiro tests, and since the residuals were normal (prerequisite for using correlation and regression), therefore, regression and correlation were used with confidence, while in examining the normality of the scores, the pre-university scores were not the only normal scores. So what is important here is checking the residuals.

Then to evaluate the relationship between the factors and the data scores, Spearman correlation coefficient test was used. According to the results in Table 3, it is clear that the economic factor had no significant relationship with the students' math score ($p > 0.05$). Therefore, it can be argued that the economic factor has no significant relationship with the students' math score.

Table 3. The Correlation Coefficient Results of Economic Factor and Math Score

| Coefficient | Variables | | Economic factor | University math score |
|-----------------------|-------------------------|-------------------------|-----------------|-----------------------|
| | Economic factor | correlation coefficient | | 1 |
| P-value | | | --- | 0.33 |
| University math score | correlation coefficient | | 0.1 | 1 |
| | P-value | | 0.33 | --- |

Based on the results in table 4, it is clear that the social factor has no significant relationship with the students' math scores ($p > 0.05$). It can be argued that social factors have no significant relationship with the students' math score.

Table 4. The Correlation Coefficient Results of Social Factor and Math Score

| Coefficient | Variables | | Social factor | University math score |
|-----------------------|-------------------------|-------------------------|---------------|-----------------------|
| | Social factor | correlation coefficient | | 1 |
| P-value | | | --- | 0.65 |
| University math score | correlation coefficient | | -0.04 | 1 |
| | P-value | | 0.65 | --- |

According to the results in table 5, it is clear that educational factors have no significant relationship with the students' math score ($p > 0.05$). Therefore, it can be argued that educational factors have no significant relationship with the students' math scores.

Table 5. The Correlation Coefficient Results of Educational Factor and Math Score

| Coefficient | Variables | | Educational factor | University math score |
|-----------------------|-------------------------|-------------------------|--------------------|-----------------------|
| | Educational factor | correlation coefficient | | 1 |
| P-value | | | --- | 0.62 |
| University math score | correlation coefficient | | -0.05 | 1 |
| | P-value | | 0.62 | --- |

As shown in Table 5, none of the economic, social, and educational factors had any significant effect on the students' math scores ($p > 0.05$).

Table 6. The Regression Coefficient Results of Three Factors, and Math Scores

| Model | Non-standardized coefficients | | Standardized coefficients | Test statistics | P-value |
|--------------------|-------------------------------|--------------------------|---------------------------|-----------------|---------|
| | Beta | Standard deviation error | Beta | | |
| Constant | 2.08 | 0.49 | --- | 4.26 | 0.000 |
| Social factor | -0.08 | 0.18 | -0.04 | -0.45 | 0.65 |
| Economic factor | 0.09 | 0.07 | 0.13 | 1.21 | 0.22 |
| Educational factor | -0.18 | 0.22 | -0.08 | -0.82 | 0.41 |

In Table 6, forming a multiple regression equation of the listed factors would be meaningless since $p > 0.05$. Therefore, none of the economic, social, and educational factors have a significant effect on their academic underachievement in math.

Since, in this research, we tried to estimate and compare the results of the two types of analysis by SPSS and DEA, it was therefore attempted to first determine the economic, social, and educational status of the students with central indicators and dispersion by descriptive statistics, and then in order to ensure the results, the correlation was estimated between the university math scores and the social, economic, and educational factors, and regression was used to find the factors which lead to academic failure. The type of regression used here is multiple regression. In fact, regression prerequisites were met, and due to the space constraints in the article, the final result of the regression will be announced. Moreover, the same analyses were repeated by the DEA-related calculations, in order to show that both methods of analysis were the same, which was a kind of innovation in analysis. Through calculating the data in the formulas that are outlined below, the researcher conducted the analysis as follows:

To calculate the DMU_0 unit's efficiency with the input x_0 and the output y_0 , the following model was considered, based on the $s_m^-, \dots, s_1^-, s_s^+, \dots, s_1^+, \lambda_n, \dots, \lambda_1$ variables.

$$\begin{aligned}
 \text{min } & \theta - \varepsilon \left(\sum_{i=1}^m s_i^- + \sum_{r=1}^s s_r^+ \right) \\
 \text{s.t. } & \sum_{j=1}^n x_{ij} \lambda_j + s_i^- = \theta x_{i0} & i = 1, \dots, m, \\
 & \sum_{j=1}^n y_{rj} \lambda_j - s_r^+ = y_{r0} & r = 1, \dots, s, \\
 & s_i^- \geq 0, s_r^+ \geq 0 & i = 1, \dots, m, \quad r = 1, \dots, s, \\
 & \lambda_j \geq 0 & j = 1, \dots, n. \\
 & \varepsilon = 0.0000000001
 \end{aligned}$$

Table 7 includes seven columns. The first column indicates DMU. The second column indicates the factor of students, and the third column indicates the factor of math professors, the fourth column indicates the faculty factor, the fifth column indicates the university factor, the sixth column indicates the students' scores, and the seventh column indicates the students' performance. In this table, 1, 4, 58 and 49 demonstrate desirable performance, which is called 'super-performance.' The students can be divided into three categories, according to Table 7:

- [0.45, 1]= Good
- [0.30, 0.45]= Average
- [0.10, 0.20]= Weak

The first category is the category where the students are performing at optimal performance, and it is thus called the 'good category'. The second category is the one that includes the students with average performance, which is called 'average category', accordingly. The third category is called the weak category, where the students are demonstrative of weak performance. For example, in the first category, in the cases of students like 1, 4, 58, 49, student 4 has a score of 19.5 and has inputs lower than those of the other students, but he has a better performance than the other students. The students 1, 58, and 49 are the other examples. The students who are in the average category are the students with higher inputs than the students in the first category, but they show lower rates of performance. In the first case: given that the input is low, which means that the students are in undesirable status regarding marital status, math professors' factor, and the university factor, the students demonstrated desirable performance. In the second case, which does not include a significant number, the students display average performance, which means that, compared to the first case, they have more inputs, but they have lower rates of performance. In the third case: the number of the students in this category is of more significance than the cases 1 and 2; which means that they have more inputs than in cases 1 and 2, meaning that the student and professor variables are more and that the student has a better status.

Table 7. Results of the SBM Model

| Number | Input 1 | Input 2 | Input 3 | Input 4 | Output | Efficiency |
|--------|---------|---------|---------|---------|--------|------------|
| 1 | 62 | 47 | 14 | 11 | 15 | 1 |
| 2 | 115 | 125 | 25 | 40 | 11 | 0.17 |
| 3 | 92 | 76 | 27 | 22 | 14 | 0.32 |
| 4 | 70 | 70 | 17 | 17 | 19.50 | 1 |
| 5 | 81 | 52 | 14 | 11 | 10 | 0.29 |
| 6 | 64 | 89 | 35 | 8 | 10 | 0.26 |
| 7 | 75 | 89 | 22 | 30 | 17 | 0.40 |
| 8 | 85 | 98 | 22 | 22 | 11 | 0.23 |
| 9 | 86 | 91 | 27 | 19 | 16.25 | 0.35 |
| 10 | 124 | 124 | 11 | 8 | 18.25 | 0.28 |
| 11 | 94 | 101 | 24 | 14 | 14 | 0.28 |
| 12 | 73 | 33 | 25 | 11 | 5 | 0.19 |
| 13 | 75 | 83 | 19 | 19 | 16 | 0.39 |
| 14 | 72 | 88 | 17 | 22 | 4 | 0.09 |
| 15 | 56 | 78 | 25 | 11 | 7 | 0.21 |
| 16 | 94 | 46 | 14 | 8 | 7.50 | 0.21 |
| 17 | 94 | 105 | 35 | 20 | 5 | 0.09 |
| 18 | 110 | 68 | 17 | 22 | 4 | 0.08 |
| 19 | 82 | 88 | 14 | 17 | 13 | 0.29 |
| 20 | 95 | 94 | 20 | 20 | 4 | 0.29 |
| 21 | 112 | 81 | 22 | 20 | 17.25 | 0.35 |
| 22 | 84 | 96 | 22 | 27 | 12.50 | 0.27 |
| 23 | 110 | 93 | 20 | 22 | 16.25 | 0.31 |
| 24 | 94 | 91 | 19 | 20 | 16 | 0.33 |

| | | | | | | |
|----|-----|-----|----|----|-------|------|
| 25 | 73 | 99 | 17 | 25 | 9.50 | 0.22 |
| 26 | 97 | 84 | 17 | 14 | 15 | 0.23 |
| 27 | 93 | 45 | 4 | 9 | 13 | 0.38 |
| 28 | 84 | 99 | 22 | 19 | 8 | 0.17 |
| 29 | 95 | 105 | 14 | 8 | 17 | 0.33 |
| 30 | 125 | 95 | 25 | 8 | 19 | 0.33 |
| 31 | 105 | 124 | 27 | 19 | 6 | 0.10 |
| 32 | 64 | 87 | 8 | 11 | 7.50 | 0.19 |
| 33 | 110 | 114 | 22 | 11 | 9 | 0.15 |
| 34 | 125 | 112 | 17 | 17 | 10 | 0.16 |
| 35 | 94 | 64 | 14 | 14 | 16.50 | 0.41 |
| 36 | 114 | 72 | 22 | 11 | 10.50 | 0.22 |
| 37 | 97 | 107 | 27 | 14 | 12 | 0.22 |
| 38 | 73 | 76 | 17 | 11 | 6 | 0.15 |
| 39 | 97 | 99 | 2 | 25 | 15 | 0.29 |
| 40 | 88 | 121 | 8 | 8 | 15 | 0.28 |
| 41 | 97 | 104 | 20 | 24 | 13.75 | 0.26 |
| 42 | 93 | 75 | 8 | 11 | 8 | 0.18 |
| 43 | 99 | 140 | 17 | 20 | 17 | 0.28 |
| 44 | 83 | 65 | 14 | 13 | 10 | 0.26 |
| 45 | 107 | 91 | 11 | 13 | 18 | 0.35 |
| 46 | 74 | 54 | 24 | 8 | 9 | 0.27 |
| 47 | 94 | 76 | 8 | 8 | 16 | 0.36 |
| 48 | 92 | 86 | 35 | 19 | 12 | 0.26 |
| 49 | 87 | 75 | 14 | 11 | 19 | 0.45 |
| 50 | 112 | 119 | 14 | 11 | 14.50 | 0.24 |
| 51 | 119 | 109 | 30 | 17 | 14.50 | 0.24 |
| 52 | 97 | 58 | 35 | 8 | 14 | 0.35 |
| 53 | 109 | 59 | 32 | 14 | 14.50 | 0.34 |
| 54 | 80 | 69 | 11 | 11 | 4 | 0.10 |
| 55 | 81 | 72 | 14 | 14 | 11 | 0.27 |
| 56 | 81 | 76 | 20 | 17 | 10 | 0.24 |
| 57 | 130 | 63 | 25 | 20 | 19.50 | 0.40 |
| 58 | 89 | 44 | 4 | 11 | 17 | 1 |
| 59 | 112 | 134 | 30 | 25 | 14.50 | 0.23 |
| 60 | 88 | 99 | 7 | 14 | 19.50 | 0.40 |
| 61 | 110 | 53 | 14 | 8 | 17 | 0.42 |
| 62 | 82 | 51 | 19 | 19 | 13 | 0.38 |
| 63 | 83 | 109 | 20 | 20 | 13 | 0.26 |
| 64 | 102 | 77 | 22 | 30 | 17 | 0.37 |
| 65 | 97 | 122 | 30 | 32 | 14 | 0.25 |
| 66 | 70 | 109 | 14 | 17 | 13 | 0.29 |
| 67 | 109 | 80 | 30 | 35 | 17.25 | 0.35 |
| 68 | 98 | 71 | 40 | 22 | 18.50 | 0.43 |
| 69 | 114 | 111 | 11 | 19 | 13 | 0.22 |
| 70 | 115 | 94 | 25 | 14 | 17 | 0.31 |
| 71 | 67 | 75 | 11 | 8 | 13 | 0.35 |
| 72 | 102 | 103 | 19 | 11 | 14.50 | 0.27 |
| 73 | 73 | 101 | 14 | 7 | 17 | 0.39 |
| 74 | 61 | 67 | 22 | 8 | 12.50 | 0.38 |
| 75 | 112 | 80 | 35 | 14 | 19 | 0.38 |
| 76 | 89 | 95 | 19 | 11 | 13 | 0.27 |
| 77 | 69 | 84 | 14 | 8 | 13 | 0.33 |

| | | | | | | |
|----|-----|-----|----|----|-------|------|
| 78 | 91 | 75 | 5 | 14 | 14.25 | 0.33 |
| 79 | 79 | 91 | 19 | 8 | 17 | 0.39 |
| 80 | 87 | 76 | 14 | 11 | 17 | 0.39 |
| 81 | 94 | 122 | 19 | 11 | 12 | 0.22 |
| 82 | 115 | 83 | 14 | 8 | 17.50 | 0.34 |
| 83 | 84 | 91 | 40 | 25 | 16.50 | 0.36 |
| 84 | 88 | 82 | 27 | 11 | 18 | 0.41 |
| 85 | 109 | 108 | 14 | 8 | 17 | 0.30 |
| 86 | 97 | 101 | 7 | 11 | 14 | 0.27 |
| 87 | 110 | 112 | 25 | 24 | 15.50 | 0.27 |
| 88 | 115 | 53 | 22 | 11 | 8.50 | 0.20 |
| 89 | 80 | 53 | 17 | 22 | 11.50 | 0.33 |
| 90 | 94 | 106 | 14 | 14 | 10 | 0.19 |
| 91 | 109 | 66 | 25 | 27 | 12.50 | 0.28 |

In this case, it may be concluded that the poor performance shows the students' lack of attention and their reluctance towards mathematics course, which indicates, in turn, that economic, social and educational factors do not have any involvement or impact on their math scores.

10. Conclusion

Regarding academic underachievement in math, most of the students are reluctant and less interested in learning math, due to the intangibility of mathematical concepts and the abstract nature of the university-level mathematics. Mathematics is one of the core scientific courses which is of great importance, but factors such as inefficiency and traditional teaching methods, unfriendly class atmosphere, the high volume of prescribed books, and the large number of students in a class, has caused some students to endure this type of course with great difficulty, during the progression of their educational careers. Mathematics is one of the sciences that strengthens the students' creativity and increases their analytical power. However, some of the students do not show enough interest and do not have enough motivation to learn this course, and we observe their academic underachievement in this type of course. In math classes, the students who are more talented in mathematics are always cared for by the professor. A large number of students in a class hinders the teacher from checking the students' learning status, especially in math lessons. Once the students understand the application of mathematics in their daily lives, they will show more interest in learning it. Therefore, the teacher must teach this course by employing the proper methodology. The relationship between mathematics and the other subjects should be specified, and it must be taught to the other students that most of the available courses can benefit from this science.

Mathematics is among the courses that dramatically help the classification and ordering of the students' assimilated information, and increases their ability in critical thinking, creativity, and curiosity. Learning this course will raise the analytical power of the students; and one of the powerful tools for enhancing the students' thinking and reasoning abilities, is teaching mathematics, which, according to the beliefs of many experts, feeds into other sciences. Mathematics is the basis of industry and technology, and the success of the students in this type, of course, will provide the basis for their success in the other sciences. With the proper teaching of math to the students, their ability to live in today's world, which is equipped with technology and computers, will be increased. One of the effective factors in the students' academic underachievement in mathematics is their anxiety in dealing with this type of course. The students' motivation levels, collectively, have a significant relationship with their general success in mathematics so that, with the increase in their motivation, their success level in mathematics will be increased and their anxiety will be decreased.

Inappropriate methodology, when teaching mathematics, is another reason behind the students' academic underachievement. Some professors rely on old teaching methods and give the students little opportunity to show their abilities. The ineffective teaching methods, the negligence in evaluation, the improper structuring of the questions and exam methods, are effective indicators

of students' academic underachievement in mathematics. Considering this issue, the strategies, such as educational planning, can be offered, involving all aspects of mathematical skill and the solving of various mathematical problems. The necessity of having a certificate from higher education schools for employment is one of the reasons why people attend universities. Choosing an improper discipline, the unfamiliarity with academic systems in the first semester and the correct study methods, personal and family issues and so forth, are the reasons for academic underachievement in universities and especially in abstract courses, such as mathematics.

Currently, the selection of academic disciplines and occupational goal-setting creates a negative attitude and decreases the educational motivation. The right choice of academic discipline is the most important factor in academic achievement and, unfortunately, because of the problems in the job market, most of the families and students choose an academic discipline with the goal of receiving a bachelor's degree and being hired by government organizations. Paying attention to the occupational ground in the future of each area is one of the issues which needs to be culturalized, so that a part of human and economic sources, as well as potential talent, would not be annually diminished in the universities; since, otherwise, the academic underachievement will become intensified, and it would have unpleasant consequences in the one's personal and social life. Higher education volunteers are not aware enough of the academic disciplines and, as a result, through the wrong choice of academic discipline – simply receiving an educational degree in any discipline is sufficient for them. The job market's inability to attract graduates is referred to as one of the reasons for not welcoming the appropriate education.

Now, society is highly interested in entering university, but choosing the field of interest, the city and so on, is not important for them, and this issue is another underlying problem affecting the academic underachievement at university – especially when it comes to abstract courses such as math. Academic underachievement is related to the problems of the current generation, because, at this point, most of the students have jobs and do not have the opportunity to involve the academic competition and as a result, they attend the class with reluctance and only for getting a passing grade. The intertwining of the factors as mentioned earlier reduces the education morale and spirit among the students and, as a result, the academic underachievement occurs in abstract subjects, such as math.

In the past, the student's duty was only to educate, assimilate information and to do research, but today, there are students who come to class after a busy day, working in order to make money to pay for their education expenses, and this will inevitably reduce their learning performance in courses such as mathematics.

Lack of proper facilities, lack of dormitories, overcrowding in dormitories, lack of studying space and so on, collectively play an important role in the students' academic underachievement. Without considering the number of the students, available facilities, and so forth, the respective capacity of universities are expanding every year, while the lack of preparedness for the appropriate conditions causes problems, such as academic underachievement. Due to the high volume of mathematics textbooks in universities, the students undergo a great deal of pressure, which should be settled by strategic educational plans. The mental and emotional crisis, being far away from family, being single, student life problems, etc., are some of the factors that contribute to the students' problems and lead to the academic underachievement. Studying at university, especially in abstract subjects such as mathematics, requires concentration and a calm atmosphere. Due to the decrease in the academic competition, with pertaining to the quantitative development of the universities and lack of attention to the quality and the educational standards, academic underachievement has considered as a basic problem and will gradually intensify. The academic achievement requires continuous evaluation, but now due to the short duration of the semester, the professors are not able to evaluate students in courses such as mathematics. Most of the students do not study the subjects that were taught in the previous sessions and wait for the exam day. Therefore, the implementation of formative assessment can help this issue. What is certain is the diagnosis of the problems and the referred factors in the system of higher education that must be considered by the officials, teachers, and the university presidents. Especially in the field of mathematics which is the foundation of most of academic disciplines and all of the students must pass this course in the undergraduate program. What was found through the statistical findings

and the DEA method was that scientific perseverance and motivation of students in learning math is more effective than the environmental factors.

At Shahre Rey Branch (university) in the province of Tehran, as one of the largest universities in this province, an image of educational quality is shown, which indicates that factors other than those mentioned here were influential in this research. Most people believe that the major factors, such as educational, economic, and social ones, can affect the students' academic achievement in any course or field of study. But in this research, it was found that these underlying factors can not affect the decline in students' educational performance in mathematics. It is then clear that factors other than those previously-mentioned factors may show as having an influence on that. It seems that factors such as the teaching methods of mathematics professors would need to be reviewed. Mathematics professors use the traditional teaching methods that are abstract, and the students do not learn how to apply mathematical methods in real life. In the view of the professors, due to the insufficient time, it needs to be taught abstractly, which has led to the lack of motivation and the decline in students' academic performance in mathematics. Teaching methods based on books and official pamphlets lead to the students' lack of critical thinking. As long as the students' thinking is not active and the classes are not student-centered, we will continue to face this decline.

Additionally, the case that needs to be considered is one of active methods, based on creative education. In university-level mathematics classrooms, due to the lack of facilities and the inadequate allocation of time for each course, professors cannot apply the active skills when teaching mathematics. The use of active educational methods can enhance the spirit of cooperation and learning, based on the student's active participation in learning concepts, and also, with the active participation of the student, the basis for lifelong learning is provided. But this important approach is not being used in university classrooms, at present. In developing countries, the educational and curricular development system has some problems, which include untrained educators in active learning, and a lack of educational facilities. While mathematics educators/professors have not learned active teaching skills, they cannot propose active strategies for effective teaching by themselves. Moreover, lack of required funds and facilities for implementing active educational activities, by which to learn mathematical concepts better, as well as the fact that qualified professors from advanced countries are not being used, can also be barriers that lead to students' academic failure. A noteworthy example of this is in Iran, where academic communication and correspondence is in Farsi, and thus, foreign professors cannot teach there. If sufficient resources and facilities are provided for the teachers of abstract subjects; such as mathematics, the more self-confidence and self-motivation will be provided for the students. Now, answering the question of how to make these resources available to professors, requires extensive research. Especially in developing countries such as Iran, decent allocation of human and non-human resources may affect the quality of education and motivation of the learners.

Research suggestions are presented as follows:

It is suggested that the educational factors, from the angles of learning environments, math class environments, math teachers' scientific levels, length of education periods, and so on, be presented in the form of a conceptual model, and the effects of these factors on the academic underachievement of the students in mathematics courses be investigated and compared to the students from the different faculties. It is suggested that the effect of educational, social, and economic factors be investigated on the other university levels, among the masters and doctoral students in mathematics courses and lessons, and it is suggested that the effect of educational, social, and economic factors be investigated at an undergraduate level at university, among male and female students taking mathematics courses and lessons.

11. Acknowledgement

This manuscript was copy-edited by volunteers, Jaime Ribeiro and Robert Jordan (OCT 639674). Without their kind assistance, this publication would not be possible.

References

Bankston, Caldas, 1998 – Bankston, CL. III., & Caldas, S.J. (1998). Family structure, schoolmates, and racial inequalities in school achievement. *Journal of Marriage and the Family*, 60(3), 715-724.

Behrangi, 2001 – Behrangi, M. (2001). Evaluation of the extent of relationship between the final results of the Isfahani third grade guidance school and fifth grade primary school students in mathematics. Research Council of Isfahan province, Isfahan.

Bloom, 1976 – Bloom, B. (1976). Human Characteristics and School Learning. New York: McGraw Hill, Inc.

Borba, 2005 – Borba, R. (2005). Math Failure Rate High. The Collegian, October 3, 2005. California State University, Fresno. Retrieved December 3, 2009, from <http://www.csufresno.edu/Collegian/archive/2005/10/03/news/math.shtml>

Bransford et al., 2000 – Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). How People Learn: Brain, Mind, Experience, and School: Expanded Edition. Washington, D.C.: National Academy Press.

Brophy, 1990 – Brophy, J.E. (1990). Teaching social studies for understanding and higher-order applications. *Elementary School Journal*, 90, 351-417.

Cash, 1993 – Cash, C. S. (1993). Building condition and student achievement and behavior. Unpublished doctoral dissertation. Virginia Polytechnic Institute and State University.

Chamanara, 2011 – Chamanara, Q. (2011). The investigation on the effects of behaviorism on the mathematical education, *Journal of Development in Mathematics Education*, 103, Educational aids publications of Ministry of Education.

Cobb et al., 1992 – Cobb, P., Yackel, E., & Wood, T. (1992). A constructivist alternative to the representational view of mind in mathematics education. *Journal for Research in Mathematics Education*, 19, 99-114.

Coleman, 1966 – Coleman, J.S. (1966). Equality of Educational Opportunity Study (EEOS). Washington, DC: U.S. Department of Health, Education, and Welfare, Office of Education.

Darling-Hammond, 1997 – Darling-Hammond, L. (1997). School reform at the crossroads: Confronting the central issues of teaching, *Educational Policy*, 11(2), 151-166.

Douglas, 1998 – Douglas, R.G. (1998). Today's Calculus Course are Too Watered Down and Outdated to Capture the Interest of Students. *The Chronicle of Higher Education*, 34, 1-3.

Eamon, 2005 – Eamon, M. K. (2005). Socio- demographic, school, neighbourhood, and parenting influence on academic achievement of Latino young adolescent, *Journal of youth and adolescents*, 34(20), 163-175.

Gellert, 1999 – Gellert, U. (1999). Prospective elementary teachers' comprehension of mathematics instruction. *Educational Studies in Mathematics*, 37, 23-43.

Grossman et al., 1989 – Grossman, P.L., Wilson, S.M., & Shulman, L.S. (1989). Teachers of substance: Subject matter for teaching, Knowledge Base for the Beginning Teacher (pp. 23-36), M.C. Reynolds, ed. New York: Pergamon Press.

Gynnild et al., 2005 – Gynnild, V., Tyssedal, J., & Lorentzen, L. (2005). Approaches to Study and the Quality of Learning. Some Empirical Evidence from Engineering Education, *International Journal of Science and Mathematics Education*, 3, 587-607.

Harkreader, Weathersby, 1998 – Harkreader, S., Weathersby, J. (1998). Staff Development and Student Achievement: Making the Connection in Georgia Schools. Atlanta, GA: The Council for School Performance.

Hochschild, 2003 – Hochschild, J. (2003). Social class in public schools. *Journal of social issues*, 59(4), 821-840.

Hull, 1990 – Hull, J. (1990). Socioeconomic status and native education. *Canadian Journal of Native Education*, 17, 1-14

Jeynes, 2002 – Jeynes, W. H. (2002). Examining the Effects of Parental Absence on the Academic Achievement of Adolescents: The Challenge of Controlling for Family Income. *Journal of Family and Economic Issues*, 23 (2), 189-210.

Jones, Myhill, 2004 – Jones, S., & Myhill, D. (2004). Seeing things differently: Teachers' constructions of underachievement. *Gender and Education*, 16(4), 531-546.

Khan, 2016 – Khan, Z. N. (2016). Factors Effecting on Study Habits. *World Journal of Educational Research*, 3(1), 45-150.

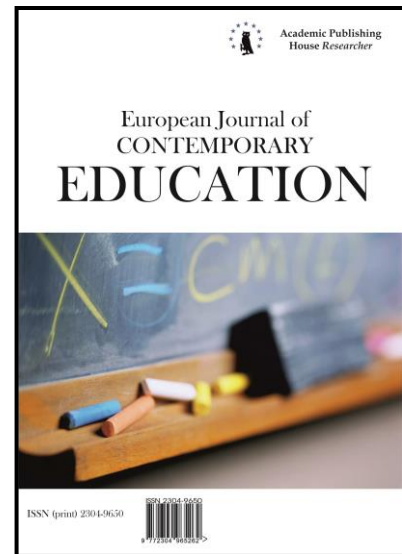
Latifi, Karachi, 2006 – Latifi, S., & Karachi, A. (2006). The investigation on the effects of the demonstration teaching methods, lectures, and collaborative learning on the academic achievement of the primary school students in mathematics. Research Council of Isfahan province.

- Lax, 1990 – Lax, P. D. (1990). Calculus Reform: A Modest Proposal. *Undergraduate Mathematics Education Trend*, 2(2), 1.
- Lee, Madyun, 2009 – Lee, M., Madyun, N. (2009). The impact of the neighborhood disadvantage on the black – white achievement gap. *Journal of Education for Students Placed at Risk*, 14(2), 148–169.
- Lehrer, Chazan, 1998 – Lehrer, R., and Chazan, D. (1998). Designing learning environments for developing understanding of geometry and space. Mahwah, NJ: Erlbaum.
- Ma, Klinger, 2000 – Ma, X., & Klinger, D. A. (2000). Hierarchical linear modeling of student and school effects on academic achievement. *Canadian Journal of Education*, 25, 41–55.
- Masoumi et al., 2007 – Masoumi, M., Hosseinzadeh Lotfi, F., Shahvarani, A., & Rashidian, Z. (2007). An investigation on the causes of high school students' academic underachievement in math in Khorramabad, Lahijan. *Journal of Applied Mathematics*, 14, 75-88.
- National Council of Teachers of Mathematics. 1989 – National Council of Teachers of Mathematics. (1989). Curriculum and evaluation standards for school mathematics. Reston, VA: National Council on Teachers of Mathematics.
- Ndebele, 2015 – Ndebele, M. (2015). Socio-Economic Factors Affecting Parents' Involvement in Homework: Practices and Perceptions from Eight Johannesburg Public Primary Schools. *Perspectives in Education*, 33 (3), 72-91.
- Payne, Biddle, 1999 – Payne, K.J., Biddle, B.J. (1999). Poor school funding, child poverty and mathematics achievement. *Educational Researcher*, 28(6), 4-13.
- Reyonds et al., 1996 – Reyonds, D., Bollen, R., Creemers, B., Hopkins, D., Stoll, L., & Lagerweij, L. (1996). Making good schools: Linking effectiveness and school improvement. London: Routledge.
- Rivera-Batiz, Marti, 1995 – Rivera-Batiz, F.L., Marti, L. (1995). A school system at risk: A study of the consequences of overcrowding in New York City public schools. New York: Institute for Urban and Minority Education, Teachers College, Columbia University.
- Romana, 2014 – Romana, M.D. (2014). Students' Failure in Academic Environment, *Procedia - Social and Behavioral Sciences*, 114, 170–177.
- Romberg, 1983 – Romberg, T.A. (1983). A common curriculum for mathematics, Individual Differences and the Common Curriculum (pp. 121-159), eighty-second Yearbook of the National Society for the Study of Education, Part I. G.D. Fenstermacher and J.I. Goodlad, eds. Chicago: University of Chicago Press.
- Schauble et al., 1995 – Schauble, L., Glaser, R., Duschl, R., Schultz, S., & John, J. (1995). Students' understanding of the objectives and procedures of experimentation in the science classroom. *The Journal of the Learning Sciences*, 4(2), 131-166.
- Scheffler, 1975 – Scheffler, I. (1975). Basic mathematical skills: Some philosophical and practical remarks. In National Institute of Education Conference on Basic Mathematical Skills and Learning, Vol. 1. Euclid, OH: National Institute of Education.
- Sitko, 2013 – Sitko, N. J. (2013). Designing a Qualitative Research Project: Conceptual Framework and Research questions. Indaba Agricultural Policy Research Institute (IAPRI).
- Smith, 2003 – Smith, E. (2003). Failing boys and moral panics: Perspectives on the underachievement debate. *British Journal of Educational Studies*, 51(3), 282–295.
- Stevenson, Baker, 1987 – Stevenson, D. L., & Baker, D. P. (1987). The family-school relation and the child's school Performance. *Child Development*, 58, 1348-1357.
- Thomas, Stockton, 2003 – Thomas, J., Stockton, C. (2003). Socio-economic Status, Ethnic Gender and Retention: Impact on Student Achievement. From <http://www.usca.edu/essays/vol72003/stockton.pdf>
- Warren, Rosebery, 1996 – Warren, B., & Rosebery, A. (1996). This question is just too, too easy, Perspectives from the classroom on accountability in science (pp. 97-125), Contributions of Instructional Innovation to Understanding Learning, L. Schauble and R. Glaser, eds. Mahwah, NJ: Erlbaum.
- Wheaton, 1985 – Wheaton, B. (1985). Models for the stress-buffering functions of coping resources. *Journal of Health and Social Behavior*, 26(4), 352-364.
- Wilson, 1996 – Wilson, B. G. (1996). Constructivist learning environments: Case studies in instructional design, Englewood Cliffs, NJ: Educational Technology Publication.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.
All rights reserved.
Published in the Slovak Republic
European Journal of Contemporary Education
ISSN 2304-9650
E-ISSN 2305-6746
2017, 6(3): 448-460
DOI: 10.13187/ejced.2017.3.448
www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



The Effects of Training and Other Factors on Problem Solving in Students

Robabeh Puran ^a, Mohamad Hasan Behzadi ^{b,*}, Ahmad Shahvarani ^a, Farhad Hosseinzadeh Lotfi ^a

^a Department of Mathematics, Science and Research Branch, Islamic Azad University, Tehran, Iran

^b Department of Statistics, Science and Research Branch, Islamic Azad University, Tehran, Iran

Abstract

The purpose of this article is to identify the factors which affect students' creative thinking in problem solving. The research which was performed was quasi-experimental. It used one experimental group and two control groups from three second-grade high school classes. They received either traditional, active or heuristic problem-solving training. In the traditional method, no teaching aids were used, and the material was taught traditionally. In the active method, 34 students were trained using teaching aids, such as coloured balls, and handicrafts, such as shirts and pants. They were trained to use the teaching aids in order to solve problems. In the heuristic method, the researcher introduced problems which the students thought about. After a few sessions, I commenced teaching the procedures — in each session, two heuristics were introduced. They learned to use these strategies to solve problems. Creativity and mathematics tests were given to the students, both before and after they received training in problem-solving. The findings show that parents' education (but not gender) and parents' job type affected students' ability to think creatively. Students' creative thinking was improved by active training, but not by the heuristic or traditional methods.

Keywords: creative thinking, problem solving, traditional method, active method, heuristic method.

1. Introduction

A six-year-old boy, born with an enlarged head, seemed to have a brain disease. Three of his sisters and brothers had died during the process of being born. His mother did not agree with her relatives' and neighbours' opinions about the baby's assumed abnormality. The child was sent to school and recognised as being psychotic. His mother was very disappointed with this matter and

* Corresponding author

E-mail addresses: robabepuran@gmail.com (R. Puran), behzadi@srbiau.ac.ir (M.H. Behzadi), maths_ahmad@yahoo.com (A. Shahvarani), hosseinzadeh_lotfi@yahoo.com (F.H. Lotfi)

prevented him from attending school, believing she could educate him at home. This child grew up and went on to invent the light bulb, gramophone and microphone. His name was Thomas Edison.

Although the above example does not reflect all intelligent children, it explains many things about such children. Can intelligent people succeed without special attention? What happens when they are introduced as unsuccessful individuals? How many of their talents and skills will be lost due to lack of attention? How badly will their abilities be damaged if they fail at school? How badly will society be damaged from their lack of success?

One of the most important goals of teaching mathematics is to improve people's intellectual abilities. One of the roads leading to this goal is via solving problems in the classroom. Problem solving is one of the basics in maths teaching. It is one of the five (National Council of Teachers of Mathematics) process standards (performance statement of 8th decade), one of the eight octal standards, the main axis of the maths syllabus in Singapore, and is an emphasised issue in the Chinese syllabus (Bruun, 2013).

What distinguishes creative thinking from ordinary thinking relates to the originality and novelty of ideas. In this way of thinking, creative methods attract the attention of an individual. Besides originality, the ability to produce new ideas (Gil et al., 2007) is one of the most important components in problem solving. According to Kontoyianni, Kattou, Pitta-Pantazi and Christou (2013), originality, fluency and flexibility are the main factors of mathematical creativity and problem solving. In this regard, Panaoura (2014) maintain that creativity is one of the most important factors in problem solving. Githua (2013) holds that there is no one, unique, accepted definition of creativity. Panaoura (2014) argues that some researchers describe creativity using words that relate to conceptual thinking, which involves problem solving.

Problem solving is a human activity, which is done by thinking and by practice. *Polya* (1962) views problem solving as the conscious search for a suitable instrument with which to achieve a certain goal, which initially appears to be inaccessible.

Problem solving is one of the most important elements in the teaching of mathematics. Before teaching problem solving, efforts to teach other math skills and content is not particularly efficient. The difficulties experienced by students in performing calculations should not be a barrier to learning problem solving strategies (Klein, 2003).

Problem solving activities have a concrete, external, and distinctive purpose. Creative thinking, on the other hand, is a new, independent, and popular way of thinking, and often has a personal aspect that depends on intuition and analysis (Runco, 2007).

Scientific studies are related to creative power – in other words, we all have creativity to different degrees. These experiments have shown that the degree of creativity is related to intellectual power and efficiency. Hence, it is more connected with effort and perseverance in problem solving, than to internal intelligence (Vidal, 2008).

Creative thinking has a crucial role in organisations, societies and individuals. Developing it is one of the most important issues in the realms of institutional psychology and family nurturing. Accordingly, teachers and researchers should pay more attention to creativity at home and at school.

There is a vital need for reviewing our lifestyles and beliefs, by creating new methods of supporting creativity in the family, civil service, social and institutional systems. In other words, we need creative and innovative people *more* than disciplined students or clerks. So, it is necessary to identify educational methods and policies that support creative thinking. Educators and teachers should help students to cultivate their talents and abilities. What is most important is to pay attention to creativity in problem solving. When creativity is cultivated by educators, it improves students' creativity and innovation, leading to new solutions in later professional life. Due to its nature, various teaching methods should be used in teaching math, based on the context. New teaching methods emphasise the development of creativity and creative thinking in students, and schools try to nurture creative thinking. Teaching maths or pedagogy in math is a branch of human science which has achieved an important position, particularly in recent years, in science assemblies, especially in developed countries. Maths is used to study questions which also require other branches of human sciences, such as maths history, psychology, sociology and educational sciences, to be understood (Tabesh et al., 2000).

Some of the concepts which will be investigated in this study are: creative thinking in problem solving, the stages of creative thinking, the importance and necessity of creative thinking,

areas of creativity, the relationship between gender and creative thinking, the relationship between parents' education and creative thinking, the relationship between traditional, active, heuristic teaching methods and the teaching of problem-solving with creative thinking, as well as factors affecting the development of creativity in problem solving. According to the above, and the necessity of paying attention to teaching methods and creative thinking in students, the researcher aims to study students' creative thinking by traditional, interactive and active methods and answer the question: Do teaching methods affect creative thinking and students' maths scores?

In one study using Tornes creativity tests on 225 school students, it was demonstrated that active teaching methods are effective in improving students' creativity, especially that of female students. On the other hand, students showed the lowest degree of improvement in creativity, with traditional methods. After one year, their creativity was even lower than the baseline, compared to the other group. In another study by Haddon and Lytton (1968), an "active class" and a "traditional class" were compared. It was shown that actively-taught students had superior divergent thinking after four years of primary school (Lester, 1994).

In his studies, Bruun (2013) found that American teachers do not use all problem-solving heuristics in their classes. They mostly use a combination of figure drawing and the key information pertaining to the problem.

Shoenfield (1985) refers to Polya describing heuristics. I have understood this approach and, later on, used it. I regretted not having learnt them before. In fact, using these strategies gave maths education new and useful challenges.

Savizi (2006) showed that the teaching of problem-solving heuristics can improve this skill and open new horizons to students, providing that it was done with precision and precaution, where appropriate. Wilson et al. (2004) warned that emphasising problem-solving strategies should guide our thinking because, based on Polya, the aim of problem-solving strategies is to learn how to think. Teachers' metacognition has a thoroughly recognised, positive and favourable role in classroom education. Therefore, modifying teacher training programs and teachers' in-service training would appear to be necessary. Lester (1994) states that no studies have confirmed improvements in student problem solving according to a syllabus which contains concepts and procedures, posing of problems, and the teaching of problem-solving heuristics.

As a result, few studies are conducted on this issue these days. Lester says that, if we expect students to be professional problem-solvers, we should change our attitude toward problem-solving. Problems are not something external and injected into a maths syllabus. Problem-solving heuristics and strategies need to be taught. In fact, maths courses contain a combination of problems and problem solving. Teaching is performed through problem-solving, and concepts are extracted and learned from problem-solving (Vidal, 2003).

2. Literature review

Based on existing studies and observations, when most students encounter a problem, they don't know where to start in order to solve it, or how to use the problem's information and data to find the answer. So, to improve students' problem-solving skills in maths and study their way of thinking, problem-solving subjects should be identified. Teaching problem-solving in maths and in contexts which involve questioning, does indeed help students to develop a deep understanding of mathematics. In this study, an effort was made to provide contexts in which talented students, individually and in groups solved problems, were able to use mathematical concepts in novel problems, and could show their creativity and innovation. Our purpose was to determine the factors that affect problem-solving and creative thinking (Jahanipour, 2006).

Polya (1962) believed that the most important purpose of teaching maths is to cultivate the ability to think and reflect properly. He also believed that this type of thinking, at least in the first instance, is equivalent to problem-solving. He saw problem-solving as an essential part of school maths courses, and believed that teaching problem-solving in maths courses is an amazing opportunity to shape the intellect of students and, thus, increase their ability to understand. More than being just an instrument to perform a job, maths improves creativity and thinking, reasoning ability, logic and aesthetics.

Everybody has a common intelligence, ability of understanding, learning, and enjoying math in different levels. Thus, the duty of every educational system is to provide a situation which is suitable for teaching and learning mathematics, and motivating students (Adamset al., 2007).

As Schoenfeld (1985) said, teaching maths in brief means whatever is related to teaching and learning math. New Viewpoint insights in teaching maths give great attention to the importance of thinking and reasoning, meaningful understanding and knowledge of concepts, and problem solving. They emphasise that students are individuals with different abilities to learn maths and, briefly, the task of researchers in mathematical education is to ensure that learners can enjoy the amazing world of mathematics.

Nekouei (2001), in studying the relationships between the school environment and the creativity of female high school students in Tehran, concluded that there is a direct and meaningful relationship between the ideal school environment and the development of creativity in students related to the organisational environment of schools.

2.1. Traditional method

In traditional teaching methods, the teacher plays an active role in teaching and presents predefined materials orally. The students do not interact very much. The only responsibility of the traditional method is to fill students' memories with information and knowledge. As a result, creativity does not have an active role in this method. The abilities to read and write are considered the most important skills to be acquired in traditional teaching. Information is learned from teachers presenting information orally, with the students repeating and memorising it. Therefore, students' minds are filled with irrelevant information. They are deprived from learning comprehensible lessons and there is no effort being made to answer challenging questions. The traditional method is called the "Socratic method", the new methods of which are speech, verbal, exploratory, and question and answer. The teacher is the only speaker in this method. He explains everything and poses the problems. In this method, students apparently make progress, but there are negative effects on their creativity in the long term. Traditional methods do not relate to the real world of students and are, therefore, inappropriate. By not challenging students, they constitute a boring educational milieu. This can lead to a lack of curiosity, questioning and cooperation from the student. In order to fill this gap, active and dynamic teaching should be used to avoid such superficial attitudes (Miri, 2011).

In this way, the teacher explains the lesson accurately, and students only write notes; in other teacher sessions, they ask questions pertaining to the same subject.

2.2. Heuristic method

Polya (1945) was the first to propose problem-solving heuristics, but he never claimed that they can be taught. Shoefeld collated the results of his research, which was conducted over several years, in a book called *Solving Math Problems* (Shoefeld, 1985). It outlined methods of problem-solving used by experts and novices, and the elements of problem-solving. He believed that teaching a limited number of problem-solving heuristics, under controlled and certain circumstances, could improve problem-solving skills in novices; however, due to the complexity of utilising heuristics in practice, they cannot be generalised (Shoefeld, 1985).

Therefore, problem-solving is an important skill to be taught in mathematics classes. Trying to teach all the skills and mathematical content, prior to teaching problem-solving, is almost useless, and students' difficulties in arithmetic should not be considered an obstacle in learning problem-solving strategies (Klein, 2003).

In recent years, some research has focused attention on heuristics in improving problem solving. Polya defined heuristics as the strategies that professional mathematicians and problem solvers use to solve maths problems (Polya, 1985).

Shoefeld believed that heuristics were strategies and techniques for creating methods to solve unfamiliar problems and define rules to solve the problem efficiently. As quoted by Polya, "they are discovery tools" (Miri, 2011).

Heuristics are the strategies which mathematicians and skilled problem-solvers use to solve mathematical problems. Some important heuristics include: drawing shape heuristics, setting a systematic table, removing undesirable alternatives, modelling, "guess and check", sub-problems (problems which are simpler and more relevant to the main material) and algebraic strategy. Broner (1960) defined heuristics as methods and strategies to facilitate problem-solving.

2.3. Active method

In active learning, each student learns at his or her own pace, and has the opportunity to think about the problems. Students figure out concepts gradually, via a problem-solving process. Instead of watching the teacher solve problems, they practice it step-by-step by themselves.

Their confidence is increased by discovering their own capabilities, because they have obtained the results and discovered the rules. They are interested in the information and feel that they own it, leading to the desire for further knowledge. Students grow in the process of active learning, and their logical thinking is enhanced (Tabesh, 2006).

In teaching problem-solving, the student is free to choose his favourite approach, to evoke every kind of knowledge he likes, and to evaluate his opinions in a way he is comfortable with. In the challenge of solving a problem, the student succeeds in explaining and evaluating his and his classmates' thoughts. He can organise his thoughts and own his knowledge. Teaching is not the responsibility of the teacher alone, but it is a bilateral activity of both teacher and students, and includes interaction between the teacher and students, and between the students themselves (Tan, Laswad, 2008).

In the active method, the student solves problems with the help of the teacher. Hence, it is centered on the student. The student is actively involved in the process of learning, he faces the problem, thinks about the solution, and solves it with the help of the teacher. He figures out the concept him/herself, by engaging in educational activities. This is how students are attracted to problem-solving. The success of this method depends on teachers' virtuosity and command over the lesson (Stigler, Hiebert, 1999).

In the active method, students are involved in the learning process. They are the centre of the classroom and, unlike teacher-centred and passive methods, they are actively involved in learning, face the problem, think about the solution, and solve it with the help of the teacher.

In the active method, students should be active and dynamic, and participate actively in learning. A student encounters a problem, thinks about its solution and, during the process, understands the concept himself, and gets help from the teacher if necessary. In this method, the student's logical mind-set is developed, and he shows a willingness to solve the problems. In this method, the teacher pays attention to the individual students and, by guiding them, improves their interest and self-confidence.

3. Methodology

This research made use of a quasi-experimental design. It used one experiment group and two control groups from three second grade high school classes to study traditional, active and heuristic teaching methods. Traditional methods were taught without using any teaching aids, and the students were tested with various problems. In the active method, 34 students from second grade science classes were selected, and the combination points were taught in several sessions, utilising the active method during the process, teaching aids such as coloured balls and clothing were used. Students could solve the problems by matching problems with balls and other patterns, both concretely and tangibly. In the heuristics method, the researcher selected 24 students from second grade science, to study the influence of heuristic teaching on their creative thinking and problem-solving. In the first sessions, I introduced some problems and the students thought about them and wrote down their thoughts. After some sessions, I started to teach the heuristic procedures. In each session, two heuristics were introduced. They learned by solving some problems and using some heuristic strategies. Then, a creativity test and mathematics exam were respectively conducted in two phases – before the heuristic teaching (pre-test) and afterwards (post-test).

Several instruments were used to collect data, including standard questionnaires, interviews with students, a maths test, as well as students' notes and group evaluations. Data analysis and statistical tests were performed with SPSS software.

The topic I considered for teaching in the traditional and active way was combinational mathematics. Not only is it an interesting topic in maths, but it also provides an appropriate subject for challenging students in the process of problem solving. It is also a useful tool for communication, modelling and improving creative thinking.

In the traditional model, I taught linear, circular and gyrate permutation, as well as combination formula $c(n,r)$ and order formula $p(n,r)$. In this model, I did not use any supplementary tools, and taught the lesson in the form of a presentation. Students simply took notes without performing any other activities. I felt that students were just memorising in the form of rote learning, and could not understand the issue at hand on a deeper level. Their questions revealed that there were some unclear ambiguities in their minds.

In the active model, I took an equal number of red, blue and green counters to the class. We examined the number of linear, circular and gyrate permutations using red, blue, and green colours. For circular permutations, students made a bracelet using a thread and the counters. As a result, they understood the distinction between circular and gyrate permutation very well.

In order to teach the concept of combination $c(n,r)$, we firstly numbered the counters. We put two red counters, R_1 and R_2 , one blue counter, B , and three green counters, G_1 , G_2 , and G_3 , in a container. I asked the students to take two counters, randomly, from the container. Then, they wrote down the various possible combinations of counters that they could have (R_1G_3 , R_1R_2 , G_1G_2 , etc.).

It was a fascinating exercise for the students. They said: “now we can easily understand why there are so many possibilities. We had never paid attention to this. We have three green counters, G_1 , G_2 , G_3 , so they are different”. In fact, they hadn’t reached that in-depth understanding. They wrote all the possibilities down, and they got 15. When they understood the concept very well, in an observed way, they referred back to the formula and they got 15 again. They were absolutely thrilled.

In teaching with heuristics, I explained one of the solutions to the problem in each session, and I did so using a sample question. Drawing a picture, forming a systematic table, eliminating in appropriate possibilities, pattern finding, trial and error, sub-questions, using simpler and more relevant questions to the main question, and the algebraic method, were among the utilised strategies.

I tried to use each strategy in every session to resolve questions and expand students’ knowledge of the methods and strategies of problem-solving. The purpose of my doing so was to allow them to understand that there is not just one possible way to obtain the answer. Instead, they should think about the question in different ways.

Examples of questions answered using the heuristic model:

1. The strategy of drawing a picture: The question of the chickens and cows.
2. The strategy of eliminating inappropriate possibilities: The question of the orange seller.

3.1. The question of the chickens and cows

Suppose a farmer has a total of 22 cows and chickens. They have a total of 56 feet. Imagine that none of them has any deformation. How many chickens and cows does the farmer have?

We reminded the students that they did not necessarily need to form an equation to solve the question. A primary student can understand this question simply by drawing a picture as follows: Draw and circle for each animal. We first draw two feet for each one of them to obtain a total of 44 feet. The question stated that there were a total of 56 feet. Therefore, we need to turn some of the “chickens” into “cows” by adding another pair of feet. We then end up with 16 chickens and 6 cows.

3.2. The question of the orange salesman

The orange salesman, who seems to be a very naïve man, invites his new neighbour, who happens to be a math teacher, to a dinner party. The orange salesman and his wife welcome the neighbour and his family. The neighbour asked the orange salesman, “Where are your children?” The orange salesman said: “They are playing.” The neighbour asked, “How many children do you have and how old are they?” The orange salesman answered cleverly: “I have three sons. The product of their ages makes 72, and the sum of their ages equals our house number. The neighbour, who was confronted by this surprising question, went to the door of the house and looked at the house number. He then came back and said: “The question is vague.” The orange salesman said: “Oh, I’m sorry. You’re right. My oldest son is very keen on cycling.

At first, all the students laughed at the question. I gave them some time to think about the question carefully, and not lose hope on resolving it. One of the groups said, “What is the meaning of: ‘The question is vague?’” I said, “It means that there is more than one possible answer to the question.” The students were discussing and exchanging opinions, and I was supervising and guiding them. Eventually, one of the groups shouted: “We have resolved the question!”

We noted down the different combinations of ages that could be multiplied to obtain 72 (Table 1).

Table 1. Which was used to solve the problem of the orange salesman

| First son's age | Second son's age | Third son's age | SUM |
|-----------------|------------------|-----------------|-----|
| 1 | 2 | 36 | 39 |
| 1 | 3 | 24 | 28 |
| 1 | 4 | 18 | 23 |
| 1 | 6 | 12 | 19 |
| 1 | 8 | 9 | 18 |
| 2 | 2 | 18 | 22 |
| 2 | 3 | 12 | 17 |
| 2 | 4 | 9 | 15 |
| 2 | 6 | 6 | 14 |
| 3 | 3 | 8 | 14 |
| 3 | 4 | 6 | 13 |

Due to the fact that the neighbour pointed out the vague nature of the question, after seeing the house number, then the two lines which calculated the sum as 14, must have contained the answer (rows 9 & 10). When the orange salesman said, “my eldest son is fond of cycling”, then row 9 could not be the correct answer, because there were two “eldest sons” (both six years old). Therefore, his eldest son must have been eight years old, with the other two being three. We can see that students obtained the correct answer in an interesting way, just by creating a table and eliminating inappropriate possibilities.

3.3. The question of chess

How many squares are there on a chess board? Count them again. There are some more...

In one of the problem-solving sessions, I asked students to think about this question and to give me their opinions. We tracked their thinking and discussion processes.

Maryam: This question is very simple. We have 64 squares, because a chess board is 8 by 8 squares.

Sara: No, that's not correct. We can see other squares.

Maryam: Yes, you're right. This question is harder than I thought.

Mina: Let's simplify to get down to the main question.

This conversation was so interesting to me. When you give students the chance to think about a question together, the level of their creativity is greatly improved. At the end, students collaborated to form a table (Table 2).

Table 2. Process of solving the chess-related question

| Size of chess board | Number of squares |
|---------------------|-------------------|
| 1*1 | 1 |
| 2*2 | 5 |
| 3*3 | 14 |

Then, they were looking for a pattern to solve the main question. Suddenly some students said they found the pattern, and they explained it really well. The answer to the main question was: $1+4+9+16+25+36+49+64=204$. I said, “Well done, guys. How beautiful it was to see you resolving the question by collaborating and discussing and using heuristics.”

The entire population of the second grade at high school in Kashan consists of 4268 people, of which 450 were selected for the pre-test. To perform post-tests after traditional, active, and heuristic teaching, 81 people from three classes were chosen using random cluster sampling.

4. Results

Hypothesis 1: Gender affects students' creative thinking.

To test hypothesis 1, independent samples *t*-tests were used. The results are shown in table 3.

Table 3. Two sample *t*-tests for hypothesis 1

| Creative thinking | Levene's test | | Means equity | | | | | |
|-------------------|---------------|----------|--------------|--------|----------|-----------------|---------------------------|-------|
| | <i>F</i> | <i>p</i> | <i>t</i> | df | <i>p</i> | Mean difference | 95 % confidence intervals | |
| | | | | | | | Upper | Lower |
| Variance equality | 0.012 | 0.914 | 0.204 | 449 | 0.838 | 0.2645 | 2.27 | -2.80 |
| Variance inequity | | | -0.204 | 441.97 | 0.838 | 0.2645 | 2.80 | 2.81 |

Table 3 shows that the *p*-value (0.914) of the Levene's test was more than 0.05, so the equity variance hypothesis was accepted. The *p*-value (0.838) of the *t*-test for means equity was greater than 0.05, thus the mean difference between the creative thinking scores of female and male students was insignificant.

Hypothesis 2: Parents' education level affects students' creative thinking.

An ANOVA was used to test hypothesis 2 of this research, with the results shown in table 4.

Table 4. ANOVA test of hypothesis 2

| Creative thinking | <i>F</i> | SS | df | MS | <i>p</i> |
|-------------------|----------|---------|-----|--------|----------|
| Between groups | 2.09 | 3832.55 | 440 | 383.25 | 0.024 |
| Within groups | | 183.39 | 450 | 183.39 | |

The results of table 4 show that the *p*-value (0.024) was less than 0.05. Therefore, parents' mean level of education and students' mean level of creative thinking do not correlate, and there is a significant relationship between parents' education and students' creative thinking. To test differences in the average level of parents' education and students' creative thinking, Tukey's test were used.

Table 5. Tukey's test

| Education | Number | Group 1 | Group 2 |
|------------------------------------|--------|---------|---------|
| Illiterate | 20 | 1.32 | |
| Under diploma | 207 | 2.43 | |
| Diploma and junior college diploma | 105 | 2.39 | |
| BA | 75 | | 2.58 |
| MA | 23 | | 3.02 |

| | |
|-----------------|-------------------------------------|
| <i>p</i> -value | 0.325 level of significance (0.000) |
|-----------------|-------------------------------------|

According to the Tukey’s test, the creative thinking of illiterate, under diploma, diploma, and junior college diploma groups had no significant differences, but means of the BA and MA groups were higher than those of the other groups.

Hypothesis 3: Parents’ job affects students’ creative thinking.

To test hypothesis 3, an ANOVA test was used, with the results shown in table 6.

Table 6. ANOVA test for hypothesis 3

| Creative thinking | <i>F</i> | SS | df | MS | <i>p</i> |
|-------------------|----------|---------|-----|--------|----------|
| Between groups | 1.30 | 2672.92 | 439 | 242.99 | 0.219 |
| Within groups | | 8185.21 | 450 | 186.45 | |

The results of table 6 show that the *p*-value (0.219) was more than 0.05, so the mean of parents' job and students' creative thinking are the same and there weren't any meaningful differences between parents' job and the students' creative thinking.

Hypothesis 4: Students' performance varies after receiving active, heuristic or traditional training in problem solving.

To test the Hypothesis 4 of the research, ANOVA was used (table 7).

Table 7. ANOVA test for Hypothesis 4

| Creative thinking | <i>F</i> | SS | df | MS | <i>p</i> |
|-------------------|----------|---------|-----|---------|----------|
| Between groups | 4.76 | 1543.76 | 439 | 324.043 | 0.000 |
| Within groups | | 6732.91 | 450 | 13.982 | |

The results of table 7 show that the *p*-value (0.000) was less than 0.05; therefore, the mean problem-solving ability of students receiving various types of training were different. To show the differences between means, a Tukey’s test was used (table 8).

Table 8. Tukey’s test

| Training method | Number | Group 1 | Group 2 |
|-----------------|--------|---------|---------|
| Traditional | 23 | 11.9 | |
| Active | 34 | | 13.8 |
| Heuristic | 24 | 9.5 | |
| <i>p</i> -value | | 0.699 | 0.001 |

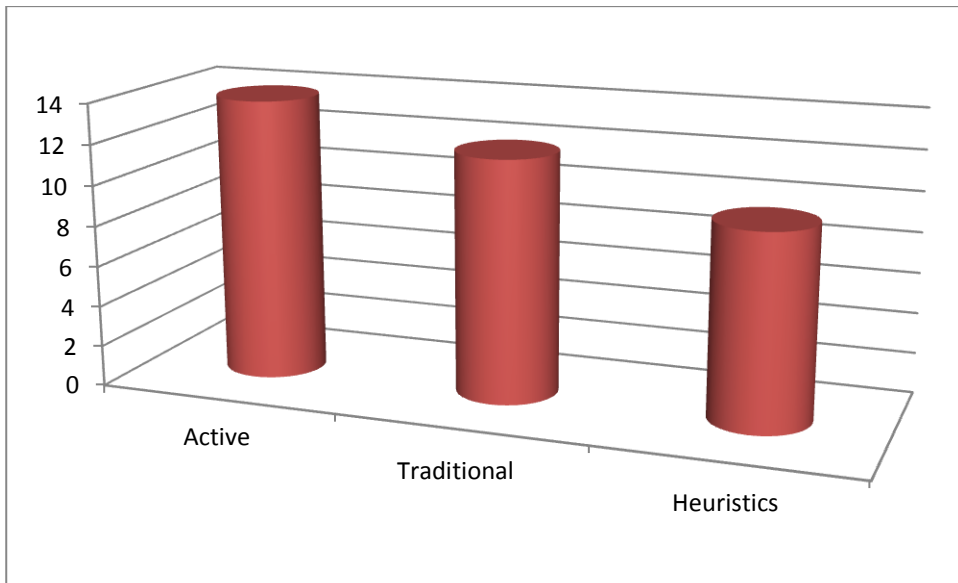


Fig. 1. Mean problem solving ability after receiving one of three teaching methods.

There was a significant difference in students' problem-solving abilities, according to the training method they received. To show the differences between means, a Tukey's test has been used, with the results shown in [table 8](#).

Based on results of [table 8](#) and the p -value, there was a clear difference between the active, traditional and heuristic teaching methods. The active method resulted in better performance than the other two methods, which had similar performances.

5. Discussion

Even advanced educational systems believe that they haven't been able to train creative individuals. We can run to catch up with the rest of the world by cultivating children's talent in Iran! As we have this power, why do we doubt it?

Mathematics teaching or, should we say, "education in mathematics", is a branch of human science which has a very important place in the scientific in situations of the world, particularly in developed countries. Mathematics training involves studying questions which require other sources of human knowledge to answer, such as mathematics history, psychology, sociology, and so forth.

In this way, in mathematical education, different subjects in terms of content, learning process, teaching methods and individual differences in learning are controversial.

Each individual with a typical level of intelligence is capable of understanding, learning and enjoying mathematics at different levels and grades. Thus, each educational system is responsible for providing proper teaching and learning conditions for mathematics, and for creating motivation within the learners.

Problem-solving skills are one of the most important subjects in learning. Generally, teaching mathematics through problem-solving can create conditions in which students focus on practicing mathematics actively and creatively. One of the most important questions about this has been resolving the problem of, "exactly what do people do when solving a problem?"

Regarding the mathematical behaviour of students solving a problem, especially intelligent students, recognising their abilities is an important issue.

Sanders emphasises that, in order to teach creativity to children and adolescents, we should allow them to think and speculate, and avoid pre-determined activities.

On the other hand, the individual creativity of the teacher plays an important role in creativity. A creative teacher can recognise and encourage creativity within his or her students. By providing creative conditions, they can provide opportunities for students to rely on their logic in solving problems creatively.

Headmasters, teachers and parents must provide the conditions to reveal the potential and hidden abilities of these learners. The current belief is that when a nation is not able to utilise its remarkable talents, it has wasted its human capital. In view of economics and politics, failure to educate remarkable talents is, indeed, negligence of future society.

Nowadays, due to the extraordinary importance of maths, and its effect on people's daily lives, we should pay close attention to maths-teaching methodologies in the syllabi of educational courses, and remove the barriers to improving problem-solving skills in students.

This study found that gender and the parents' occupation type did not affect students' creative thinking. However, parents' education level did have an effect, such that there were differences in the mean scores of children of illiterate, under diploma and junior college diploma-qualified parents, and those with BAs and MAs.

In the analysis of the results, it can be said that creativity is found in every single person, to some extent. As Torrens (1974) showed in his investigation of the role of gender in creativity, there is no significant relationship between creativity and gender. In the analysis of this result, and with due consideration of the fact that most parents were self-employed, it can be concluded that parents elaborate on the creativity and significance of their own job less, because they prefer their children to be educated. As a result, few children pursue their parents' profession.

The analysis of the results shows that highly-educated parents pay more attention to their children's creativity, and create situations in which they can express it. Therefore, parent groups could be formed at school in which to exchange ideas and cooperate with teachers, with a view to the utilisation of the available facilities, in order to improve their children's creativity-levels.

The intelligence quotient (IQ) of students is not enough to predict their educational progress. Other issues, such as favourable social, educational and family conditions, can prevent the wasting of their talents and abilities, so that they can easily reveal their special and remarkable talents.

There were significant differences between the problem solving abilities of students according to the teaching method they received (traditional, active, and heuristic).

Based on the results of this study, it is concluded that the traditional method (with the teacher teaching in detail and solving the problems) does not develop students' creative thinking. It also does not cover all maths problems, and causes confusion in students.

Students' views of mathematics affect their thoughts, mathematical function and grasp of mathematical concepts. Additionally, it will affect their future decisions about studying mathematics. Thus, teachers must not allow students to learn mathematics in such a way that they imitate the teacher, as they will lose interest in maths.

The heuristic method did not affect students' creative thinking. Therefore, it is suggested that teachers use active and collaborative methods, in order to solve maths problems.

Different approaches to solving maths problems have been mentioned, including heuristic, traditional and active. These three methods correspond with the three historical stages of education (teaching-centred, information processing and student-centred).

Direct teaching methodologies are a unidirectional flow, and the teacher's task is to transfer some predefined information to the students. On the other hand, the students' task is to be passive and to not participate in decisions regarding plans and educational activities. In such an educational milieu, students would never get a chance to practice team skills, leading to a lack of interest in cooperating and collaborating with others and, ultimately, individualism (MehrMohammadi, 2007).

The student must be trained in problem-solving methods, so that he or she can use different strategies when confronted with different issues. One of the methods to help students to be receptive towards maths, is to provide a mathematical environment different from the one they had experienced in school, and give them opportunities to speculate and deepen their problem-solving skills.

The power to inspect and assess solutions, and recognise ways of thinking by metacognition skills, is good. Students who learn metacognition skills are more efficient in thinking about, rationalising and solving problems, leading to more creative and thoughtful work. Instruction in the use and selection of explorative problem-solving strategies is very important. By using this idea and providing problem-solving classes, strategy selection can be taught. Therefore, teachers must learn these methods and use them in class to teach students how to think mathematically, and not learn other mathematical ideas.

A Chinese proverb says, “If a fish is given to a man, he will only have a meal to eat. But if fishing is taught to him, he will always have a meal to eat.” So, essential changes must be made in teaching maths.

In fact, there is a mutual interaction between the students and the teacher, and between the students themselves. We suggest reducing the extent of the syllabus in the traditional method, and take into account the quality of education. It is proven that knowledge, acquired by exploration and free research, can be better retained in the mind, allowing students to learn methods which they can make use of for the rest of their lives. They also increase their curiosity gamut consistently, and learn to use their brains. As a result, they would be able to formulate their own concepts and imaginations independently. Therefore, implementing active methods not only arouses students’ enthusiasm, and strengthens their learning motivation, it also allows the teacher to create a small and desirable community within the class. So, creating and improving such an atmosphere will trigger students’ sense of curiosity.

Providing and facilitating ways to improve creative thinking in schools has wide implications, ranging from changing attitudes to teaching methods. The attitude of the teacher towards the lesson, his or her interest in teaching, use of supplementary materials, preparing an appropriate environment in the classroom so that students can think, students’ conversation and questions, holding problem-solving workshops in groups, and using active and modern ways of teaching, altogether leads to the improvement of children’s creativity-levels. It is suggested that those teachers who utilise heuristic methods pay close attention to the fact that teaching heuristics alone does not lead to any improvement in problem solving. In fact, content and conceptual knowledge is the prime issue in this process.

6. Acknowledgement

This manuscript was copy-edited by volunteer Jaime Ribeiro. Without his kind and selfless assistance, this publication would not be possible.

References

- Adams et al., 2007 – Adams, J. P., Kaczmarczyk, S., Picton, P., & Demian, P. (2007). Improving problem solving and encouraging creativity in engineering undergraduates. In: *Proceedings of the International Conference on Engineering Education*. New York: Springer.
- Bruun, 2013 – Bruun, F. (2013). Elementary teachers' perspectives of mathematics problem solving strategies. *The Mathematics Educator*, 23(1), 45-59.
- Clark, 1988 – Clark, B. (1988). Growing up gifted (3rd edition). Columbus: Ohio.
- Cohen, 1987 – Cohen, L.M. (1987). 13 tips for teaching gifted children. *Teaching Exceptional Children*, 20(1), 34-38.
- Gil et al., 2007 – Gil, E., Ben-Zvi, D., & Apel, N. (2007). What is hidden beyond the data? Helping young students to reason and argue about some wider universe. In: D. Pratt & J. Ainley (Eds.), *Proceedings of the Fifth International Research Forum on Statistical Reasoning, Thinking and Literacy: Reasoning about Statistical Inference: Innovative Ways of Connecting Chance and Data* (pp.1-26). UK: University of Warwick.
- Githua, Njubi, 2013 – Githua, B. N., & Njubi, J. N. (2013). Effects of practicing mathematical creativity enhancing learning/teaching strategy during instruction on secondary school students’ mathematics achievement by gender in Kenya’s Nakuru municipality. *Leena and Luna International*, Oyama, Japan, 2(2), 113-124.
- Jahanipour, 2006 – Jahanipour, R. (2006). Choosing strategy in the problem-solving process. *Roshd Teaching Math Magazine*, 47(11), 45-51.
- Keramati, 2004 – Keramati, M. (2004). A new and different outlook to cooperative learning approach: Training regulation. Tehran, Iran: Research and Educational Planning.
- Klein, 2003 – Klein, D. (2003). A brief history of American K–12 mathematics education in the 20th century. In J. Royer (Ed.), *Mathematical cognition: A volume in current perspectives on cognition, learning, and instruction* (pp. 175-225). Charlotte NC: Information Age.
- Kontoyianni et al., 2013 – Kontoyianni, K., Kattou, M., Pitta-Pantazi, D., & Christou, C. (2013). Integrating mathematical abilities and creativity in the assessment of mathematical giftedness. *Psychological Assessment and Test Modeling*, 55(3), 289–315.

Lester, 1994 – Lester, F.K. (1994). Musing about mathematical problem-solving research: 1970-1994. *Journal for Research in Mathematics Education*, 25, 660-675.

MehrMohammadi, 2007 – MehrMohammadi, M. R. (2007). Modern teaching patterns and creativity. *Research Magazine in Upbringing-related Issues*, 4, 234-245.

Miri, 2011 – Miri, Z. (2011). The effects of problem-solving skills on learning. *School Consultant Magazine*, seventh period. Tehran, Iran: Ministry of Education, Research and Educational Planning.

Nekouei, 2001 – Nekouei, B. (2001). The relationship between creativity, courageous beliefs, learning strategy, self-regulating, and progress in education. MA thesis, *Talented Students Magazine*, 9th year, No 1.

Panaoura, Panaoura, 2014 – Panaoura, A., & Panaoura, G. (2014). Teachers' awareness of creativity in mathematical teaching and their practice. *IUMPST: The Journal*, 4, 1-11.

Polya, 1962 – Polya, G. (1962). *Mathematical discovery: On understanding, learning, and teaching problem solving*. New York: John Wiley.

Polya, 1985 – Polya, G. (1985). *How to solve it*. New Jersey: Princeton University Press.

Runco, 2007 – Runco, M.A. (2007). *Creativity. Theories and themes: Research, development, and practice*. San Diego, CA: Academic Press.

Savizi, 2006 – Savizi, B. (2006). Applicable problems in history of mathematics: Practical examples for the classroom. *Philosophy of Mathematics Education Journal*, Available at <http://people.exeter.ac.uk/pome19>.

Shoenfeld, 1985 – Shoenfeld, A. H. (1985). *Mathematical problem solving*. Orlando, FL: Academic Press.

Schoenfeld, 2015 – Schoenfeld, A. H. (2015). How we think: A theory of human decision-making, with a focus on teaching. In: Cho, S. (Eds.). *The Proceedings of the 12th International Congress on Mathematical Education*. Springer, Cham.

Siew, 2005 – Siew, T. (2005). Top-down approach to teaching problem solving heuristics in Mathematics. Centre for Research in Pedagogy and Practice, National Institute of Education, NIE.

Stigler, Hiebert, 1999 – Stigler, J. & Hiebert, J. (1999). *The teaching gap: Best ideas from the world's teachers for improving education in the classroom*. Harvard Educational Review. New York: Free Press.

Tabesh et al., 2000 – Tabesh, Y., Hajibabaei, J., & Rastegar, A. (2000). *Teaching problem solving art (complementary mathematics)*. High school book. Tehran, Iran: Ministry of Education, Research and Educational Planning. Madreseh Publication.

Tabesh, 2006 – Tabesh, Y. (2006). *Teaching the art of problem solving (supplementary math)*. High school course book, first edition. Tehran, Iran: Ministry of Education, Research and Educational Planning. Madreseh Publication.

Tan, Laswad, 2008 – Tan, L. M., & Laswad, F. (2008). Impact of prior content and meta-cognitive knowledge on students' performance in an introductory accounting course. *Pacific Accounting Review*, 20(1), 63-74.

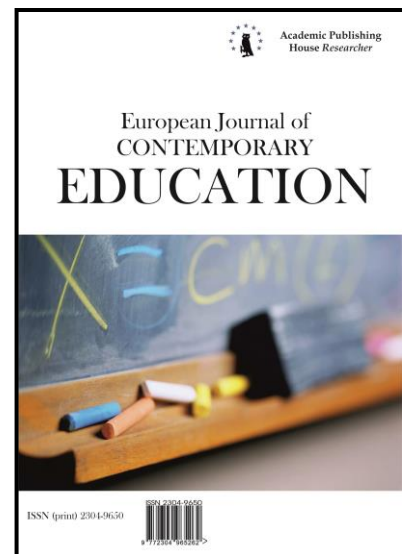
Vidal, 2003 – Vidal, R.V.V. (2003). Creativity and problem solving. Lecture Notes, Informatics and Mathematical Modelling, Technical University of Denmark, p. 60.

Vidal, 2008 – Vidal, R.V.V. (2008). Creativity and problem solving. Chapter 5. Technical University of Denmark.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.
All rights reserved.
Published in the Slovak Republic
European Journal of Contemporary Education
ISSN 2304-9650
E-ISSN 2305-6746
2017, 6(3): 461-478
DOI: 10.13187/ejced.2017.3.461
www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



Factor Analysis of Inertia, Capacities, and Educational Performance of At-Risk Students' Training Centres According to Their Academic Failure in Mathematics

Parvaneh Amiripour ^a, John A. Dossey ^{b,*}, Ahmad Shahvarani ^c

^a Department of Mathematics, Science and Research Branch, Islamic Azad University, Tehran, Iran

^b Department of Mathematics, Illinois State University, USA

^c Department of Mathematics, Science and Research Branch, Islamic Azad University, Tehran, Iran

Abstract

Immigrants face many barriers in moving from one country to another. Today's massive migrations are dislocating students from their cultures, families, and their schooling. In Iran, such students were not able to enter Iranian schools prior to 2017. Even now, many such immigrant students are being educated in centres administered by non-governmental organisations (NGO) where the schooling is focused on providing youth with knowledge on nutrition, health care, language and mathematics, and maintaining family links where possible. Still, external and internal factors lead to many at-risk students dropping out of the programs. The researchers have focused on the failure of at-risk students in mathematics in four of these schools supported by two NGO agencies. It was clear that the inertia of both teachers and students in mathematics was influencing both teacher choices and planning and student choices in providing conceptual understanding and algorithmic performance. Given the lack of instrumentation to gauge and describe organisational and managerial aspects of the schools and meaningful assessments of students' progress, the researchers modified a questionnaire from organisational inertia for examining the administrative factors in business and created a series of mathematics tests to quantify and describe at-risk students' movement through either second or third grade mathematics classes. The data provided by an Exploratory Factor Analysis of the assessment outcomes provide a predictive picture of student persistence versus administrative changes and, more generally, on ways that teacher/educators and educational staff members can implement

* Corresponding author. Address: 65111 East Crystal Ridge, Tucson, AZ 85739, USA
E-mail addresses: parvaneh.amiripour@gmail.com (P. Amiripour), jdossey@illinoisstate.edu,
jdossey44@gmail.com (J. Dossey), maths_ahmad@yahoo.com (A. Shahvarani)

strategies to help immigrant at-risk students transition from mindless repetition to understanding in their mathematics school work.

Keywords: At-risk students, mathematics, inertia, dynamic capacities, educational performance.

1. Introduction

Continuity and survival are among the most important goals of all organisations. Organizations face a constant struggle to deal with changing environments filled with accelerating rates of change affecting each issue. Factors such as intense global competition, changing technologies, and demands for increased quality of service all call for rapid-response from companies to schools. In both arenas, prior solutions fail to meet emerging problems. When pre-set rules and formulas are not helpful, students need to know how to learn, innovate, and adapt new solutions (Abbasi et al., 2010). Using the principles of inertia in physics in organisational management often illustrates how inertia may affect the organisation's ability to learn and solve problems (Laio, 2002). Today, innovation is required in the operations of organisations, if the organisations are looking to create new ideas. The organisations need to create infrastructures to turn innovation into a continuous process focused on new product generation and new service processes that lead every changing source of continuity and guarantee survival in a changing world (DehghanNajm, 2009).

2. Resistance to Change

At the heart of making change for students at risk is overcoming resistance to change from both students and teachers. In the "resistance to change" literature, researchers stress the fact that in change management, the human aspects of change, i.e., the effects of the changes on the individuals or the individuals' roles in the change, are the factors most often ignored (Szamosi, Duxbury, 2001). Tichy and Devanna (1997) identified three basic factors for resistance to effective organisational change: technical barriers (such as organisational inertia), political barriers (such as threats or coalitions), and cultural barriers (such as lack of the atmosphere which supports the change or commitment and attachment to the existing methods). Inspection shows that each of these factors is related to the organisation's previous daily activities and thus directly to the employees' support or resistance.

Hedberg and Ericson (1979) believed that inertia in insights, action, and organisational psychology are an obstacle to the way in which the organisation will develop and implement the major strategic decisions they make. Inertia appears when there is a considerable interval between the time at which decisions are made about major changes in the environment of an organisation and the time at which the members of the organisation are informed about these changes. Therefore, the analysis of the organisational environment reflects a managerial insight on the created environment. However, the response of the organisation to these changes is often slow and the attempts to apply the changes do not occur at appropriate or useful times (Edberg, Wolff, 2003). Given the above, the researcher seeks to introduce and express a metaphor titled inertia for educational settings. Since using a metaphor is a way to facilitate understanding of the intangible issues, it is useful in describing the resistance to change in educational settings or organisations. The main aim of the researcher is to investigate the resistance to changes in learning environments, such as the training centres for children at risk.

In Iran, a developing country, immigrant children or other at-risk children do not have access to the special educational facilities and benefits. Lack of such funding from the government and the financial stresses associated with the refugees have attracted more attention to these issues. The affected children have migrated from neighbouring countries to Iran for reasons such as war, terrorist activities, and to gain stability in their lives. Therefore, they require financial and non-financial resources from Iran. If the necessary measures are not implemented properly, these children and their families will live under adverse conditions and the human and financial resources of Iran will be wasted.

3. At-risk Students

Various definitions and conceptions of at-risk students have been proposed in the literature. Alfassi (2003), defined at-risk students as "a group of students who have experienced difficulties

and/or failures as learners" (p. 29). Masten (1997) noted that the label of "at-risk" is given to affected students for several different reasons, often without consistency. Christiansen (1997) cited several risk factors, such as substance abuse, increased violence, disabilities, neglect and abuse, and a change in family structure. These potential causal factors of at-risk students are often linked with school failure. As MacMath et al. (2009) declared, at-risk students face challenges such as failing classes, inability in adapting to the school environment, difficulty completing high school, inconsistent attendance, and negative behaviours at school. In the literature, "dropouts" is another label that is often given to at-risk students. Menzer and Hampel (2009) defined dropouts as non-graduating students who have left the school before finishing their senior year. According to Kayler and Sherman (2009), dropouts possibly have difficulty with other issues, as they are more likely to be recognised as at-risk students. In Iran, the economic status of families has resulted in most refugee students working in the local economy from grade two forward. This impacts their time for study and their physical preparedness and frame of mind for learning.

In the literature, at-risk students have been categorised in different groups. In their study, Menzer and Hampel (2009) identified four types of at-risk students who were at risk of dropping out and not graduating. *Lackadaisical* was the first classification, referring to the lazy students who pass their classes, but do not believe in planning for college. *Overwhelmed* describes the second group. Students in this classification are students with low flexibility who have to give more importance to their need to survive than to their education. The third classification, *Strugglers*, refers to students whose parents have not been involved in their education, have repeatedly showed academic needs, and have been involved in remedial classes or retained in a lower grade. The final group, labelled as the *surprised* students, refers to students who were unable to graduate due to miscounting their credits or failing one of their classes at the end of their senior year. Menzer and Hampel (2009) stated that considering these four types of students, the last group showed the most flexibility. Irrespective of how classifications of at-risk students are conceptualised, it is clear that all at-risk students face a mixture of academic and life challenges that can affect their ability to be successful in educational settings. Bruyere (2010), and Gutman et al. (2002), argue that since the majority of at-risk students have a number of factors that affect their education, it is not effective to identify only a single risk factor. They agree with others that each of the variables, such as the educational staff, teachers, and administrators; school contexts and regulations; family issues; and the responses of the individual play major roles in determining whether students become at-risk or not.

3.1 Immigration Issues and Afghani Students

Until very recently, refugee Afghani school-aged immigrant students were unable to attend public schools in Iran as they lacked citizenship or the legal papers providing them with access to public schools. However, starting with Supreme Leader Ayatollah Ali Khamenei's decision in 2016 that all immigrant students should be educated, Iran's educational institutions, from the early grades through to university level, have begun to integrate Afghan and other immigrant students into their classrooms. The merging of refugee students in Iran, legally or illegally, is proceeding well, according to Iranian educational sources. Challenges exist in urban areas where a lack of school room space is a problem, but new schools are being built (PressTV News, January 24, 2017).

3.2 Learning Mathematics in Iranian Elementary Schools

One of the major problems that at-risk students in Iran have, be they refugees or not, is learning mathematics. Extant research is scarce, even with Iran having the fifth largest refugee population internationally (Dryden-Peterson, 2015). Existing studies speak to unusually high levels of anxiety, memory problems, difficulties in ordering, difficulties in processing mathematics, difficulties in dealing with mathematical language, visual-spatial misperceptions related to mathematics learning, and word problems in at-risk students. Although the process of identifying and managing the problems is still at an early stage, much attention is now being directed to these issues and more stimulating learning climates have been designed by specific educators. However, teachers should pay special attention to the specific needs that exist in the students themselves.

According to Carpenter (1985), one-third of the time spent for teaching in resource rooms is for the subject of mathematics. Yet, in most of the inclusive classes, not enough attention is paid to the learning differences of the students in mathematics' classes by the mathematics curriculum or

the teachers in those classes. According to the National Council of Teachers of Mathematics (NCTM) (2000), most of the new mathematics curriculum changes in Canada and the United States have been inspired by the *Principles and Standards for School Mathematics* document introduced by the National Council of Teachers of Mathematics (2000). The NCTM argues that by providing at-risk students with rich learning experiences, teachers help the students learn to solve mathematical problems. The Equity Principle of the NCTM highlights the notion that, irrespective of the students' levels of practical skills, problem-based learning, along with the rich and appropriate mathematical experiences should be provided for all the students (Van de Walle, Folk, 2005). Instead of exactly following the problem-solving procedures prescribed by the teachers, the students should be encouraged to find their own way to solve the problems and share various solutions to show their full understanding. Many studies have shown that procedural practice and rote learning alone are not beneficial for at-risk students, which supports the Equity Principle (Van de Walle, Folk, 2005). Since learning basic, fundamental skills might be boring for at-risk students, negativity towards the subject matter may increase (Expert Panel on Student Success in Ontario, 2004). Moreover, when students rely on rote learning, the probability that they practise incorrect methods increases. Henceforth, more individual practice and volume do not guarantee success in mathematics (Woodward, Brown, 2006).

According to Wood et al. (2006), since reform-based classroom environments expect students to support their responses and defend their strategies for solving the problems, the students must be able to interact and communicate effectively in a social setting. A teacher is required to support all students' communication of mathematical concepts along with disseminating mathematical knowledge. Thus, communication and language issues must develop with the study of mathematics. Switching back and forth between a teacher-centred and a student-centred classroom cannot be done by the students alone. Therefore, according to Hahn et al. (2006), the transition to a student-centred learning environment should be undertaken consistently and gradually. Such a supportive context in classrooms for refugee children removes the stigma of not immediately knowing an answer and gives them opportunities to structure their own knowledge. While not a direct goal of this study, student knowledge of communication and language skills is also important.

At-risk students can be reached by teachers in different ways. In a study by George (2010), remedial maths interventions were given to a group of college students. The findings of the study revealed that teachers who provided caring behaviours, critiques, and autonomy resulted in students in the class being more motivated. The subjects of the study described the teacher they needed as one who considers the students' limitations in regard to their true needs and lives, and ignores their minor misconceptions. George (2010) also reported that the students emphasised the importance of teachers not imposing on their ability or autonomy in making personal decisions and choices. According to the finding of Kamath et al. (2009), simplifying or changing the curriculum is not necessary; instead providing real-life examples and making the curriculum more application-based is more effective. As MacMath et al. (2009) declared, students can improve self-efficacy and can better grasp the topic through using positive reinforcement and providing repetition.

For at-risk students, the school can have either a detrimental or a beneficial role. The studies by Christiansen (1997) and Bowen et al. (1998) indicate the importance of being part of the solution to problems that affect students and contributing to their learning. Educationally challenged students can be aided if the schools implement the numerous interventions and strategies existing in textbooks, method classes, and research findings. A set of very specific strategies to be implemented by the schools was developed by Wright (2006): first, schools should identify the root problem, whether it is a result of true lack of skill or a lack of motivation. Second, identify the learning stage of the student, and then determine whether the student is in the appropriate instruction level or not. If the interventions are being applied, it is crucial to ensure that the students are actively involved in the intervention, and that the instruction provided matches the students' needs. Considering the steps that the students are required to complete, we can refer to reviewing the material and proving understanding of it in several ways. In the study by Wright (2006), following those strategies, the students' progress was regularly monitored and they were provided with choices. Moreover, Wright suggested that schools create a school-wide program for the students or develop an intervention team that involves the teachers and staff for the students with educational problems (Wright, 2006).

Since non-governmental training centres (child houses) for children at risk in Iran have been in existence, scientific, educational, financial, and progress records are available by law. The researchers decided to find the probable causes of resistance to change. It seems that at-risk students face more academic failure in mathematics in terms of teaching and learning compared to other subjects. Hence, the focus of this study is on the factors affecting academic failure (educational loss) in mathematics. Such failure motivated the researchers to address the causes of resistance to change in students and staff. It is essential for the child houses to help the students in studying with regard to the organisational/educational inertia and also to support at-risk children with reference to social, financial, educational, and cultural affairs. The difficulties of the at-risk students in addressing mathematics in the full range of their programs may negatively affect their academic performance. Studying organisational/educational inertia can help to reduce inertia among the at-risk students. Moreover, study of academic performance of at-risk students' organisations is innovative in terms of its variables/factors on at-risk students' final performance.

Therefore, the main aim was to investigate the factors of organisational inertia in the training houses of the children at risk, the dynamic capabilities and the educational performance of these houses in accordance with the views of educators and the training personnel there due to the successive failure of the children at these houses in mathematics. Of course, there is a lack of a means to estimate this type of resistance (inertia) and dynamic capacities and educational performance. In this study, a questionnaire was designed based on the foreign research to identify the relevant factors, so that the later researchers will be able to use them to estimate self-inertia in the organisational-training centres for children in special circumstances.

4. Inertia and Change

In studies of change, inertia is often treated as an explanation for an organisation's failure or deferral of goals in reacting to changes under competitive pressure. Therefore, as Gresov et al. (1995) stated, inertia is considered as a key predecessor of strategic consequences like organisational mortality or impaired performance. Miller and Friesen (1980) and Hannan and Freeman (1984) defined organisational inertia as the equivalence of external environment and organisational capabilities. However, inertia gets its meaning when it is studied from a more dynamic and analytical viewpoint. The finding of Hakonsson et al. (2009) revealed that long-term performance can be significantly improved as the result of constant change, even in settings that begin as inert organisations. They also maintained that organisations that adjust on a constant basis are more successful. Likewise, Huff and Huff (1995) focused on *future orientation* as an indicator of organisational inertia. In cases where there is a high participant ability for change or the organisation has good capacity to react to change in the external environment, the future potential of the current strategy for change will be high. The three constituent indicators of organisational inertia that best generalise and reflect the organisational inertia construct are extensively examined and defined in this study.

4.1 Resource and Process

In a study on dynamic capabilities, Teece et al. (1997) proposed a definition for the strategic capability and competitive advantage in change, in which they were considered as a function of organisational paths, positions, and processes. "What it [an organization] can do and where it can go is thus heavily constrained by the typography of its processes, positions, and paths" (Teece et al., 1997). According to Teece et al. (1997), the prediction of an organisation's performance and opportunities is possible from the vantage points of its organisational paths, positions, and processes.

Teece et al. (1997) described the managerial and organisational processes theoretically and considered them as a three-fold process comprising reconfiguration, coordination and integration, and learning. The researchers highlighted the effective way through which both external and internal integration and coordination is achieved and also emphasised its high importance. These outcomes indicate that productive systems show high interdependency and that changing one level without changing the other levels is impossible, which means that partial replication is likely to be impractical.

Teece et al. (1997) defined learning as a process through which experimentation and replication which identifies the new production opportunities, also makes the performance of the

task quicker and better. Literature findings indicate that new choices become less attractive and observed as more risky, due to the focus on studies with current capabilities. Firm positions were defined by Teece et al. (1997) as the placement of firm goals in terms of its business assets. By this approach, business assets refer to the difficult-to-exchange knowledge assets and their corresponding assets, and also the relational and reputational ones, instead of referring to its tools and capital goods, unless they are at the heart of the particular change. These assets (vocational assets, complementary assets, technological assets, financial assets) are the determiners of its productivity and market share at any time. The three organisational inertia indicators identified by Teece et al. (1997) suffer from the fact they are theoretical and unsupported through the use of empirical evidence. Resource commitment can be motivated by external threat. However, in the traditional business pattern, routines may stay unchanged.

4.2 Path Dependency

It is essential for managers to search for genetic diversity and for organisations to learn to overlook their past (Hamel, Prahalad, 1994). Kelly and Amburgey (1991) also maintained that organisational history makes the managers remain controlled and, as their study showed, the impact of the previous organisational experiences and actions on the content and probability of change is very high. Teece et al. (1997) defined path dependences as a function of the present position and the onward paths. The path the organisation has already travelled is what frequently forms that organisation's current position. The concept of path dependences indicates that history is important. However, at the same time, the past itself may be the problem. Therefore, a company's repertoire of routines and its previous investments may restrain its upcoming behaviour. According to the Gilbert (2005), routine and resource rigidity approaches and path dependency theory views appear to be complementary.

Sydow et al. (2009) suggest three indicators considering the path dependences that could be used by other researchers. The first indicator is to conduct a comprehensive path analysis and to identify the operational rigidity or the strategic persistence (or the stimuli that lead to this path dependency). The second indicator included the exploration, identification, and restoration of the self-reinforcing feedback mechanisms, which are probably the basis of the organisational rigidity. And, the third indicator, the important part of a systematic path analysis, is to look for a prompting incident that was expected to have directed the path building process. A question was raised by Sydow et al. (2009) that explored the probability of the path dependences scope, and they maintained that unpredicted de-locking with regard to a by-product of other organisational decisions, unanticipated exogenous factors (crises or shocks), or an insidious change in organisational demography can lead to the occurrence of the path dissolution.

4.3 Performance and Inertia

Miller and Chen (1994) considered two aspects for the performance consequences of inertia: inertia can negatively affect performance due to the inability to reconcile or it can reduce the risk of making hasty and costly decisions and help the principals to emphasise the strengths of the organisation. According to Miller and Chen (1994), considering both strategic and tactical change actions, no negative effects have been shown towards good performance by organisational inertia, yet, "the performance implications of inertia seem to be very much a function of environment" (p. 18): by the increase of the competitors' action and the multiplicity of customer needs, the benefits of inertia decrease. As Greve (1999) declared, organizational inertia, at the time of changing, makes larger organisations encounter greater losses of market. It is worth mentioning the finding that the inspection of state effect on performance is a key moderator – because of the greater losses of the high performing organisations and the larger losses of the low performing organisations that occur during the change. Using the managerial implications, the experts explain this issue. According to Greve (1999), high performing principals lose from changing due to overestimating their capabilities, as low performing organisations "gain from changing simply because of regression toward the market mean" (p. 610). Therefore, inspection for destination and origin state effects on performance reveal more strong effects of inertia. In a study on the behaviour of banking industry organisations throughout the recession, Ma and Karri (2009) proposed a threshold level of performance which indicates that due to the negative managerial perception, and the lack of available resources, the organisational inertia prevents change within

the organisation. These empirical outcomes indicate the curvilinear and non-monotonic performance effects on inertia. The results of the study by Dobrevet et al. (2003) show inert organisations to be both less likely and more likely to fail while changing. Suppression of organisational or inertia stimulation and its unique effects on performance or the change is dependent on the complex interactions between external and internal contexts.

5. Dynamic Capacities

According to Helfat (1997), dynamic capability is the capacity of an organisation to perform succeeding revisions and extensions, after creating its resource base. She argued that the enterprise processes that can alter existing positions that lead to competitive advantage and the changes in performance encompass dynamic capabilities. As it was defined by Zollo and Winter (2002), dynamic capability is a constant and learned form of collective activity through which the operating routines of the organisation are systematically created and revised in search of better effectiveness. Dynamic capabilities are defined by Winter (2003) as those that function to create, revise or extend ordinary capabilities. According to Katkalo et al. (2010), dynamic capabilities indicate the capacity of an enterprise to organise its resources/assets and activities inside the system of co-specialisation and global specialisation. Moreover, they indicate the enterprise's attempts to generate/form the market in ways that allow the value to be shaped and apprehended. For those individuals who are sceptical about the existence of dynamic capabilities, Winter (2003) asserted that capabilities that would let the enterprise look for new customers, create new sales channels, provide new products, and create relationships with new suppliers, are not at the zero level. Maintainable competitive gain, reconciled to enterprise ecosystems in an open environment, is guaranteed by the promotion to replicate dynamic capabilities, generating and protecting the related organisation's distinctive asset base. Traditional factors of success, which are important but not adequate for a sustainable outstanding performance, include strategic goals arrangement, cost efficiency, economy of scope or scale, and tangible assets. Teece (2007) maintains that effective use of dynamic capabilities is due to the presence of three components: proper implementation, seizing ability and the sensing of new opportunities.

5.1 Sensing Opportunities and Threats

Organizations must constantly filter, search, calibrate, and shape through a search for new opportunities, to shape and identify opportunities (new products, markets, or technologies). Organisations have a variety of accesses to needed information. Such opportunities can be created by new knowledge and new information. Information must be gathered and then filtered from social and professional contacts in order to create a hypothesis or an assumption about the probable evolution of changes, technologies, shifts, marketplace, etc. According to Teece (2007), corporations must create procedures and mechanisms to keep management informed in order to prevent the decline of information moving down and up a hierarchy.

5.2 Seizing Opportunities

Seizing is defined as the skill of making a strategic decision and executing it. The technological opportunity of a new market or supplier must be addressed through new processes, products, and services, once it is detected. Investments in commercialisation and development activity are always needed for addressing opportunities. The business model and the customer solution must be specified by the organisation in order to have knowledge of distribution and supply costs for being able to measure the possible competitive reaction to gain marketplace benefit and approval. An important classification of dynamic capabilities appears around management ability to challenge specific dysfunctional characteristics of traditional resource allocation processes and decision rules. Validation of a business model and processes, and making investment choices, requires special skills which, historically, are not distributed among management crews, as well as both careful judgment and effort. It is partly an art to design organisation borders and design a business model. Nevertheless, according to Teece (2007), organisations that take a relatively or impartially efficient viewpoint to outsource decisions, evaluate the value chain carefully so as to recognise how to provide what the customer needs in a timely and cost-effective mode, have a deep understanding of user needs, examine multiple choices, and have chances to succeed.

5.3 Managing Threats and Transformation/Reconfiguration

The guarantee of resources to investment opportunities, the wise selection of product attributes and technologies, the successful regulation and identification of market and technological opportunities, and the design of business models can lead to the success and growth of organisations. To preserve evolutionary fitness and, if required, to try organisational inertia and negative path dependences and escape from them, reconfiguration is essential. In other words, since operational efficiency needs some level of routine, success will breed it. Change should happen rapidly, because it is expensive to change routines. Withdrawal from routines will cause more anxiety inside the organisation, except when the culture is formed in a way that accepts high levels of internal change.

The best skills of management leadership are necessary for putting up with dynamic capabilities. A main managerial function is achieving business renewal and semi-continuous asset organisation, containing the reform of routines. The old and the new should complement each other within the organisation. Inside the corporation, the management ability to incorporate and mix assets such as know-how is also a major skill. It is crucial to integrate the know-how inside the company, and between the company and organisations outside it. Many control disputes are linked to dynamic capabilities. Some control disputes are associated with incentive alignment. Agency theory highlights that the splitting of ownership from control leads to problems in interest alignment, mostly around the allocation of corporate privileges and management benefits. Another problem related to control is participation at the board level by those who can regulate whether the top management team is adequately dynamic oriented. According to Teece (2007), the boards which are set by new independent board members, may not have the necessary abilities to accurately detect strategic malfeasance and react based on that.

5.4 Performance and Dynamic Capacities

According to the findings by Proelleret et al. (2011), organisational performance is affected by the mediation of strong dynamic capabilities – if the organisation has settled dynamic capabilities in advance, the organisational performance can be positively affected by strategic management. Generally, two recognisable points of reference, organisational resources (Adner, Helfat, 2003; Lopez, 2005) and ordinary capabilities (Pavlou, El Sawy, 2011; Teece, 2007), can be affected and reformed by dynamic capabilities to attain better performance and guarantee competitive advantages. According to the empirical and theoretical evidence, it can be understood that dynamic capabilities can be a direct cause for improvement of organisational performance and can act as a mediator. Future studies should follow two research goals in the relationship between organisational performance and dynamic capabilities – first, to discover the relationship between intermediate outcomes and dynamic capabilities and, second, to investigate and evaluate organisational performance and the intermediate results (Barreto, 2010). The relationship between these indicators and organisational performance can be dissimilar as well. During different stages of the organization's development, the dynamic capabilities' constituent indicators can be joined and can correspond in order to improve the organisational performance, even though they are not discrete and are interdependent. Applying the dynamic capabilities in order to use their potential must be considered as a set of actions on different levels of management.

6. Methodology and Material

The researchers have applied a descriptive analysis method based in data collecting methods, schedule, and the analysis methods for interpreting the data. The present study is an 'applied research' with regard to the objective, involves 'testing hypotheses' in regard to study of beliefs and actions, and can be useful for future research. The quantity-descriptive/analysis method is applied for testing hypotheses. The researchers started by exploring the aim of interest through qualitative methods, working with a few students to see what approaches might work and what difficulties the students encountered in educational centres. The following sections describe the selection of subjects and random assignment of students to treatments, the development of instrumentation and related treatments, specification of hypotheses, and data analysis methods.

6.1 Selecting Sample from the Child Houses of the Society for Protecting the Rights of the Child (SPRC)

The sample of at-risk students and the associated education staff for this present study were chosen from two houses (*Naser Khosrow & Shosh Houses in the south of Tehran*). These two houses serve a population that comprises 150 (kindergarten to grade three) at-risk students with 90 educational personnel at present (2015-2016). Through simple random sampling, 40 at-risk students – 21 males and 19 females – were chosen as at-risk students affected by mathematical difficulties as determined by assessments that educational personnel have made at 2nd and 3rd grades. The 50 randomly selected educational personnel* comprise the teachers of mathematics, literature, and reading; the school psychologist; relevant educational personnel; and counsellors in the field of educational affairs. There is a relationship between the at-risk students and educational personnel from pre-kindergarten to upper grades. At-risk students have worked with the educational personnel in various activities at the houses.

6.2 Selecting Sample from the Child Houses of the Association for Protection of Child Labour (APCL)

Members of the APCL society prepare educational programs and teach at-risk children (Afghans) at kindergarten, pre-school, and first to fourth grade levels. The member child houses of *Molavi & Khavaran Houses* (in Tehran) provide services for at-risk students up to and including grade five. The conditions of at-risk students and personnel in APCL were similar to SPRC in terms of economic, social and cultural, and instructional statuses. Generally, the two Houses (*Molavi & Khavaran Houses in south of Tehran*) are considered as a population that comprises 200 (1st to 5th) at-risk students and 95 educational personnel to date (2015-2016). Through simple random sampling, 50 personnel from the education section and 60 at-risk students (31 males and 29 females) were chosen as at-risk students with mathematical difficulties with regard to assessments that educational personnel have said occur at 2nd and 3rd grade levels. The educational personnel comprise teachers of mathematics, literature, and reading; a psychologist; educational personnel; and counsellors in the field of educational affairs.

6.3 Questionnaire

In this study, the researchers also administered a questionnaire designed by Nedzinskas (2013). The questionnaire has two sections: demographic items and the main questions. The portion of the questionnaire dealing with the main questions was structured based on many variables: reconfigure, seize, and sense for the '*dynamic capabilities variable*'; resource, path dependency, and process for the '*organisational inertia variable*', and new innovations executed and new process for the '*educational performance of child houses variable*'. This portion of the questionnaire has 32 items, each scored on a five-point Likert scale ranging from 1 to 5 for "strongly disagree", "disagree", "neutral", "agree", "strongly agree" responses, respectively. Since the items were originally structured for an organisation and its inertia, the questions have been modified in terms of the educational procedures at the four child houses involved. Items 1-4 deal with reconfigure, items 5-8 deal with seize, items 9-12 deal with sense and are from the '*dynamic capabilities variable*'. Items 13-16 that deal with new innovations and items 17-20 that deal with new processes executed are from the '*educational performance of child houses variable*'. Items 21-24 deal with resources, items 25-28 deal with process, items 29-32 deal with path dependency and are from the '*organisational inertia variable*'. Before distribution of the questionnaire, the researcher explained all items for the educational personnel. They were told to view these items in the context of supposing that they have to solve an educational crisis in the respective child house of the SPRC & APCL societies and they should answer as to how they would make the particular decision for the future.

7. Findings

In examining students' inertia, factors were described detailing the dynamic capabilities of organisations that grew and adapted to change in their organisational inertia. These actions were

* Researchers interviewed staff with respect to their views about the factors in the educational and environmental circumference that lead to failure of Afghan students in mathematics.

sensing opportunities, seizing opportunities, and reconfiguring and recombining their assets to grow their organisations in an era of change. Education is rife with challenges and opportunities at the present. Likening the decision making and role of the faculty and staff to that of the decision making in a business, the researcher created a questionnaire focusing on decisions and actions characterising the three actions above, sometimes referred to as dynamic capabilities (Teece, 2007). The researcher combined these factors with other factors that give an organisation an advantage in grasping opportunities when they arise (dynamic capabilities) (Teece, 2007) into a questionnaire focused on measuring the readiness for change in organisational inertia in a school setting (Amiripour et al., 2017).

The questionnaire has *face* and *content validity* with regard to experts in educational management. In addition, *convergent* and *divergent* validity are computed with regard to factor loading and *average variances extracted* (AVE) in construct validity respectively (Amiripour et al., 2017). EFA (Exploratory Factor Analysis) will be estimated for divergent validity. In addition, *discriminate validity* values are computed with regard to AVE and R². The results of the AVE and R² analysis are examined for the instruments in this study and the values all fall between the commonly accepted critical values for acceptance of 0.50 to 0.70 (Amiripour et al., 2017). The reliability of the questionnaire and related sub-measures has been studied by Nedzinskas (2013) and all such estimates of the reliability found to be between 0.80 to 0.90 (see Table 1). These values, computed by SPSS, support the use of these measures as reliable measures for research. Before implementing the questionnaire, the questions were modified many times in order to access suitable reliabilities.

Table 1. Factors and their questions along reliabilities by Nedzinskas (2013)

| Factor | α | Observed Variable | α | The questions | The authors |
|---|----------|--------------------------|----------|---------------|---|
| Dynamic Capabilities | 0.66 | Reconfigure | 0.74 | 1,2,3,4 | Teece (2007) |
| | | Seize | 0.81 | 5,6,7,8 | Teece (2007); O'Reilly & Tushman (2008); Pavlou & El Sawy (2011); Eisenhardt & Martin (2000); Zott (2003) |
| | | Sense | 0.83 | 9,10,11,12 | Teece (2007); Wang & Ahmed (2007); Borch & Madsen (2007) |
| Non-financial performance (Educational performance) | 0.92 | New Innovations Executed | 0.82 | 13,14,15,16 | Drnevich & Kriauciunas (2010) |
| | | New Process | 0.81 | 17,18,19,20 | Bititci et al. (2011) |
| Organisational Inertia | 0.83 | Resource | 0.62 | 21,22,23,24 | Gilbert (2005) |
| | | Process | 0.79 | 25,26,27,28 | Gilbert (2005) |
| | | Path Dependency | 0.83 | 29,30,31,32 | Sydow et al. (2009) |

7.1 Descriptive Statistics

Members of the educational personnel of the society schools consisted of 50 individuals from each of the two societies whose schools were involved in the study (80 females and 20 males). These personnel consisted of teachers of mathematics, literature, and reading; the school psychologist; relevant educational personnel; and counsellors who were mainly between 20 and 29 years old and most have the B.C (licentiate degree). The final mathematical examination scores for at-risk students were between 10 to 10.50. Before distribution of the questionnaire, the researcher read all items to the educational personnel. They were instructed to view these items in the context of supposing that they have to solve an educational crisis in their respective child house and were asked to answer as to how they would make the particular decisions for the future. As such, the results of the questionnaire items, when gathered into the varied cluster groups, provided a profile of the teachers' and staff

members' views about the dynamics of educational inertia in their respective schools, as well as the factors supporting the dynamic in their schools. Educational personnel have chosen a modal response of either "strongly disagree" or "disagree" for seven of the eight choice clusters. For the remaining cluster, statements dealing with "path dependency", they selected the "neutral" response.

7.2 Inferential Statistics

The following sections focus on examining the structures of the responses of the educational personnel to the questionnaire through factor analyses enacted by algorithms in the SPSS.

7.2.1 Exploratory Factor Analysis (EFA)

The questionnaire designed for the study has 32 questions designed to measure the varied hypothesised factors mentioned in the main text. The first test involved submitting the items to an EFA to see if the results confirmed the hypothesised latent variables mentioned by Teece and associates. To make sure that the data are suitable and reflective of adequate sampling for conducting an EFA, the data were tested with the Kaiser-Meyer-Olkin test relative to the sampling and then the Bartlett's test (Kaiser, 1970). The size of the adequate sampling (KMO) is > 0.70 and the significant level of sampling test of Bartlett's Test is < 0.05 (Fabrigar et al., 1999). Table 2 demonstrates that KMO is 0.85 and the p-value of Bartlett's Test is 0.000. Therefore, the data structure is suitable for factor analysis:

Table 2. KMO and Bartlett's Test

| | | |
|---|--------------------|---------|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | | 0.85 |
| Bartlett's Test of Sphericity | Approx. Chi-Square | 2620.52 |
| | df | 496 |
| | p-value | 0.000 |

Further, the communalities of the items, or the amount of common variance shared with other items, shown in Table 3, indicates that all items in factor analysis are adequate, because their factor loadings are greater than 0.50.

Table 3. Communalities

| Items | Initial | Extraction | Items | Initial | Extraction |
|-------|---------|------------|-------|---------|------------|
| REC1 | 1.00 | 0.88 | NP1 | 1.00 | 0.77 |
| REC2 | 1.00 | 0.68 | NP2 | 1.00 | 0.73 |
| REC3 | 1.00 | 0.63 | NP3 | 1.00 | 0.75 |
| REC4 | 1.00 | 0.74 | NP4 | 1.00 | 0.81 |
| SEI1 | 1.00 | 0.84 | RES1 | 1.00 | 0.88 |
| SEI2 | 1.00 | 0.80 | RES2 | 1.00 | 0.80 |
| SEI3 | 1.00 | 0.81 | RES3 | 1.00 | 0.82 |
| SEI4 | 1.00 | 0.75 | RES4 | 1.00 | 0.76 |
| SEN1 | 1.00 | 0.85 | PD1 | 1.00 | 0.78 |
| SEN2 | 1.00 | 0.85 | PD2 | 1.00 | 0.82 |
| SEN3 | 1.00 | 0.72 | PD3 | 1.00 | 0.70 |
| SEN4 | 1.00 | 0.79 | PD4 | 1.00 | 0.68 |
| NI1 | 1.00 | 0.66 | PRO1 | 1.00 | 0.83 |
| NI2 | 1.00 | 0.88 | PRO2 | 1.00 | 0.74 |
| NI3 | 1.00 | 0.79 | PRO3 | 1.00 | 0.76 |
| NI4 | 1.00 | 0.80 | PRO4 | 1.00 | 0.82 |

The table of total explained variance (Table 4) shows that eight factors have been identified. The total explained variance shows that these factors, as a group, can explain about 78.28 % of the variance. This is a significant amount of variance explained and sufficient to continue to interpret the

findings of the EFA. Rotating the component matrix with the use of varimax rotation resulted in the matrix values listed in Table 5. The rotated component matrix includes the factor loadings of each factor multiplied by remaining factors after the rotation.

Table 4. Total explained variance

| Component | Extraction Sums of Squared Loadings | Rotation Sums of Squared Loadings | | |
|-----------|-------------------------------------|-----------------------------------|---------------|--------------|
| | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 37.51 | 3.84 | 12.01 | 12.01 |
| 2 | 50.49 | 3.54 | 11.06 | 23.07 |
| 3 | 57.10 | 3.30 | 10.34 | 33.41 |
| 4 | 62.98 | 3.07 | 9.61 | 43.02 |
| 5 | 67.63 | 2.98 | 9.33 | 52.36 |
| 6 | 71.58 | 2.93 | 9.15 | 61.52 |
| 7 | 75.21 | 2.91 | 9.10 | 70.62 |
| 8 | 78.28 | 2.40 | 7.66 | 78.28 |

Table 5. Rotated component matrix

| Items | Component | | | | | | | |
|-------|-----------|--------|--------|--------|--------|-------|-------|--------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| REC1 | 0.50 | -0.18 | -0.19 | 0.28 | 0.00 | 0.51 | 0.20 | 0.41 |
| REC2 | 0.21 | -0.11 | -0.12 | 0.19 | -0.09 | 0.74 | 0.07 | 0.08 |
| REC3 | 0.27 | -0.03 | -0.005 | 0.04 | -0.00 | 0.71 | 0.07 | 0.19 |
| REC4 | 0.05 | -0.09 | -0.06 | 0.06 | -0.03 | 0.84 | 0.04 | -0.004 |
| SEI1 | 0.44 | -0.25 | -0.15 | 0.67 | 0.004 | 0.23 | 0.17 | 0.11 |
| SEI2 | 0.43 | -0.18 | -0.08 | 0.70 | 0.06 | 0.22 | 0.14 | 0.000 |
| SEI3 | 0.18 | 0.007 | -0.05 | 0.83 | -0.11 | 0.03 | 0.15 | 0.17 |
| SEI4 | 0.06 | -0.009 | 0.08 | 0.84 | -0.01 | 0.10 | 0.05 | 0.11 |
| SEN1 | 0.61 | -0.17 | -0.12 | 0.30 | 0.002 | 0.49 | 0.16 | 0.26 |
| SEN2 | 0.89 | -0.02 | -0.09 | 0.07 | -0.02 | 0.14 | 0.01 | 0.07 |
| SEN3 | 0.78 | -0.03 | -0.04 | 0.19 | -0.05 | 0.14 | 0.04 | 0.22 |
| SEN4 | 0.83 | -0.02 | -0.03 | 0.19 | -0.05 | 0.16 | 0.17 | 0.05 |
| NI1 | 0.38 | -0.23 | -0.23 | 0.28 | 0.03 | 0.32 | 0.35 | 0.31 |
| NI2 | 0.24 | -0.17 | -0.24 | 0.11 | -0.07 | 0.14 | 0.06 | 0.83 |
| NI3 | 0.40 | -0.31 | -0.24 | 0.27 | -0.08 | 0.37 | 0.07 | 0.50 |
| NI4 | 0.16 | -0.22 | -0.13 | 0.18 | -0.09 | 0.11 | 0.16 | 0.79 |
| NP1 | 0.19 | -0.45 | -0.34 | 0.16 | -0.08 | 0.12 | 0.55 | 0.24 |
| NP2 | 0.07 | -0.20 | 0.07 | 0.25 | -0.006 | -0.06 | 0.78 | 0.04 |
| NP3 | 0.14 | -0.29 | -0.22 | -0.008 | -0.09 | 0.13 | 0.74 | 0.07 |
| NP4 | 0.07 | -0.12 | -0.14 | 0.09 | -0.16 | 0.17 | 0.83 | 0.08 |
| RES1 | -0.15 | 0.62 | 0.38 | -0.19 | 0.23 | -0.10 | -0.34 | -0.32 |
| RES2 | -0.10 | 0.83 | 0.18 | -0.05 | 0.12 | -0.11 | -0.13 | -0.10 |
| RES3 | 0.006 | 0.84 | 0.15 | -0.02 | 0.17 | -0.07 | -0.20 | -0.07 |
| RES4 | -0.05 | 0.77 | 0.16 | -0.09 | 0.12 | -0.11 | -0.24 | -0.19 |
| PRO1 | -0.02 | 0.17 | 0.38 | 0.08 | 0.72 | -0.12 | -0.18 | -0.14 |
| PRO2 | 0.01 | 0.12 | 0.08 | -0.02 | 0.89 | -0.00 | -0.07 | 0.02 |
| PRO3 | -0.12 | 0.09 | 0.03 | -0.05 | 0.81 | 0.05 | 0.04 | -0.10 |
| PRO4 | 0.02 | 0.09 | 0.16 | -0.04 | 0.78 | -0.10 | -0.10 | 0.009 |
| PD1 | -0.09 | 0.41 | 0.67 | 0.001 | 0.26 | -0.02 | -0.25 | -0.23 |
| PD2 | -0.03 | 0.26 | 0.72 | 0.05 | 0.25 | -0.18 | -0.13 | -0.16 |
| PD3 | -0.11 | 0.21 | 0.77 | -0.16 | 0.18 | 0.02 | -0.08 | -0.15 |
| PD4 | -0.08 | 0.06 | 0.89 | 0.01 | 0.06 | -0.11 | -0.03 | -0.03 |

Table 5 shows that eight factors were identified as the main factors. By studying the literature of institutional inertia research and the structure of the pre-designed conceptual model, the following eight factors were named:

1. Sensing (SEN): REC 1, REC2, REC3, REC4
2. Resource (RES): RES1, RES2, RES3, RES4
3. Path Dependency (PD): PD1, PD2, PD3, PD4
4. Seizing (SEI): SEI1, SEI2, SEI3, SEI4
5. Process (PRO): PRO1, PRO2, PRO3, PRO4
6. Reconfigure (REC): REC1, REC2, REC3, REC4
7. New Process (NP): NP1, NP2, NP3, NP4
8. New Innovations Executed (NI): NI1, NI2, NI3, NI4

As is shown in Table 5, the item *New Innovation Executed NI1* (0.38) has a cross loading with the Sensing factor. As theoretical knowledge is more relevant than a statistical measure when such cross loadings occur, if the item is not significantly correlated to any of the factors (generally considered to be less than 0.30) and does not provide a conceptually vital dimension to the measure, the item should be removed. Additionally, a complex variable, or a variable that loads on more than one factor, should be removed if the cross loading is greater than 0.40 (Schonrock-Adema et al., 2009). Hence, from this point forward, item NI1 is treated as belonging to Factor 8.

8. Conclusion

Empirically it can be said that paying attention to the reasons for failure to change in training centres has always been a subject of study for various local and foreign researchers. Since change in today's turbulent modern environments is an inevitable issue for schools and training centres, identifying the reasons for resistance to change and ways of dealing with them, increases the possibility of successful organisational changes. One of the common reasons mentioned for the failure in organisational change in training centres is resistance to change. Resistance of the teachers/educators to change is a complicated issue that school principals always face in the evolving schools/training centres. Resistance to change processes always exist and the individual's resistance is always considered to be one of the critical and important factors for their failure. This issue represents a set of challenges that the principal must overcome to apply the desired changes. In order to facilitate the change from the old methods to the new ones, organisations must have the necessary competence in effective change management. Change management process includes an effort to accept change by those who are involved in this process or those who are affected by change, as well as managing any resistance to it. Inertia and stagnation in the development of the knowledge of the organisation, lead to inertia and stagnation in the entire organisation. Of course, this relationship will be moderated by the arrival of the knowledge absorption capacity variable. This means that if knowledge has stagnated in an organisation (schools/training centres) and the capacity to absorb knowledge is low among the individuals (teachers/educators), the incidence of organisational inertia in schools/training centres will be intensified.

The obtained results for the hypotheses show that the main cause of the recession and the organisational inertia is the low absorption capacity of the organisation. If the schools/training centres intend not to face inertia and stagnation, they should look for strategies to provide ways out of the recession of knowledge as well as increasing the capacity of the individuals to absorb knowledge. The main motivation for conducting this study was to investigate the reasons for the failure of at-risk students in the training centres. One of the major failures of the at-risk students was their failure in mathematics. It seemed that the teachers and educators of their training centres (child houses) had complained about the students' educational status and their successive failures, especially in mathematics at primary schools. Therefore, the researcher decided to examine this issue from a different angle. It seemed that the organisational reasons and the ways of attracting human resources had led to this situation. Previous studies had shown that the failure of the at-risk students, especially in mathematics, is due to the students themselves. However, in this study, we addressed the organisational-environmental factors. Therefore, since there were no means to explore the views of the people working in the training centres for at-risk children, the researcher

decided to develop a questionnaire consistent with the organisational inertia questionnaires adopted from Nedzinskas (2013).

Identification of the factors and their analysis is more important than ever for developing a new questionnaire. The three main factors of dynamic capabilities, organisational inertia, and educational performance were analysed in this study. The study of the dynamic capabilities model let us claim that the dynamic capabilities notion is in its early stages and there are some areas for the further agreement among the researchers, such as in the following areas: organisational innovation and ordinary capabilities, dynamic capabilities' impact on educational performance in different external contexts, common definition of dynamic capabilities and the antecedents of dynamic capabilities, the indicators of dynamic capabilities, and clear borders among dynamic capabilities. The currently evolving dynamic capabilities model also emphasises the conscious management and managerial understanding of dynamic capabilities for employing its benefits.

Even though external environment is important, external context should not be coordinated with dynamic capabilities by default, since for initiation of the dynamic capabilities, different stimuli might act as predominant factors. Investigation of the dynamic capabilities theory has shown different effects of school dynamism to dynamic capabilities and has revealed that competitive benefits do not lie in dynamic capabilities but in their usage and application. Organisational inertia was revealed as an opposing concept for dynamic capabilities, which is obligatory on processes and resources; path dependency prearranged self-reinforcing mechanisms by theoretical findings. Practice analysis and organisational inertia theory have indicated two opposing perspectives by two groups of researchers – that is, the organisational ecologists' and adaptation points of view. The organisational adaptation standpoint considers organisational inertia as a prerequisite to change instead of a consequence of reliability. According to the organisational ecologists' definition, inertia is a consequence of the selection process instead of being a prerequisite for selection. Hence, the path dependences, processes, and observed resources as previous choices that have impact on the competence domains make a foundation for causality between organisational inertia and dynamic capabilities. Many studies explained the interrelationship between organisational inertia and dynamic capabilities. The theory of dynamic capabilities considers dynamic capabilities as a condition for organisational adaptation and, consequently, a tool for overcoming organisational inertia.

Nevertheless, the experts on the dynamic capabilities model have emphasised the fact that dynamic capabilities are required, but are not the only instrument to improve inflexibilities reconfiguration and organisational resources. According to the previous empirical and theoretical analysis and both quantitative and qualitative studies implemented in this study, eleven dynamic capabilities were derived for the first order dimensions in which dynamic capabilities show up. Through these dynamic capabilities' dimensions, the organisations are allowed to react to arising threats and opportunities (sensing), to take proper actions in respect of change implementation (reconfiguration), and to evaluate possible competitive responses and to make appropriate strategic decisions (seizing). Each of these three indicators of organisational inertia (path dependency, resources, and processes) were considered as inflexible actors in the rapid changing of the external environment and as factors that decrease the relative educational performance. The study has recognised processes as the most important indicator of the relative learning performance and as the indicator of organisational inertia.

The relationship between learning performance and dynamic capabilities can be moderated by organisational inertia, so that compared to the child houses with low organisational inertia, the child houses with high organisational inertia have a weaker positive relationship. Schools/training centres and the performance of the education system for at-risk children is very important in any society. When we see scientific recessions and educational failures, it seems that the human and financial resources of that country are wasted. Educational failure in mathematics in child houses was an impetus to investigate the causes of the failures. Investigating educational failure from the angle by which we addressed organisational failure can reveal a new perspective. Considering the above, for each of the three main factors, some sub-factors were made and developed through exploratory factor analysis (EFA) based on the views of teachers/trainers and education staff in child houses for the at-risk children. This questionnaire with these factors and sub-factors can reveal the scientific recessions, educational capabilities, and dynamic and static educational

performance in child houses for at-risk children. Suggestions are offered below for coping with inertia and intensity of the dynamic capabilities:

Strategies for training the human resources based on their dynamic capabilities:

With all the difficulties and problems, it must be admitted that the survival of the training centres for at-risk children is largely dependent on the knowledge, awareness and new and different skills of the teachers. The more their knowledge and skills are coordinated and compliant with the needs of the community and scientific progress, the higher is the assurance of the success of the individuals and education centres. The basis of dealing with inertia in the organisation and the institutional development is the improvement of human resources, which is executed in different forms (pre-service and in-service teacher/educator trainings) in organisations.

Strategies to overcome resistance to change: One of the most documented achievements about the behaviour of individual and the organisations is that the organisation and its members resist change. Resistance to change can be identified as one of the sources of organisational inertia. The individual's resistance to change is one of the most important issues in organisations because they see change as a threat to themselves and do not simply accept the changes. Overcoming this resistance and directing it is one of the most difficult tasks that the principals of the training centres for at-risk children face. However, whatever the change is, and regardless of whatever intensity it has, it needs management and leadership, and the principal should justify the changes and provide the necessary information and knowledge. There are two sources for the resistance to change:

- The resistances that have individual origins and are related to the personal characteristics of the individuals, including: habit, security, fear of the unknown, economic factors and lack of self-confidence.

- The resistances that have organisational origin, including: the structural mechanisms, feeling threatened by the experts, group norms, and job investment.

Each of these two factors can lead the organisation toward stagnation and inertia. The principals of the training centres for at-risk children, especially the principals of the government agencies, should think about ways to overcome these factors. Some strategies are provided below:

Education and communication: To break resistance, communication must be established with teachers and the reasons for the changes must be explained and outlined for them.

Participation: Before making any changes, an invitation must be extended to those who are likely to oppose them and they should be allowed to participate in decision-making.

Considering the facilities: In exchange for a decrease in resistance, something valuable should be given to those individuals or the advantages that they gain in this way should be counted.

Use of force: This means that the management of child houses for the at-risk children directly threatens the resistance groups and forces them to abandon their resistance. Examples of the use of force are: threat of dismissal, change of the job position and demotion.

Use of educational technology programs: One of the strategies for overcoming inertia among teachers/staff of child houses is to implement technological program courses in a monthly cycle so that teachers/staff have to introduce self-skills in the field of technology for teaching and educating at-risk students. This procedure will motivate and improve technology literacy among teachers/staff in order to prevent inertia.

It must be acknowledged that the complexity of the phenomenon of organisational inertia is due to the fact that environmental change is a dynamic process and it is made by the interaction of various factors. All of these factors and variables in causal relationships with each other create a mechanism that makes understanding and analysing inertia difficult. Therefore, detection of the appropriate direction of the change becomes difficult and the role of principals in dealing with the more fundamental changes becomes more apparent. The child houses for at-risk children, as the most important training centres in each country, should move towards trust making, facilitating the flow of knowledge, structural flexibility, and the development of informal relationships and collaborative groups. The principals must take heed of their teachers' spirit, social communications and maintain and promote friendly relations, participate in teamwork, eliminate the obstacles to

activities, and prepare the appropriate conditions, facilities and setting for such teachers/educators. For the development of knowledge-based training centres for at-risk children and for overcoming inertia, beliefs, attitudes and behaviours must be oriented towards the production of knowledge. This questionnaire must be used during the training period to evaluate the scientific, financial, and human recessions, and to evaluate the capabilities of the individuals and educational performance of the child houses for at-risk children, and to propose solutions like the above-mentioned ones, if any recession is observed.

References

- Abbasi et al., 2010 – Abbasi, S., Alameh, M., Hoveyda, R. (2010). *Measurement of organizational learning capacities in electric firm of Esfahan*, Master dissertation, Esfahan, Iran.
- Adner, Helfat, 2003 – Adner, R. and Helfat, C. (2003). Corporate effects and dynamic managerial capabilities. *Strategic Management Journal*, 24, 1011–1025.
- Alfassi, 2003 – Alfassi, M. (2003). Promoting the will and skill of students at academic risk: An evaluation of an instructional design geared to foster achievement, self-efficacy, and motivation. *Journal of Instructional Psychology*, 30(1), 28–40.
- Amiripour et al., 2017 – Amiripour, P., Dossey, J.A., Shahvarani, A. (2017). Impact of Organizational Inertia and Dynamic Capabilities on Educational Performance of the Charitable Societies and Its Impact on Mathematical Performance of Elementary At-Risk Students. *Journal of New Approaches in Educational Research*, 6(1), 37–49.
- Barreto, 2010 – Barreto, I. (2010). Dynamic capabilities: a review of past research and an agenda for the future. *Journal of Management*, 36(1), 256–280.
- Bowen et al., 1998 – Bowen, G. L., Richman, J. M., Brewster, A., & Bowen, N. (1998). Sense of school coherence, perceptions of danger at school, and teacher support among youth at risk of school failure. *Child and Adolescent Social Work Journal*, 15(4), 272–285.
- Bruyere, 2010 – Bruyere, E. B. (2010). Child participation and positive youth development. *Child Welfare*, 89(5), 205–220.
- Carpenter, 1985 – Carpenter, T. (1985). Learning to add and subtract: An Exercise in Problem Solving. In E. A. Silver (Ed.), *Teaching and learning mathematical problem solving: Multiple research perspective* (pp. 13-42). Hillsdale, NJ: LEA.
- Christiansen, 1997 – Christiansen, J. (1997). Helping teachers meet the needs of students at risk for school failure. *Elementary School Guidance & Counseling*, 31(3), 204–211.
- DehghanNajm, 2009 – DehghanNajm, M. (2009). Knowledge management and its role in organizational innovation. *Journal of Car Engineering and Its Depended Industries*, 1, 46-52.
- Dobrev et al., 2003 – Dobrev, S. D., Kim, T. Y. and Carroll, G. R. (2003). Shifting gears, shifting niches: organizational inertia and change in the evolution of the U. S. automobile industry, 1885–1981. *Organization Science*, Vol. 14, No. 3, 264–282.
- Dryden-Peterson, 2015 – Dryden-Peterson, S. (2015). Refugee education in countries of first asylum: Breaking open the black box of pre-resettlement experiences. *Theory and Research in Education*, Cambridge, MA: Harvard University.
- Expert Panel on Student Success in Ontario. 2004 – Expert Panel on Student Success in Ontario. (2004). *Leading math success, mathematical literacy, Grades 7-12: The report of the expert panel on student success in Ontario*. Toronto: Ontario Ministry of Education. Retrieved October 8, 2008, from <http://www.ontla.on.ca/library/repository/mon/9000/245282.pdf>
- Fabrigar et al., 1999 – Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, 4, 272–299.
- George, 2010 – George, M. (2010). Ethics and motivation in remedial mathematics education. *Community College Review*, 38(1), 82–92.
- Gilbert, 2005 – Gilbert, C. G. (2005). Unbundling the structure of inertia: resource versus routine rigidity. *Academy of Management Journal*, 48(5), 741–763.
- Greve, 1999 – Greve, H. R. (1999). The effect of core change on performance: inertia and regression toward the mean. *Administrative Science Quarterly*, 44, 590–614.
- Gresov et al., 1995 – Gresov, Ch., Haveman, H. A. and Oliva, T. (1995). Organizational design, inertia and the dynamics of competitive response. *Organization science*, 4(2), 186–208.

Gutman et al., 2002 – Gutman, L. M., Sameroff, A. J., & Eccles, J. S. (2002). The academic achievement of African American students during early adolescence: An examination of multiple risk, promotive, and protective factors. *American Journal of Community Psychology*, 30(3), 367–399.

Hakonsson et al., 2009 – Hakonsson, D. D., Klaas, P. and Carroll T. N. (2009). Organizational adaptation, continuous change, and the positive role of inertia. *Academy of Management Annual Meeting Proceedings*, 1–6.

Hamel, Prahalad, 1994 – Hamel, G. and Prahalad, C. K. (1994). *Competing for the Future*. Harvard Business School Press: Boston, Massachusetts.

Hannan, Freeman, 1984 – Hannan, M. T. and Freeman, J. (1984). Structural inertia and organizational change. *American Sociology Review*, 49, 149–164.

Hedberg, Ericsson, Anders, 1979 – Hedberg, Bo, & Ericsson, Anders. (1979). Insiktströghetochmanövertröghetiorganisationersomorientering [Insight inertia and action inertia in organizational reorientation]. In Bo Hedberg& Sven-Erik Sjöstrand (Eds.), *FrånFöretagskriser till Industripolitik* [From Organizational Crisis to Industrial Politics]. (pp. 54-66). Malmö: Liber.

Hedberg, Wolff, 2003 – Hedberg, B. & Wolff, R. (2003). Organizing, learning, and strategizing: From construction to discovery. In MeinolfDierkes, Ariane BerthoinAntal, John Child, & Ikujiro Nonaka. (Eds.). *Handbook of Organizational Learning & Knowledge* (pp. 535-556). Oxford: Oxford University Press.

Helfat, 1997 – Helfat, C. E. (1997). Know-how and asset complementarity and dynamic capability accumulation: the case of R&D. *Strategic Management Journal*, 18, 339-360.

Huff, Huff, 1995 – Huff, J. O. and Huff, A. S. (1995). Stress, inertia, opportunity and competitive position: a SIOP model of strategic change in the pharmaceuticals industry. *Academy of Management Best Papers Proceedings*, 22–26.

Huhn et al., 2006 – Huhn, C., Huhn, K., & Lamb, P. (2006). Lessons teachers can learn about students' mathematical understanding through conversations with them about their thinking: Implications for practice. In L. Van Zoest, (Ed.) *Teachers Engaged in Research: Inquiry into Mathematics Classrooms, Grades 9-12* (pp. 97-118). Greenwich, CT: Information Age Publishing.

Katkalo et al., 2010 – Katkalo, V. S., Pitelis, Ch. N. and Teece, D. J. (2010). Introduction: on the nature and scope of dynamic capabilities. *Industrial and Corporate Change*, 19 (4), 1175 – 1186.

Kayler, Sherman, 2009 – Kayler, H., & Sherman, J. (2009). At-risk ninth-grade students: A psycho educational group approach to increase study skills and grade point averages. *Professional School Counseling*, 12(6), 434–439.

Kaiser, 1970 – Kaiser, Henry F. (1970). A second generation little jiffy. *Psychometrika*, 35(4):401–415.

Kelly, Amburgey, 1991 – Kelly, D. and Amburgey, T. L. (1991). Organizational inertia and momentum: a dynamic model of strategic change. *Academy of Management Journal*, 34(3), 591–612.

Liao, 2002 – Liao, S.H. (2002). Problem solving and knowledge inertia. *Expert Systems with Applications*, 22:21–31.

Lopez, 2005 – Lopez, S. V. (2005). Competitive advantage and strategy formulation. The key role of dynamic capabilities. *Management Decision*, 43(5), 661–669.

Ma, Karri, 2009 – Ma, H. and Karri, R. (2009). Impact of firm performance on changes in strategic resource allocation decisions. *Journal of Business and Management*, 15(2), 171–185.

MacMath et al., 2009 – MacMath, S., Roberts, J., Wallace, J., & Chi, X. (2009). Curriculum integration and at risk students: A Canadian case study examining student learning and motivation. *British Journal of Special Education*, 37(2), 87–94.

Masten, 1997 – Masten, A. S. (1997). Resilience in children at-risk. University of Minnesota Research and Practice Newsletter, 5(1). Retrieved from <http://www.cehd.umn.edu/CACREI/Reports/RPractice/Spring97/resilience.html>

Menzer, Hampel, 2009 – Menzer, J. D. & Hampel, R. L. (2009). Lost at the last minute. *Phi Delta Kaplan*, 5, 660–664.

Miller, Chen, 1994 – Miller, D. and Chen, M. J. (1994). Sources and consequences of competitive inertia: a study of the U. S. Airline industry. *Administrative Science Quarterly*, 39, 1–23.

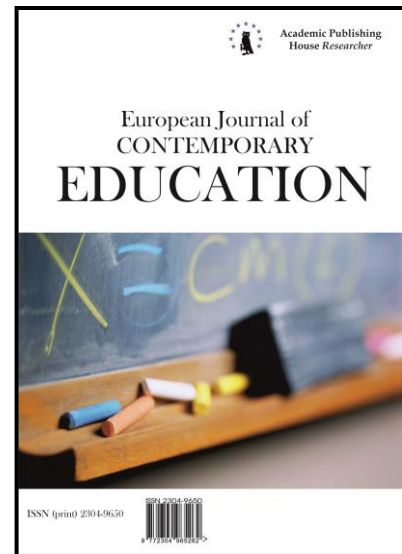
Miller, Friesen, 1980 – Miller, D. and Friesen, P. H. (1980). Momentum and revolution in organizational adaptation. *Academy of Management Journal*, 23(4), 591–614.

- National Council of Teachers of Mathematics. 2000 – National Council of Teachers of Mathematics. (2000). Principles and standards for school mathematics. Reston, VA: The Author. Retrieved October 8, 2008, from National Council of Teachers of Mathematics (NCTM) Web site: Executive Summary: http://www.nctm.org/uploadedFiles/Math_Standards/12752_exec_pssm.pdf Table of Contents – Overview Web site: <http://standards.nctm.org/document/index.htm>
- Nedzinskas, 2013 – Nedzinskas, Š. (2013). *Dynamic capabilities and organizational inertia interaction in volatile environment*. Doctoral Dissertation, Social Sciences, Management and Administration. ISM University of Management and Economics.
- Pavlou, El Sawy, 2011 – Pavlou, P. A. and El Sawy, O. A. (2011). Understanding the elusive black box of dynamic capabilities. *Decision Sciences Journal*, 42(1), 239–273.
- PressTV News – PressTV News. *Sixty percent of refugees in Iran become educated: Official*. Tehran, PressTV, Tuesday, January 24, 2017.
- Proeller et al., 2011 – Proeller, I., Kroll, A., Krause, T. and Vogel, D. (2011). *How dynamic capabilities mediate the link between strategy and performance*. A paper prepared for the Annual Conference of the European Group for Public Administration Panel on Strategic Management in Government, Bucharest, Romania.
- Schonrock-Adema et al., 2009 – Schonrock-Adema, J., Heijne-Penninga, M., Van Hell, E.A. & Cohen-Schotanus, J. (2009). Necessary steps in factor analysis: enhancing validation studies of educational instruments. *Medical Teacher*, 31, 226-232.
- Sydow et al., 2009 – Sydow, J., Schreyogg, G. and Koch, J. (2009). Organizational path dependence: opening the black box. *Academy of Management Review*, 34(4), 689–709.
- Szamosi, Duxbury, 2001 – Szamosi, L. T., & Duxbury, L. (2001). Development of a measure to assess organizational change. *Journal of Organizational Change Management*, 15(2), 184-201.
- Teece et al., 1997 – Teece, D. J., Pisano, G. and Shuen, A. (1997). Dynamic Capabilities and Strategic Management. *Strategic Management Journal*, 18(7), 509–533.
- Teece, 2007 – Teece, D. J. (2007). Explicating dynamic capabilities: the nature and micro foundations of (sustainable) enterprise performance. *Strategic Management Journal*, 28, 1319–1350.
- Tichy, Devanna, 1997 – Tichy, Noel M., & Devanna, Mary Anne. (1997). *The Transformational Leader: The Key to Global Competitiveness* (2nd ed.). Somerset, NJ: Wiley.
- Wood et al., 2006 – Wood, T., Williams, G., & McNeal, B. (2006). Children's mathematical thinking in different classroom cultures. *Journal for Research in Mathematics Education*, 37, 222-255.
- Woodward, Brown, 2006 – Woodward, J., & Brown, C. (2006). Meeting the curricular needs of academically low-achieving students in middle grade mathematics. *The Journal of Special Education*, 40(3), 151-159.
- Winter, 2003 – Winter, S. (2003). Understanding dynamic capabilities. *Strategic Management Journal*, 24, 991–995.
- Wright, 2006 – Wright, J. (2006). Learning interventions for struggling students. *Education Digest*, 1, 35–39.
- Van de Walle, Folk, 2005 – Van de Walle, J. A., & Folk, S. (2005). *Elementary and Middle School Mathematics: Teaching Developmentally*. Toronto: Pearson Education Canada Inc.
- Zollo, Winter, 2002 – Zollo, M. & Winter, S. G. (2002). Deliberate learning and the evolution of dynamic capabilities. *Organization Science*, 13(3), 339–351.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.
All rights reserved.
Published in the Slovak Republic
European Journal of Contemporary Education
ISSN 2304-9650
E-ISSN 2305-6746
2017, 6(3): 479-496
DOI: 10.13187/ejced.2017.3.479
www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



Development of Information Competency in Students during Training in Al-Farabi's Geometric Heritage within the Framework of Supplementary School Education

Yesen Bidaybekov ^{a,*}, Gulдина Kamalova ^a, Bektas Bostanov ^a, Indira Salgozha ^a

^a Department of Information Science and Education Informatisation,
Abai Kazakh National Pedagogical University, Almaty, Republic of Kazakhstan

Abstract

Information competency is one of the essential qualities of a person living in the information age. It includes skills in information handling in both educational domains and the outside world, as well as readiness and capability to use modern information and communication technologies when involved in various types of information activities. Building and developing information competency in students during teaching and upbringing is one of the primary goals of education. This article describes possible ways of developing it in students within the framework of supplementary education when studying the mathematical heritage of Al-Farabi, one of the greatest scientists of the early Middle Ages, whose fundamental studies made a significant contribution to development of world science. It has been proven that integrated extracurricular classes in geometry and information science are one of the most useful patterns of teaching the scientist's heritage within the framework of supplementary school education. The article highlights the main components of information competency for the most effective organisation of its development process, provides geometric construction problems from the scientist's mathematical heritage, tasks related to his biography and scientific activities, as well as up-to-date educational and information and communication technologies to facilitate the most effective development of information competency in students.

Keywords: Al-Farabi, mathematical heritage, extracurricular work, information competency, geometric constructions, GeoGebra.

* Corresponding author. URL: <http://www.kaznpu.kz/en/1560/personal/>
E-mail addresses: esen_bidaibekov@mail.ru (E. Bidaybekov), g_kamalova@mail.ru (G. Kamalova),
bbgu@mail.ru (B. Bostanov), indi_s@mail.ru (I. Salgozha)

1. Introduction

One of the main educational goals of the modern school is development of key competencies in schoolchildren to ensure their future success in society. The list of key competencies to be formed in school is based on the main goals of general education, the structural representation of social and personal experience, as well as a student's basic activities allowing him/her to gain social experience, and acquire practical skills in modern society. At present, there is no exact list of the competencies to be developed in a general education school. The list proposed in (Khutorskoy, 2003) is most common one. It is characterised by seven items, namely value semantic, general cultural, cognitive educational, information, communicative, social labour and personal self-improvement competencies. These competencies are universal and necessary for a school graduate to achieve success in any domain of public life and professional activities.

Information competency stands out from the group of key competencies of schoolchildren, and is perceived as one of most significant for continuing education, and for solving life and professional problems as a whole.

This competency is an integrative component of the knowledge, skills and abilities of a person to retrieve, analyse, evaluate, organise, present and transmit information, simulated information objects and processes for solving emerging problems in any area of activity, using modern tools of information and communication technologies. It is one of the essential qualities of a person living in the information age.

Its development in schoolchildren is necessary, first of all, for their successful life and professional activities in the future. It is equally important for a successful solution, even at the school level, of personally important educational tasks, such as acquisition of knowledge in subjects being studied, self-education, research and project activities, which is reflected in their academic achievements in general. Therefore, the conditions for developing information competency in students during teaching and upbringing are one of the primary goals of school education.

First of all, it involves strengthening the practical orientation of education through the use of active teaching approaches that build up practical skills, as well as increasing the share of self-motivated work of students for effective organisation of their search and research activities, whose full implementation is possible in a specially organised educational, information and communication space. This is possible within the modern secondary school today, in particular, when organising supplementary education for schoolchildren, where the main purpose is students' acquisition of additional knowledge and skills unforeseen by compulsory educational programmes. With a focus on the free choice and adoption of additional educational programmes by students, it corresponds to their talents and interests. It is also important for their personality development, as well as for a more productive life and activities in society.

The most effective way to develop information competency in students within the framework of supplementary education is a well thought-out set of topics and personal interests of everyone involved in its implementation. The availability of tasks crucial to research that describe the real situation, as well as the practical and cognitive significance of the expected results, is very important. There are many such problems that a student can solve using ICT tools in the mathematical treatises of Al-Farabi, one of the greatest scientists, thinkers and encyclopedists of the early Middle Ages, a native of the Kazakh land, and a world-renowned personality who made a significant contribution to the development of world science. Such tasks will arouse the students' interest, making it possible to verify the practical applicability of acquired knowledge, and thus boost their autonomous cognitive activities.

The predominant part of Al-Farabi's mathematical work has been studied relatively recently, mainly by the well-known Kazakh researcher of the history of mathematics and pedagogy of the Islamic East, A. Kubesov. It is reflected in his works *Mathematical Heritage of Al-Farabi*, *Mathematical Treatises*, *Comments on Almagest by Ptolemy*, which have been highly praised by foreign Farabist scientists (Comments, 1975; Kubesov, 1972; Kubesov, 1974; Garry J. Tee, 1978). However, their application in modern school education has not been studied yet.

The *Book of Mental Skills and Natural Secrets of the Subtleties of Geometric Figures*, whose only manuscript is kept in the library of Uppsala University in Sweden (Kubesov, 1972) stands out from numerous mathematical studies by Al-Farabi. It offers unique algorithms for solving a huge number of geometric construction problems by means of a compass and a ruler, which are important in human practical activities, e.g., land surveying, architecture, engineering, geodesy, etc.

The studies of many of Al-Farabi's predecessors were also dedicated to geometric constructions. A considerable number of works belong to the ancient Greeks, but the oldest book that specifically addresses similar problems is the work of Indian mathematicians of the 7th to 5th centuries B.C.

The centuries-long interest in such problems can be explained not only by their beauty and originality of the solution methods, but above all by their great practical value. Even today, geometric construction problems are of considerable interest, since construction design, architecture, design of various equipment and many other practical tasks are based on geometric constructions. Similar problems also play an enormous role in mathematical development of students. As one of the conceptual lines of a school geometry course, they are a very essential element in teaching geometry, and are an integral part of it.

Al-Farabi's construction problems are distinguished by various applications in practical activities and richness in inter-subject links. They are closely connected with nearly all sections of a school geometry course, which makes it possible to use them as a tool for repetition, generalisation and systematisation of the geometric material being studied. In terms of their formulation and methods of solution, they are the best way to stimulate the accumulation of knowledge in geometry. In addition, they will contribute to the development of students' spatial thinking and boost their exploratory and search skills.

Consideration of a chain of basic constructions proposed by Al-Farabi that lead to the goal, when solved as a kind of algorithm, allows them to be used in upper grades as content-rich material for an information science course. In general, when studying the algorithmisation section, and also when studying application software, it will be more effective if we study the capabilities of modern ICT tools exemplified by such problems. In the process of solving them, a teacher can also effectively build elements of the algorithmic culture in schoolchildren, by systematically demanding a clear sequence of basic constructions.

Since these problems are of an interdisciplinary nature, integrated classes in information science and geometry within the framework of supplementary school education may be one of the most effective teaching approaches (Bidaybekov, 2016).

Al-Farabi's *Book of Mental Skills and Natural Secrets of the Subtleties of Geometric Figures* includes a large number of problems and can satisfy the needs of such extracurricular classes for a sufficient number of special construction tasks. Their study will help deepen students' knowledge of geometry, expand their understanding of construction tasks and possible solutions, and increase their knowledge of algorithmisation. Moreover, their use, along with some historical information about them, will highlight their practical significance, raise students' interest in the material being studied and will contribute to its deep assimilation. The use of modern information and communication technologies for collecting, processing and storage of information will contribute to development of the following skills among students:

- working with various information sources, including the Internet;
- independent searching, extracting, systematising, analysing and selecting information necessary for problem-solving, as well as transforming, saving and transmitting it;
- awareness of information flows, ability to identify their main and necessary points; conscious perception of information published in the global network;
- using a computer and its peripheral devices to work with information in solving these problems, which characterises the student's information competency in active form.

However, despite the rather wide range of pedagogical studies (Yermakov, 2009; Kizik, 2003; Falina, 2007; Trishina, 2005; Moore, 2002; Kamhi-Stein, 1998; Gilinsky, 2008; Kwon, 2011; Cunningham, 2003), issues of developing information competency in students through training in Al-Farabi's geometric construction tasks, together with the scientist's other mathematical achievements, including in the context of supplementary education, within the framework of a general secondary school, have not yet been the subject of a separate study.

The urgency of the problem, its importance and insufficient development have determined the theme of this work.

Research Methodology

A set of methods mutually enriching and complementing each other was used in the research: the method of theoretical analysis conducted with the aim of comprehensive study of the state of the problem in question, revealing the extent to which it has been studied and determining the set of pedagogical conditions for solving it; direct and indirect observation; study of products of schoolchildren's activities.

2. Al-Farabi's Construction Problems in the Context of Supplementary Education of Schoolchildren as a Tool for Developing their Information Competency

2.1 Information Competency and Some Approaches to its Development in Schoolchildren

Information competency is considered as a quality of an individual, including a set of knowledge and skills in performing various types of information activities using ICT tools, together with a value-based attitude towards them.

By analysing studies of different authors (Yermakov, 2009; Kizik, 2003; Falina, 2007; Trishina, 2005), three main components can be distinguished:

- the technological component - knowledge and skills in information handling. It includes main types of information activities in problem-solving using the tools of information and communication technologies, namely, definition, retrieval, integration, management, evaluation, creation and transmission of information. Students must master them and be able to perform them;
- the reflexive evaluative component - understanding and application of knowledge and skills in information handling, both with and without the use of various automatic devices, using a variety of forms and means of communication;
- the motivational value component - the choice of value orientations that reflect a person's motivational intentions, as well as an individual's level of self-awareness.

Highlighting the structural components is advisable both for objective evaluation of the extent of its formation and for the most effective organisation of information competency development.

An effective method of developing it in schoolchildren and their successful mastery of the main types of information activities is the use of various practical information tasks that simulate real-life situations. As noted above, a huge set of such tasks is contained in Al-Farabi's *Book of Mental Skills and Natural Secrets of the Subtleties of Geometric Figures* (Kubesov, 1972). Consisting of 10 books, this work is entirely dedicated to geometric constructions, and as follows from the title "mental skills", it was created to apply geometry to various practical matters and other sciences. The books present unique algorithms for solving a huge number of geometric construction problems by means of a compass and a ruler (this restriction on tools was an indispensable requirement of ancient mathematics). Even for problems that cannot be accurately constructed with the use of these tools, there are algorithms that allow them to be constructed with a practically insignificant error.

Thus, the first book considers elementary constructions using a compass and a ruler. The second book of the treatise is dedicated to regular polygons constructed on an assigned interval, and the third one covers regular polygons inscribed in a circle. The fourth book deals with problems of constructing a circle described around a triangle and regular polygons; the fifth book considers problems of constructing a circle inscribed in a triangle. The sixth book is dedicated to construction of regular polygons inscribed in each other. The seventh book considers equipartition problems of a triangle, and enlarging and reducing it by several times. The eighth book is dedicated to division of quadrilaterals by straight lines satisfying various conditions. The ninth book solves a number of square transformation problems. The tenth book is dedicated to various constructions on a sphere, including division of a sphere into regular spherical polygons equally matched to a construction of inscribed regular polyhedra, whose vertices are the polygon vertices.

All of these problems relate to practical geometry, considers lines and surfaces belonging to specific material bodies. These are lines and surfaces of "a wooden body, if used by a carpenter, or an iron body if used by a blacksmith, or a stone body, if used by a stone mason, or surfaces of the

earth and fields if used by a surveyor." All these problems "include purely down-to-earth issues that are the subject of practical arts" (Kubesov, 1974); and they have the nature of activities.

Of course, they are all worthy of study, proof and application in modern school education. It will contribute to both promotion of the scientist's mathematical heritage, to expanding and enriching the system of subject knowledge of students, and to increasing their strength by analysing and repeating the educational material in a new historical context that is interesting and emotionally satisfying for students' perception. The historical context of the training material will greatly strengthen substantiation and persuasiveness of the importance of obtained results.

Based on the foregoing, all of these problems are included in the programme of integrated classes in information science and geometry developed by teachers of the Department of Information Science and Education Informatisation of Abai Kazakh National Pedagogical University, and introduced into a sponsored school within the framework of supplementary education. Studying and working with them will enable schoolchildren to master all the main types of information activities.

Assimilation is most successful with the use of active teaching methods that take into account the psychophysiological characteristics of schoolchildren in designing and carrying out teaching and upbringing aimed at independent mastery of knowledge and skills by students in the process of active mental and practical activities.

The project method was primarily used in teaching Al-Farabi's mathematical heritage within the framework of supplementary school education aimed at development of the students' cognitive and creative skills and critical thinking, and most importantly, the ability to independently construct their knowledge and orient themselves in information space. Most of Al-Farabi's problems were offered to students as project themes for self-study.

It was noted above that all of Al-Farabi's geometric constructions are presented as a clear sequence of actions, which greatly facilitates their computer implementation, thus increasing the efficiency and quality of training. Interactive geometric environments specially designed for use in teaching geometry and allowing the creation of qualitative planimetric and stereometric drawings are of particular interest (Ziatdinov, 2010; Ziatdinov, 2012). GeoGebra software is the most popular of these. It makes it possible to implement all kinds of constructions, including 3D format, and then to dynamically change them, and to build animations. A student can enter equations and manipulate coordinates directly. By offering huge capabilities, GeoGebra allows you to execute geometric constructions using a computer such that when one of the geometric objects of the drawing is changed, the others are also changed, leaving the given relations unchanged. The software can interactively combine geometric, algebraic and numerical representations. Its application in the study of geometric construction problems from Al-Farabi's mathematical heritage will both make construction itself easier, and allow the creation of an interactive dynamic model (Ziatdinov, 2012), whose study provides students with an understanding of the correctness of this construction, and allows them to come up with an idea for proving it and implementing it independently.

2.2 Al-Farabi's Problems on Construction in a Plane

Among planimetric problems presented in the scientist's work, there are a lot of problems on construction of regular polygons of different levels of complexity, including those insoluble with a compass and a ruler.

Regular polygons have always attracted the attention of scientists, builders, architects and designers. Construction algorithms for some of them were considered by Euclid himself, but a major contribution to solving problems of constructing such polygons was made by the German mathematician Carl Friedrich Gauss. He gave all values of n that make it possible to construct a regular n -gon, using a compass and a ruler. These are polygons for which the number of sides is a prime number of the form $2^{2^k} + 1$, as well as those obtained from the ones specified by doubling the number of sides. However, it turns out to be impossible to construct regular n -gons that do not satisfy these conditions by means of a compass and a ruler. These are 7-, 9-, 11-, 13-, 14-, 18-, 19-, 21-, 22-, 23 -, 25-, 27-, 28-, ... -gons. Euclid did not consider them. But they are necessary in practice. Therefore, Al-Farabi's studies provide construction algorithms for both heptagons and nonagons using a compass and a ruler. Thanks to these algorithms, the construction is quite

simple, although with a certain insignificant error. If necessary, approximation of these algorithms can be shown by justifying them even on the basis of school mathematics knowledge using modern computer tools.

Let us consider some of them.

Here is one of the simplest problems in Al-Farabi's work:

Problem 1. Construct a regular triangle.

He writes "... to build an equilateral triangle on the line AB , let us circumscribe circles from each point A and B as from centers at the distance AB . They intersect at the point C . Let us join the point C with points A and B by the straight lines CA and CB . We will obtain an equilateral triangle ABC " (Kubesov, 1972).

The text clearly presents a sequence of necessary actions. By consistently performing them, using tools of the environment, one can build a triangle with a given side that will be equilateral (Fig. 1):

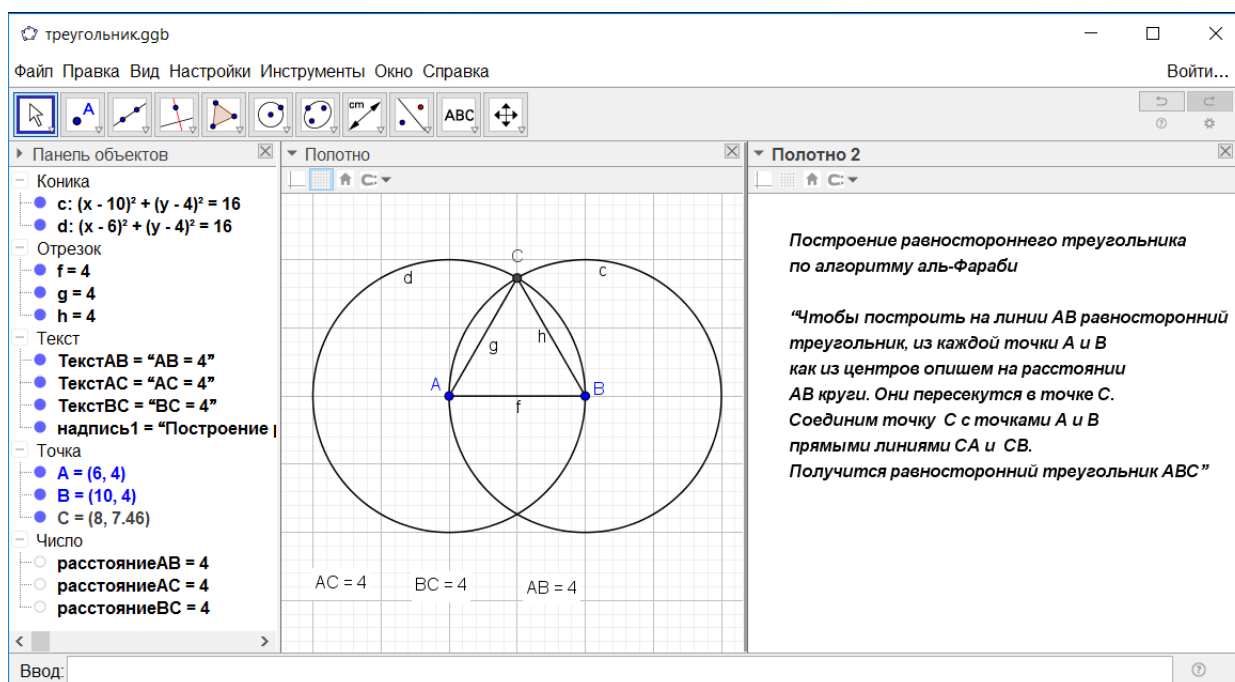


Fig. 1. Construction of an equilateral triangle according to Al-Farabi's algorithm

Thanks to the visual image, justification of the correctness of this construction is quite obvious.

Solution. By construction, $CA = AB$ and $CB = AB$ (as radii of circles); consequently, $CA = CB = AB$ and the constructed triangle ABC with the sides CA , AB and CB is equilateral.

Students can prove this on their own. A small experiment on the constructed model helps verify it.

Another interesting problem is:

Problem 2. Construct a regular heptagon.

Constructing it with a protractor is not difficult for a student, but it is not easy to do with a ruler and a compass. This problem belongs to the category of construction problems that are insoluble with a compass and a ruler. If ideal accuracy of the drawing is not required by the problem condition, and a small error is not critical, it is possible to construct such a heptagon using a compass and an ordinary ruler on the basis of special algorithms.

Al-Farabi's work provides an algorithm for solving it, which is, of course, approximate with some error, but in the work he does not specify the approximate nature of his constructions, probably because the resulting error was not so significant for practical problems being solved.

He described the solution algorithm thus: "... to build an equilateral heptagon on the line AB , let us make the line BC equal to the line AB , construct the equilateral triangle DAC on the line AC and circumscribe a circle around the triangle ADC . Let us draw a bisecant in it - the line AE , equal to the line AB - and divide AE into two halves at the point G , raise the perpendicular GH and extend it to the circumference of the circle. Divide AB in half at the point F , raise in it the perpendicular FI equal to the perpendicular GH . Draw a circle ABI through the points A, B and I , and raise arcs AK, KL, LI, IM, MN and NB ; this is an equilateral and equiangular heptagon" (Kubesov, 1972).

However, like all of Al-Farabi's other algorithms, this algorithm is easy to implement in the GeoGebra software environment described above (Fig. 2).

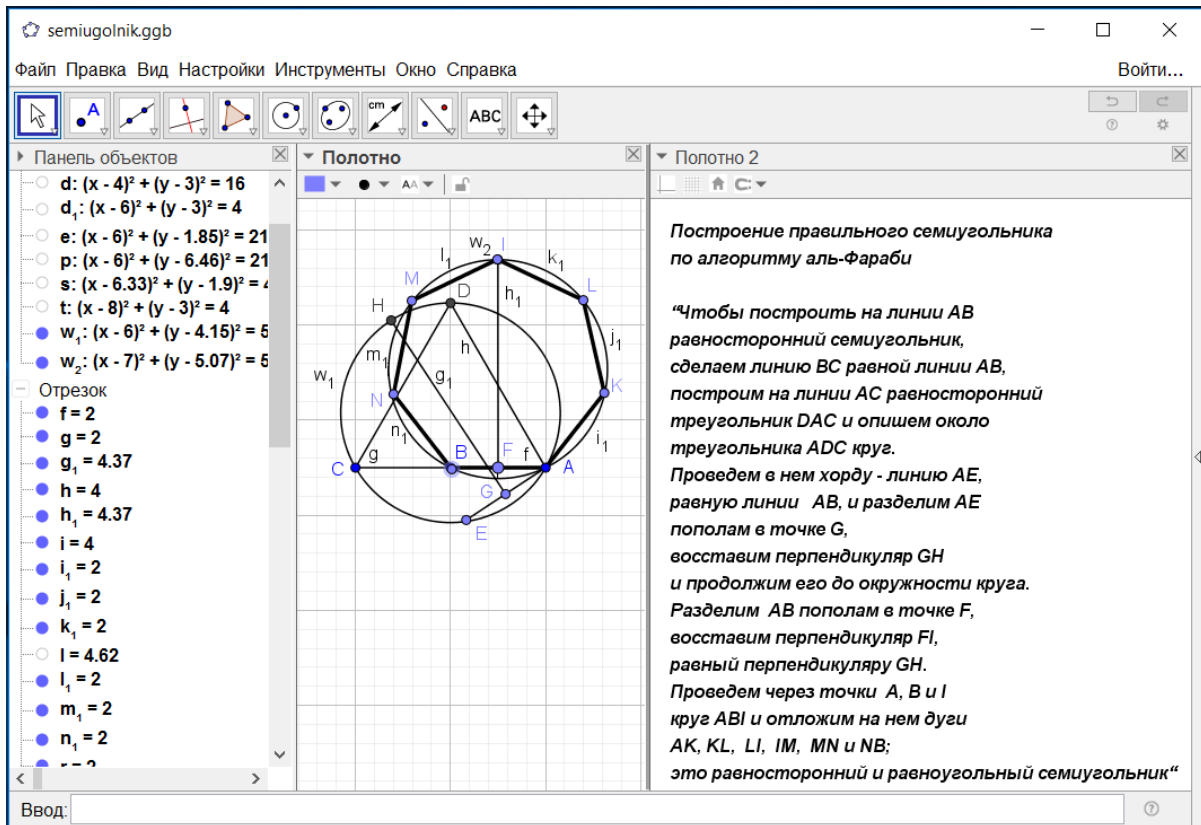


Fig. 2. Construction of a regular heptagon according to Al-Farabi's algorithm

The computer model obtained from constructions based on the described algorithm looks accurate and mathematically exact in this environment.

Students are required both to make constructions according to Al-Farabi's algorithm in this software environment, and to justify this algorithm through a small experiment with the model based on modern knowledge of school geometry.

Solution. According to the constructions based on Al-Farabi's algorithm

$$BC=AB; AE=AB; AG=GE;$$

$$GH \perp AE; AF=FB; FI \perp AB; FI=GH;$$

w_1 — is a circle circumscribed around a regular triangle with side $AC=2AB$.

w_2 — is a circle passing through points A, B and I .

Since according to the construction $AF=FB=AG=GE$, the radii of both these circles w_1 and w_2 are equal to each other: $R_1=R_2$.

R_1 , as the radius of the circle circumscribed about the right triangle with side AC is equal to $R_1= 2AB/\sqrt{3}$. From which, $AB = R_1\sqrt{3}/2$.

Bearing in mind that $R_1=R_2$, the side AB of the regular heptagon through the radius of the circle circumscribed about it is determined by the formula: $AB = R_2\sqrt{3}/2$.

Its value to an accuracy of thousandths is equal to $AB \approx 0.866 R_2$.

On the other hand, according to the formula of the circle circumscribed around the regular heptagon $R_2 = AB/(2 \sin \frac{180}{7})$, we have $AB = 2R_2 \sin \frac{180}{7} \approx 0.868 R_2$.

Students are asked to find out whether there are other algorithms for constructing a regular heptagon using a compass and a ruler, and what the value of its side is, to compare results for evaluation of Al-Farabi's algorithm.

A series of problems in the scientist's work is dedicated to constructions of some figures inscribed in others using a compass and a ruler. Here is one of them.

Problem 3. Construct an equilateral triangle inscribed in an equilateral quadrilateral.

Al-Farabi proposes the following algorithm: "... let us construct the square $ABCD$, extend the line DC to the point E and make CE equal to CD . Construct a semicircle on the line ED , make the point D the center of the circle and mark the point G at the distance CD . Next, make the point E the center at the distance EG , mark the point H , construct AF equal to DH , connect B with F , B with H , F with H . We obtain the equilateral triangle BFH inscribed in the square $ABCD$ " (Fig. 3) (Kubesov, 1972).

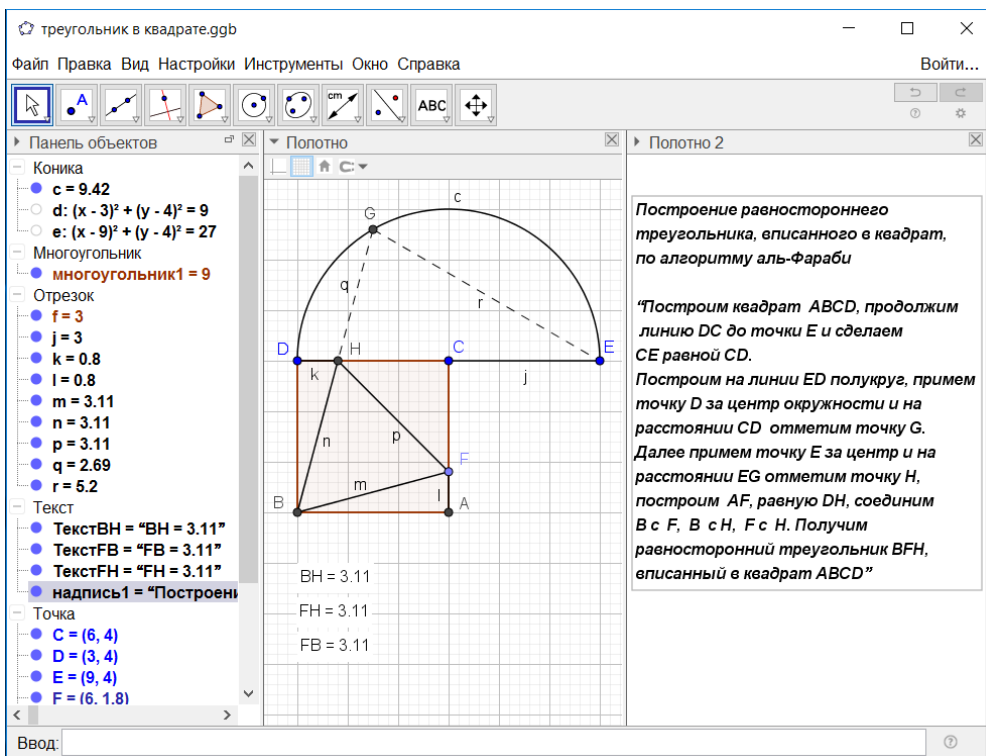


Fig. 3. Construction of an equilateral triangle inscribed in a square according to Al-Farabi's algorithm

The correctness of this construction algorithm is also easy to prove due to the study of a dynamic model built in the GeoGebra environment and based on the knowledge gained earlier from a school geometry course.

Solution. For greater clarity, it is desirable to draw the auxiliary line DG .

According to the property of an inscribed angle based on the circle diameter, the angle DGE is a right angle; therefore, the triangle DGE is a right triangle.

It is easy to find its leg EG : $EG = \sqrt{(2CD)^2 - (DG)^2} = \sqrt{3}CD$.

Then the following are defined $DH = 2CD - EH = 2CD - EG = (2 - \sqrt{3})CD$ and

$$BH = \sqrt{(BD)^2 + (DH)^2} = \sqrt{(CD)^2 + (2 - \sqrt{3})^2 (CD)^2} = 2\sqrt{2 - \sqrt{3}}CD.$$

According to the test of equality of triangles by two sides and the angle between them, the triangles BDH and ABF are equal. Therefore, $BH = BF$.

It remains to determine FH . It is equal to:

$$FH = \sqrt{2(HC)^2} = \sqrt{2(CD - DH)^2} = \sqrt{2(CD - (2 - \sqrt{3})CD)^2} = \sqrt{2((\sqrt{3} - 1)CD)^2} = 2\sqrt{2 - \sqrt{3}}CD.$$

Since all sides of the triangle FBH are equal to each other:

$$BH = BF = FH = 2\sqrt{2 - \sqrt{3}}CD, \text{ this triangle is equilateral.}$$

Work on similar tasks requires students to update the knowledge they have acquired earlier, to master modern information tools and technologies, and to be able to navigate information space in search of the necessary information. They make it possible to synthesise retrieved information, create new knowledge on its basis, raise awareness of the need for additional information and to search for it; select, compare and evaluate it; and organise, process and reproduce retrieved information, which means more than mere captivation of schoolchildren. These information activities contribute to the development of their information competency.

It is noteworthy that these problems, as well as all other construction problems considered in Al-Farabi's work, differ in complexity. This makes it possible to involve nearly all students in the work, ensuring a differentiated approach to their training.

Another project task is team development of interactive models for problems of separating and compiling squares often encountered in practice. Al-Farabi dedicates an entire section to them.

As he writes in his work (Kubesov, 1972), solution of such problems is based on the following principles for constructing a square from two squares:

1. "... if these two squares are equal, let us divide each of them by a diagonal. As a result, we get four equal triangles. Their diagonals are equal to the side of the desired square. If you add these triangles such that they are adjacent to each other with their right angles, you get a square";
2. "... if the squares are unequal, let us construct two rectangles; the length of each of them is equal to the side of the larger square, and the width is equal to the side of the smaller square. Cut each of them in half by a diagonal; we get four equal triangles with sides equal to the sides of the squares; their diagonal is equal to the side of the desired square. If we place a square in the middle with a side equal to the difference of the sides of the two given squares, and arrange the sides of the triangles on its sides, we get one square constructed of squares."

The construction of a square from m^2+n^2 equal squares is based by him on the relation $m^2+n^2 = (m-n)^2 + 2mn$.

Students are offered the following problems:

Problem 4. "Construct one square from eight equal squares" (you can split the squares, cut them diagonally, move them, or change places).

The solution algorithm proposed by Al-Farabi is quite simple: "... let us construct two squares, each of which consists of four squares. Then we divide them by diagonals; we get four equal triangles. If you combine these triangles such that they adjoin each other with their right angles, you will get a square" (Kubesov, 1972).

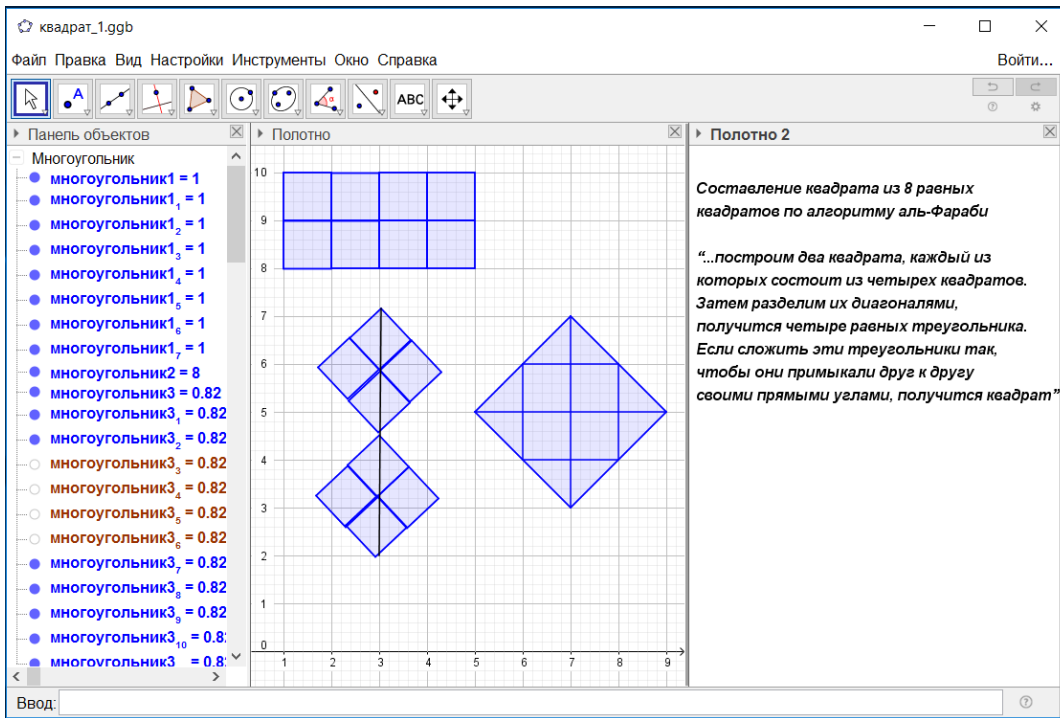


Fig. 4. Compilation of a square from 8 equal squares according to Al-Farabi's algorithm

Problem 5. "There are two squares consisting of nine and four equal squares, respectively. It is required to compile one square from these two squares."

According to Al-Farabi, the solution algorithm is as follows: "... Let us construct two rectangles, each of which consists of six squares. Cut them diagonally; we get four triangles, the long leg of each of which is three, the short leg is two, and the hypotenuse is the root of thirteen. Let us separate a single square from the squares, place it in the middle and adjoin triangles to it with large legs to the side of the square. They will form a square, each side of which is a hypotenuse of the triangles, i.e., the root of thirteen" (Fig. 5) (Kubesov, 1972).

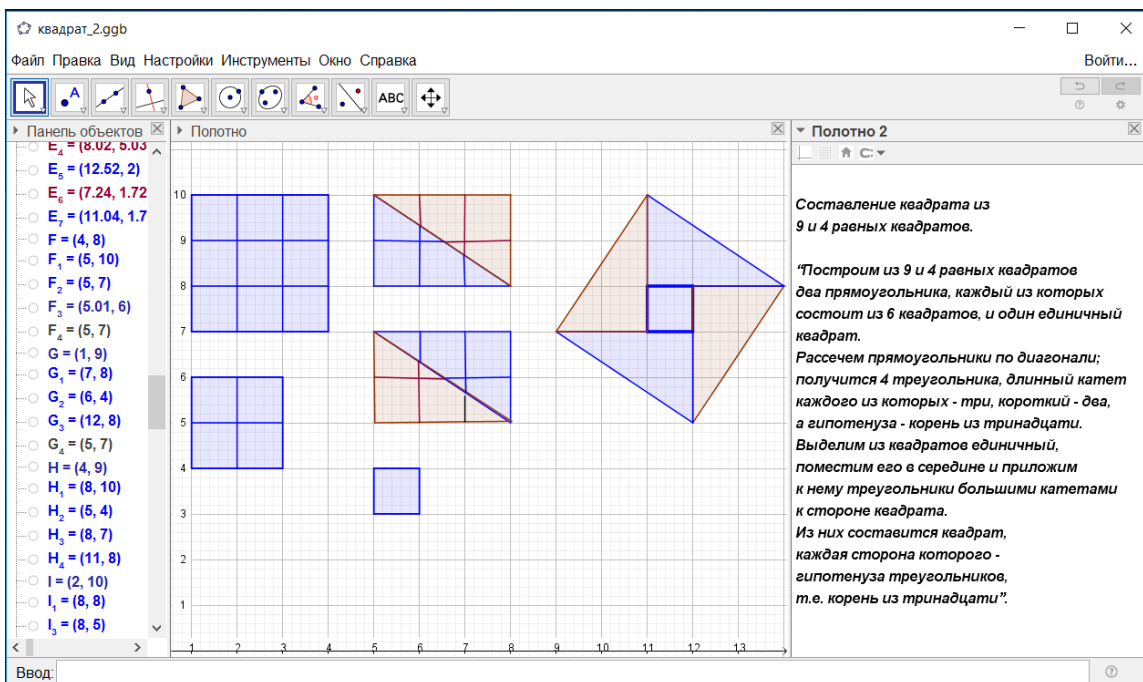


Fig. 5. Compilation of a square from nine and four equal squares according to Al-Farabi's algorithm

However, using the principles of square construction formulated by the scientist, the teams seek the solution on their own, describing it as a sequence of actions that along with the knowledge of GeoGebra capabilities makes it possible to quickly prepare the necessary interactive models without much difficulty (Figs. 4, 5). Only after completion, they are offered a ready algorithm described by Al-Farabi in his treatises for comparison. This contributes, first of all, to building and developing the ability to create information with consideration of a specific problem and to evaluate it, to express the main idea and to give arguments and evidence confirming the correctness of the created information.

2.3 Al-Farabi's Problems on Construction in Space

Students are very interested in problems on construction in space presented in the treatises. These include problems on dividing a sphere into a number of spherical polygons. One of them is as follows:

Problem 6. Divide a sphere into four equal triangles with equal sides and angles, if the sphere diameter is known.

Al-Farabi proposes the following solution: "... if the diameter of the sphere is equal to the line AB , let us construct a semicircle on the line AB , measure the line AC equal to one third of AB , draw the line CD perpendicular to the line AB ; it will meet the semicircle ADB at the point D . Let us take a random point E on the circle, make it a pole and draw the circle FGH at the distance BD , divide it into three equal parts at points G, H, F and draw large circle arcs through the pole and through each point G, H and F , intersecting at the point J , and a large circle arc through every two of points of G, H and F . Then we obtain a sphere divided into four equilateral and equiangular triangles. These are the triangles JHF, JHG, FJG and GHF " (Kubesov, 1972).

Using the GeoGebra environment to implement this algorithm greatly simplifies construction, provides an opportunity for more illustrative execution and dynamic manipulation of the drawing parts for better understanding of both the algorithm and obtained results, encourages involvement of students in active cognitive activities by proposing different hypotheses and searching for answers (Figs. 6, 7).

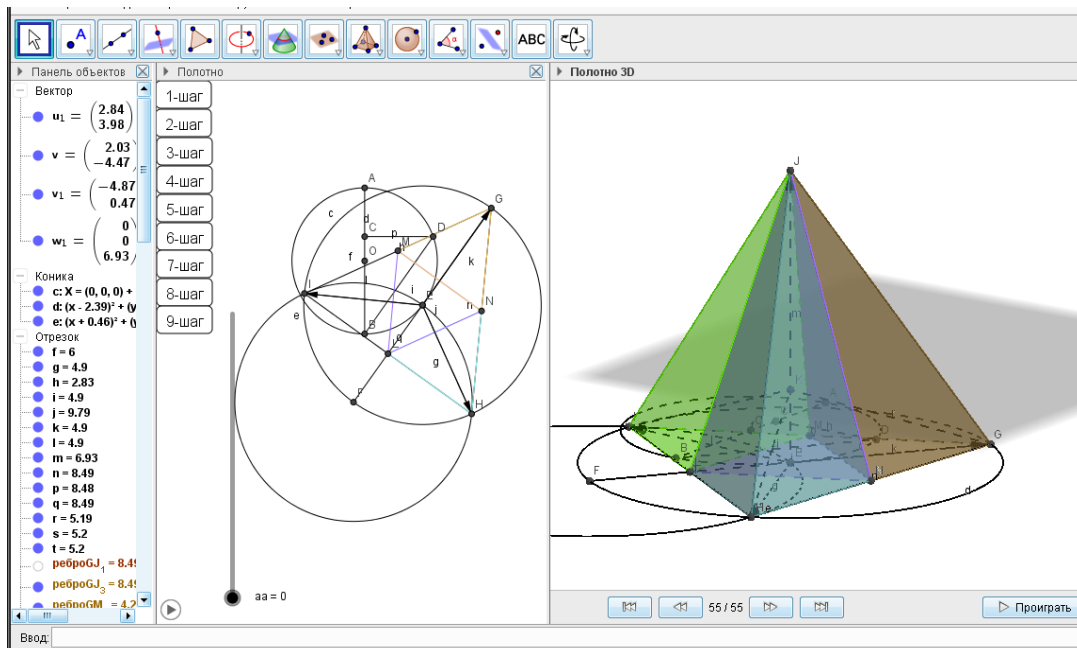


Fig. 6. Division of a sphere into four equal parts according to Al-Farabi's algorithm

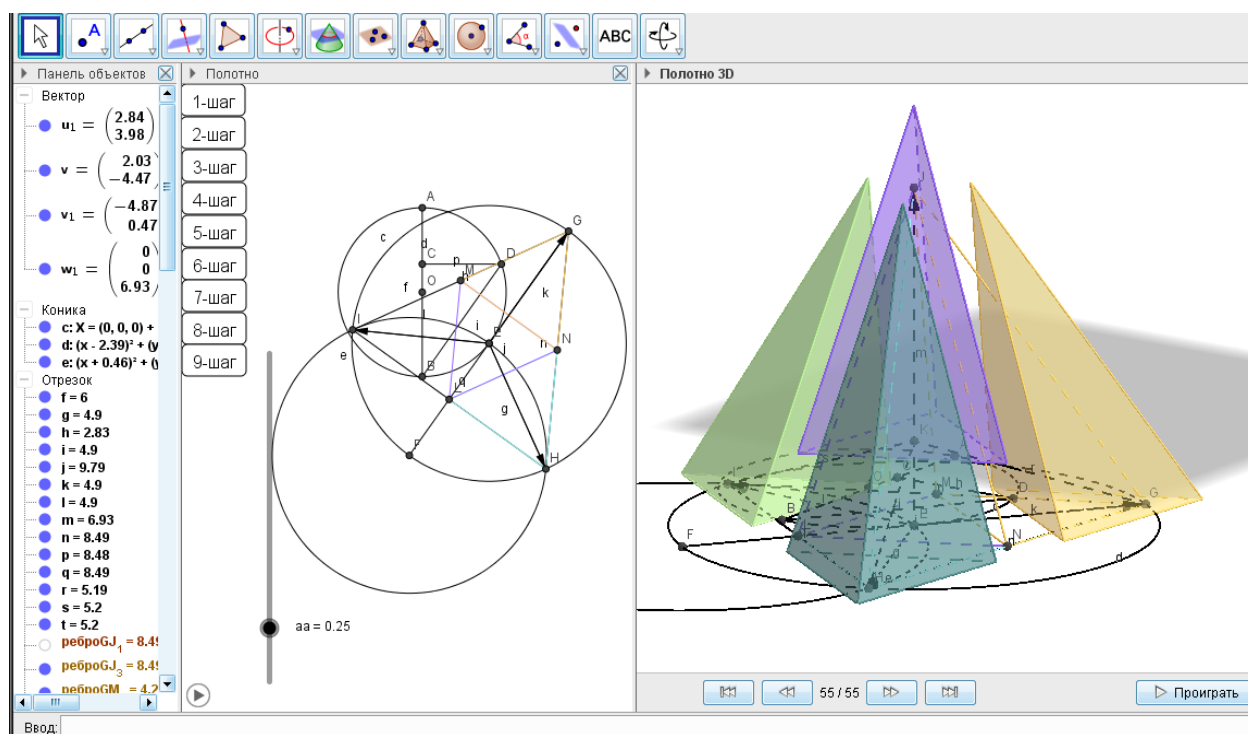


Fig. 7. Animation of parts of a sphere divided according to Al-Farabi's algorithm

Based on theoretical knowledge, such tasks enable students to develop skills in analysis, work with additional sources of information, and boost creativity.

2.4 Tasks for Studying the Biography and Scientific Heritage of Al-Farabi

A wider range of schoolchildren become interested in and captivated by problems of Al-Farabi's mathematical heritage through group projects. Participation in the collective struggle for victory and an opportunity to be useful to the team often are critical to awakening their interest.

Group projects within the supplementary education described are diverse. Here is one of them in information science:

Task 1. Develop a web page about Al-Farabi's life and mathematical heritage.

It should contain a biography of the scientist, his mathematical works, a bibliographic index, a photo gallery, the surnames and works of researchers of his scientific heritage, etc. Similar tasks in web programming and design, as well as other types of Internet creativity, are very popular among students.

However, for such a task to contribute to effective development of information competency in students, it must be formulated for a specific individual, taking into account the views and opinions of the students. This is exactly what we have done. It allows them to play the role of an active information converter, without simply repeating other people's texts. Therefore, the following topics were offered to students: *10 Facts from Al-Farabi's Life that Surprised Us*, *The Life and Creativity of Al-Farabi: My Biographical Discoveries in Questions and Answers*, *My Virtual Journey with Al-Farabi*, etc.

Personal importance of the performed task, a high degree of motivation and positive emotions that are a kind of melting pot, in which knowledge and skills acquire the power of competency, are an integrating and connecting element of knowledge and skills in information search acquired by students.

Work organised in this way makes it possible to regulate the activities of students involving the use of Internet resources and contributes to development of their information competency, above all, information search, a component of information competency. In particular:

- the ability to navigate information flows by identifying basic and essential points;
- the ability to systematise, creatively transform, save and transmit retrieved information.

Another assignment within organised extracurricular classes in the mathematical heritage of Al-Farabi involves testing students' knowledge of topics studied earlier (Al-Farabi: the life and mathematical heritage). It is conducted as a game.

Task 2. One student from each team participates in the game. They are offered three topics with three questions each, differing in level of complexity: 20 is an easy question, 30 is a medium-complexity question and 40 is a difficult question. After selecting the topic and specifying the number corresponding to the question number, a video question prepared in advance by the organisers is opened. The participant in the game is required to first press the button and answer this question. If the answer is correct, he/she gets points corresponding to the level of complexity of the question, and has the right to choose the next topic. If he/she makes a mistake, the correct video response is played, and the turn goes to the next participant. When all cells are opened, the game is over, points of each participant are summed up, and victory is awarded to the team whose members earned the most points.

Here are some video questions.

- What is the peculiarity of the algorithm for constructing a regular heptagon using only a compass and a ruler proposed by Al-Farabi? Are there precise algorithms for constructing a regular heptagon using these tools?

- When was the great scientist and thinker Al-Farabi born? Where did he live? Which branches of knowledge were his scientific studies dedicated to?

- How do you scale a scene and animate images in the GeoGebra environment?

Working on this task contributes, above all, to development of the reflexive evaluative and motivational value components of information competency.

2.5 Academic Competition on Al-Farabi's Construction Problems within the Framework of Supplementary Education

An organised school inter-subject academic competition that included geometric construction problems of Al-Farabi helped diversify the activities of schoolchildren when studying Al-Farabi's mathematical heritage within the framework of supplementary education and maintain their interest. The scientist presented these constructions in his work without any proof. Students were required to make the appropriate constructions in the GeoGebra software environment and justify them based on modern knowledge of school geometry. Among them was a problem on dividing quadrangles, which is quite often encountered in practice. For example,

Problem 7. It is required to divide the planar figure $ABCD$ in half by a line passing through one of its angles.

The solution algorithm proposed by Al-Farabi is as follows:

"Take the angle A and draw lines AC and BD intersecting at the point E . Then, if the line BE is equal to the line ED , the line AC divides the figure $ABCD$ in half "(Fig. 8) (Kubesov, 1972).

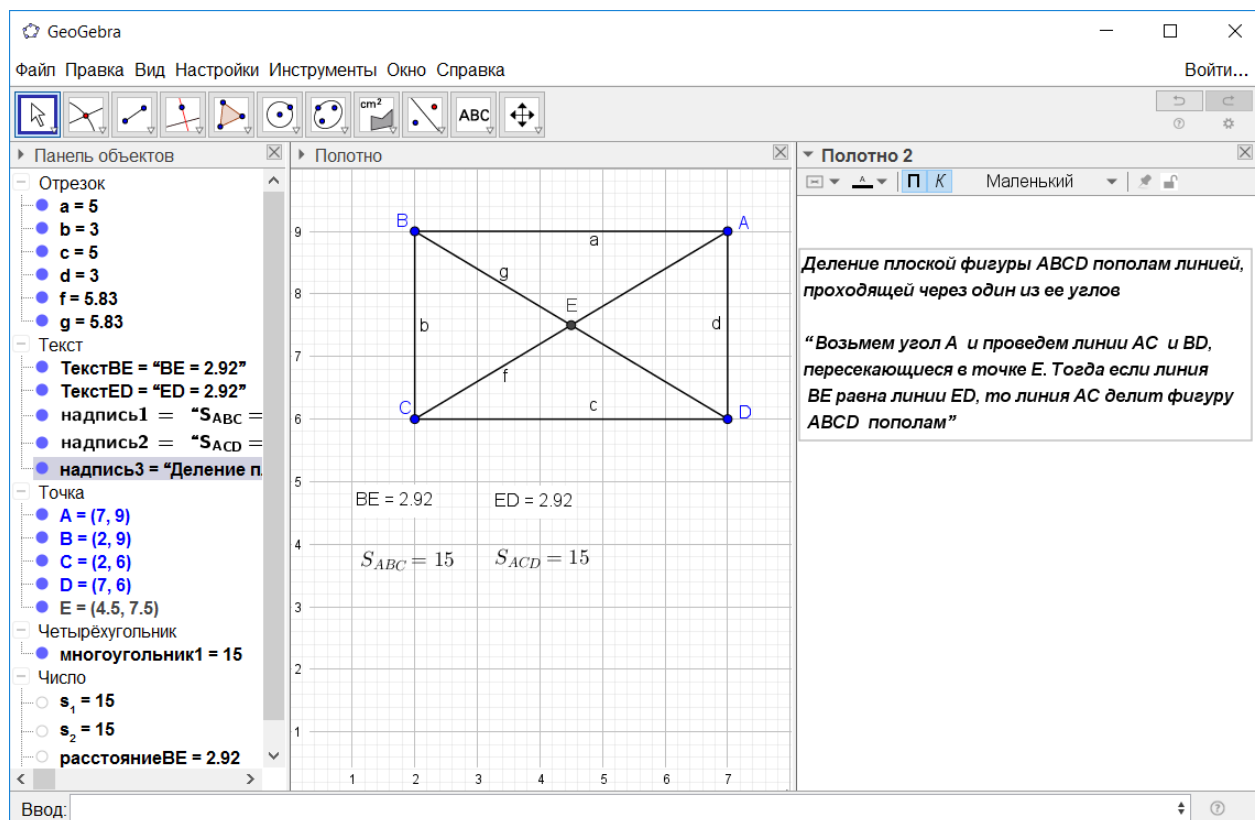


Fig. 8. Division of a planar figure in half with a line passing through one of its angles (when $BE = ED$)

Its proof to be carried out by schoolchildren on their own is simple and is given below.

Solution. Since $BE = ED$, AE is the median of the triangle ABD , and CE is the median of the triangle BCD .

According to the property of the triangle median: "The median breaks the triangle into two equal-sized (with equal areas) triangles." We have

$$S_{ABE} = S_{AED} ;$$

$$S_{BCE} = S_{ECD} .$$

Then $S_{ABC} = S_{ABE} + S_{BCE} = S_{AED} + S_{ECD} = S_{ACD}$, i.e. $S_{ABC} = S_{ACD}$.

The second case is also possible, when $BE \neq ED$.

The algorithm for solving this problem is described by Al-Farabi as follows:

"If BE is not equal to ED , let us divide BD in half at the point G , draw the line GH through it parallel to the line AC , connect A with H . Then the figure $ABCD$ will be divided in half by the line AH " (Fig. 9) (Kubesov, 1972).

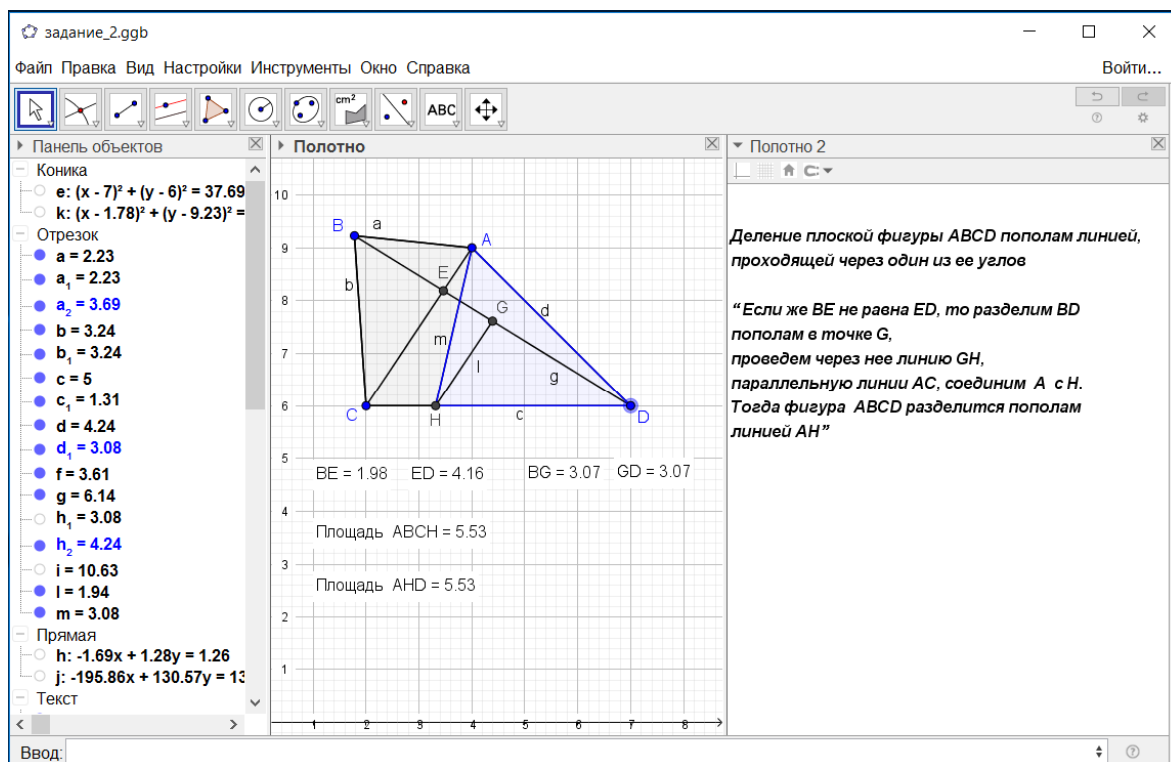


Fig. 9. Division of a planar figure in half by a line passing through one of its angles (when $BE \neq ED$)

Solution. The following property of the triangle median is used for the proof: "The median breaks the triangle into two triangles with equal areas." (These triangles have a common height and equal bases).

The median AG divides the triangle ABD into two triangles of the same area $S_{ABG} = S_{AGD}$. Similarly, the median CG divides the triangle BCD into two triangles of the same area $S_{BCG} = S_{GCD}$.

$$\text{Then, } S_{ABCG} = S_{AGCD}.$$

Let us write both parts of this expression:

$$S_{ABCG} = S_{ABCH} - S_{FCH} + S_{AFG};$$

$$S_{AGCD} = S_{AHD} - S_{AFG} + S_{FCH}.$$

Based on the properties of triangles: "All triangles with a common base, and with vertices positioned on a line parallel to the base are of equal size." We have $S_{ACH} = S_{ACG}$, as triangles ACH and ACG have the common base AC and vertices positioned on the line GH : $GH \parallel AC$.

Triangles ACH and ACG have the common part ACF , consequently, $S_{FCH} = S_{AFG}$.

Therefore,

$$S_{ABCG} = S_{ABCH} - S_{FCH} + S_{AFG} = S_{ABCH};$$

$$S_{AGCD} = S_{AHD} - S_{AFG} + S_{FCH} = S_{AHD},$$

Consequently, since $S_{ABCG} = S_{AGCD}$, then $S_{ABCH} = S_{AHD}$.

There is an interesting problem among those on division of quadrilaterals considered by Al-Farabi. The problem concerns dividing a square in half, leaving a path of a given width in it. It is used in surveying, for example:

Problem 8. Divide the square $ABCD$, in half, leaving a path of width DH .

For this purpose, the scientist proposes the following algorithm: "continue CA in its direction to M such that MA is equal to CH ; continue BA in its direction to L , from the center C at the distance CM draw a circle intersecting the line BA at the point L , and connect L with C . Measure LK equal to CH , draw the line KEG parallel to the line AL , and draw HF parallel to the line DB . Then, the figure HE is not equal to the figure EB " (Fig. 10) (Kubesov, 1972).

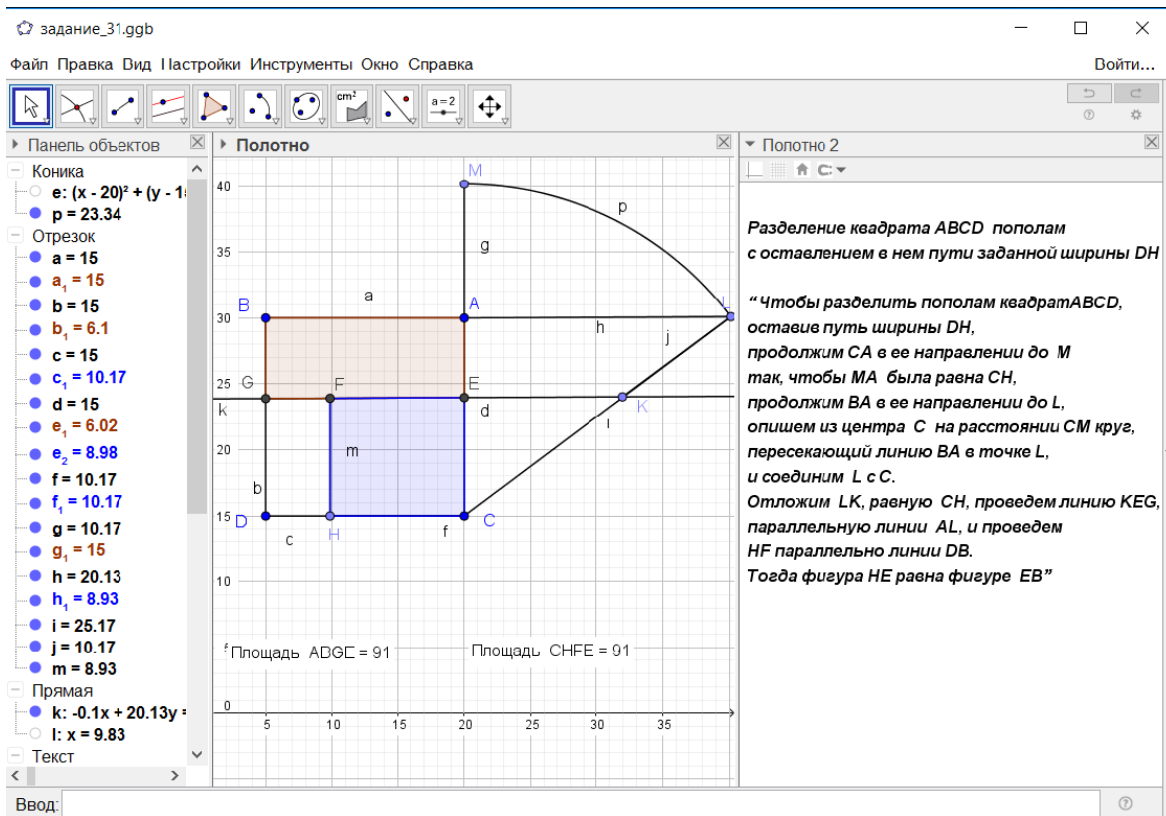


Fig. 10. Division of the square $ABCD$ in half, leaving a path of the given width DH

Solution. The proof is based on a property that follows from the similarity of triangles.

Triangles ALC and EKC are similar. The similarity results in $\frac{AC}{EC} = \frac{LC}{KC}$;

$$\frac{AE + EC}{EC} = \frac{CH + KC}{KC};$$

$$1 + \frac{AE}{EC} = 1 + \frac{CH}{KC};$$

$$\frac{AE}{EC} = \frac{CH}{KC};$$

$$CH \cdot EC = AE \cdot KC = AE \cdot BD;$$

$$S_{HE} = S_{EB}.$$

Justifying the correctness of the algorithms considered above requires knowledge of a set of geometric data.

This knowledge and awareness of the capabilities of this software environment needed for implementing the geometric construction problems of Al-Farabi being considered contribute both to consolidation of previously acquired knowledge of geometry and information science, its generalisation and systematisation, and build up and develop the technological and reflexive evaluation components of information competency. Setting a task containing a cognitive issue that

is personally meaningful to a student, with a clearly defined incentive (for example, you are a surveyor, and you need to correctly divide a land plot) motivates the student to perform the task, and contributes to development of the motivational value component of information competency.

Thus, skillful use of active methods of teaching Al-Farabi's problems during teaching and upbringing activities within the framework of supplementary education leads to a qualitatively new level of students' skills, ensuring effective development of their information competency.

Google Drive was used to organise students' collaboration on tasks. All participants were previously registered in the service, and assignments were also uploaded there. At present, cloud services allow a user to efficiently solve his/ her problems by using free online office software for processing and storing text and table information, and preparing presentations. The opportunity to work with files directly in the browser interface without downloading them, and having access to them at any time and from any gadget, including mobile devices that are now widely used by young people, have made it possible to effectively organise students' collaboration.

3. Conclusion

To sum up, we would like to stress the vital importance of supplementary education in the general education system in the context under consideration, as an environment for effective teaching of Al-Farabi's geometric heritage. Modern educational technologies used to motivate, stimulate and activate search and cognitive activities of students, which contributes to development of their information competency, as well as communication skills and the ability to reasonably defend their opinions. They boost students' interest in information science and geometry through joint activities, and increase interest in national history and the heritage of the great scientist.

Practice shows the impact of teaching students about Al-Farabi's mathematical heritage in the context of supplementary education on the quality of their academic performance in general. They are more successful in training, and participate in various research competitions and projects that require skills in handling various sources and types of information. They are able to independently retrieve, extract, systematise, analyse and select the necessary information to solve the problems they face. They can creatively transform, save and transmit it using modern ICT tools, draw conclusions on its basis, present an information product and apply it in practice.

Issues related to teaching problems of Al-Farabi's mathematical heritage require further theoretical and experimental research. In particular, it is necessary to determine the criteria, indicators and levels of development of students' information competency in order to objectively evaluate it, as well as to explore opportunities for introducing other mathematical achievements of the scientist in the educational system, and to identify conditions for their effective use in the educational process, both to promote them and develop information competency in students.

References

- [Hutorskoy, 2003](#) – *Hutorskoy, A. V.* (2003). Klyuchevye kompetentnosti kak komponent lichnostno-orientirovannogo obrazovaniya. *Narodnoe obrazovanie*. 2, 58-64.
- [Kommentarii k Almagestu Ptolemeya, 1975](#) – *Kommentarii k Almagestu Ptolemeya* (1975). Per. s arab. A. Kubesova i Dzh. al-Dabbaha. Alma-Ata: Nauka.
- [Kubesov, 1972](#) – *Kubesov, A. K.* (1972). Al-Farabi. Matematicheskie traktaty. Alma-Ata: Nauka.
- [Kubesov, 1974](#) – *Kubesov, A. K.* (1974). Matematicheskoe nasledie al-Farabi. Alma-Ata: Nauka.
- [Garry, Kubesov, 1978](#) – *Garry J. Tee, Kubesov, A. K.* (1978). The Mathematical Heritage of Al-Farabi. *Journal for the History of Arabic Science*, No. 1.
- [Bidaybekov et al., 2016](#) – *Bidaybekov, E. Y., Kamalova, G. B., Bostanov, B. G., Umbetbaev, K. U., Salgozha, I. T.* (2016). Ob organizatsii i povedenii vneklassnogo meropriyatiya po informatike "Matematicheskoe nasledie al-Farabi – dukhovnaya tsennost". *Sovremennye informatsionnye tekhnologii i IT-obrazovanie*. 12(4). 197-207.
- [Ermakov, 2009](#) – *Ermakov, D.* (2009). Informatizatsiya obrazovaniya i informatsionnaya kompetentnost uchashchikhsya. *Narodnoe obrazovanie*. 4, 158-161.
- [Kizik, 2003](#) – *Kizik, O. A.* (2003). K voprosu o stanovlenii informatsionnoy kompetentnosti kak sostavlyayushey professionalnoy kompetentnosti vypusknika professionalnogo litseya /

Materialy nauchno-metodicheskoy konferentsii "Universitety v obrazovatelnom prostranstve regiona: opyt, traditsii i innovatsii". Petrozavodsk. Chast 1.

Falina, 2007 – Falina, I. N. (2007). Informatsionno-kommunikatsionno-tehnologicheskaya kompetentnost. Metod.rukovodstvo dlya podgotovki k testirovaniyu uchiteley 8, 20-21.

Trishina, 2005 – Trishina, S. V. (2005). Informatsionnaya kompetentnost kak pedagogicheskaya kategoriya. Internet-zhurnal Eydos. Available online at: <http://www.eidos.ru/journal/2005/0910-11.htm>

Moore et al., 2002 – Moore, D., Brewster, S., Dorroh, C., & Moreau, M. (2002). Information competency instruction in a two-year college: One size does not fit all. *Reference Services Review*, 30(4), 300-306.

Kamhi-Stein, Stein, 1998 – Kamhi-Stein, L. D., & Stein, A. P. (1998). Teaching information competency as a third language: A new model for library instruction. *Reference & User Services Quarterly*, 173-179.

Gilinsky, Robison, 2008 – Gilinsky Jr, A., & Robison, R. (2008). A proposed design for the business capstone course with emphasis on improving students' information competency. *Journal of Management Education*, 32(4), 400-419.

Kwon, Song, 2011 – Kwon, N., & Song, H. (2011). Personality traits, gender, and information competency among college students. *Malaysian Journal of Library & Information Science*, 16(1).

Cunningham, 2003 – Cunningham, N. (2003). Information competency skills for business students. Academic Brass.

Ziatdinov, Rakuta, 2012 – Ziatdinov, R., Rakuta, V. M. (2012). Dynamic Geometry Environments as a Tool for Computer Modeling in the System of Modern Mathematics Education. *European Journal of Contemporary Education*. 1(1), 93-100.

Ziatdinov, 2010 – Ziatdinov, R. A. (2010). Geometricheskoe modelirovanie i reshenie zadach proektivnoy geometrii v sisteme GeoGebra. Materialy konferentsii "Molodezh i sovremennyye informatsionnye tekhnologii", Tomsky politekhnicheskii universitet, Tomsk, 168-170.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.

All rights reserved.

Published in the Slovak Republic

European Journal of Contemporary Education

ISSN 2304-9650

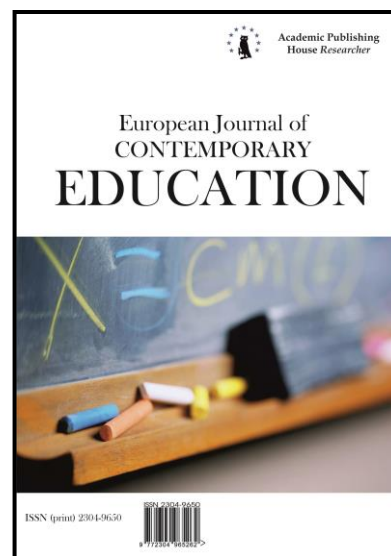
E-ISSN 2305-6746

2017, 6(3): 497-515

DOI: 10.13187/ejced.2017.3.497

www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



Understanding of Selected Geometric Concepts by Pupils of Pre-Primary and Primary Level Education

Ján Gunčaga ^{b,*}, Štefan Tkačík ^a, Katarína Žilková ^b

^a Department of Mathematics, Faculty of Education, Catholic University in Ružomberok, Slovakia

^b Department of Science Education, Faculty of Education, Comenius University in Bratislava, Slovakia

Abstract

Misconceptions in geometry are an essential problem in the understanding of geometric terms by primary and pre-primary aged children. Present research shows some misconceptions in geometry demonstrated in the understanding of circles, squares, triangles and oblongs for children in the last year of kindergarten and pupils in the last year of primary school. The research methodology is based on the Van Hiele's theory of understanding geometric thinking. Qualitative analysis of videotapes with recorded children's activities was the method used for pre-primary children. Whereas for the examination of 4th graders, a quantitative analysis was conducted via student-completed tests. Pupils' common misconceptions are shown and identified in our research. Based on these findings, recommendations for best pedagogical practice are suggested for teachers in primary and pre-primary levels and also for the teacher training of pre-service teachers.

Keywords: geometry, misconceptions, Van Hiele levels, pupils in primary and pre-primary level.

1. Introduction

The theory of education includes a development of examined, planned and realized activities in pre-school children and elementary school children with an aim to develop the mathematical imagination. Cognitive processes in mathematics are divided into several exact levels. These levels are structured by different patterns and they mostly reflect general pedagogical and/or psychological theories within the developmental psychology field (e.g. J. Piaget, L. S. Vygotskij, J. Bruner, etc.). A concrete description of each stage of the cognitive process in mathematics was mentioned and published by Hejný et al. (2006). In terms of the development of geometric

* Corresponding author

E-mail addresses: jguncaga@gmail.com (J. Gunčaga)

thinking, a well-known theory published by Dutch mathematician, Van Hiele (1986); Van Hiele (1999), revealed a definition of key levels typical of each stage of interpretation of geometry terms and characteristics.

The aim of the research is to present a pilot experience of research verification of Van Hiele's theory under the socio-cultural conditions of Slovakia. As a part of the national program VEGA 1/0440/15, named "Geometric Conceptions and Misconceptions of Preschool and School Age Children", we examined the thinking of pre-primary and primary aged children about geometrical shapes. The main purpose of the project was to recognize the conceptions of the pre-primary and younger aged children about geometrical shapes, recognize their characteristics for the shapes and subsequently identify the potential misconceptions. Moreover, we aimed to identify the levels of geometric knowledge in children based on the definition published by Van Hiele and essentially specify relevant and present levels (especially the levels of visualization and analysis) based on the information obtained from research analysis.

We present the partial results of the understanding of elementary geometrical shapes by pre-school children (5-6 year olds) and students attending the fourth year of elementary school (10 year olds).

2. The theoretical basis

The main theoretical platform for our research was not only pedagogical-psychological knowledge of children's interpretations of the world, but also the knowledge of geometric thinking development based on the Van Hiele's theory.

Theory by the Dutch mathematics teachers Pierre Van Hiele and his wife Diana Van Hiele-Geldof has many defenders in the world but criticism towards the theory has also emerged. The experts in the field are trying to identify different levels of geometric knowledge in children from the youngest age until the correct abstract levels and axiomatic geometric conceptions are reached. Different scientific studies show a big interest in this area by experts. Mostly, the research is focused on knowledge about the levels of the pupils of primary and pre-service primary teachers (Çontay, Duatepe Paksu, 2012; Fujita, Jones, 2006; Marchis, 2012). Levels of geometric knowledge of primary students in Slovakia were examined by the submitter of the present study (Žilková, 2013). The results of the research correspond with results from similar research in Romania, Turkey and Scotland.

The perception or geometrical shape thinking of pre-school and younger children in Slovakia has not been scientifically explored. This is the main reason we have decided to carry out the research where the main theoretical source is the Van Hiele's theory. We were focused on the identification, distinction and selection of geometrical shape characteristics. We assumed that children's thinking would correspond with the first two Van Hiele levels.

The characteristics of all five Van Hiele levels will be mentioned shortly. Each level of cognitive process is characterized by a few important attributes that will help us to determine the cognitive level of the examined subject and to identify its perception of elementary geometric concepts.

A lot of authors (e.g. Usiskin, 1982; Musser et al., 2001; De Villiers, 2010, etc.) published different names for the levels, however, the main characteristics are the same. Therefore, based on the published materials we compiled the following names and characteristics:

Level 1 (Visualization)

In the first of the Van Hiele levels, children/pupils should be able to think about the geometric shapes based on the overall look of the shape. At this point children identify shapes because of the holistic view rather than thinking of any distinct characteristics. This level can be analysed through verification of the identification abilities of geometrical shapes according to a picture.

Level 2 (Analysis)

The second Van Hiele level, also known as descriptive-analytical, is characterized by the ability of a pupil to think only about the characteristics of the geometrical shape, mostly only about the important elements of the shape. The visual perception and comparison with its prototype is too simplistic for pupils at this stage. They describe the shape by pointing out the important attributes. However, they are not able to choose the most important attributes that will be

characteristic for the next stage of geometric thinking. Therefore, a very common answer used by children to the question of why the concrete shape is a square is that it has four angles and four sides. For younger children, their answer is that it has four corners (vertices) and four sides.

Level 3 (Abstraction)

The following Van Hiele level is often called the abstraction or relationship level. At this stage, the pupils think about the characteristics of the shape in a more general and complex way. They are able to formulate simple and abstract definitions. These pupils are able to see a difference between necessary and sufficient requirements for a concept and they have the ability to understand and create logical arguments. Pupils have the ability to classify shapes hierarchically based on the analysis of their characteristics and they are able to formulate informal arguments for the reasoning of their classification. For example, pupils are able to understand a square as a rhombus with some “special characteristics” and therefore, they understand inclusive relationships between types of shapes.

Children understand that deductive reasoning can be useful when explaining relationships that are not obvious, but the need to use deduction for verification is still missing. For example, pupils are able to conclude that in every quadrilateral the sum of the inner angles is 360° with the reasoning that, therefore, every quadrilateral can be divided into two triangles with the sum of its inner angles equal to 180° .

Level 4 (Deduction)

The fourth Van Hiele level is known as a formal deduction. Pupils are able to discover and formulate simple formal evidence of Euclidean geometry and therefore, they are able to prove the validity of claims within the axiomatic system. Children understand the differences between undefined term, definition, axiom and sentence. They are able to create a proof by using a method of creating a sequence of claims that logically explains the result as a consequence of given assumptions about the properties. However, the axiomatic system is understood as consistent and unchanging and cannot be imagined by children as non-Euclidean representations of geometric shapes.

Level 5 (Rigor)

The last Van Hiele level is known as axiomatization. Pupils at this level think formally about mathematical systems, they study geometry without concrete reference models and they are able to compare different systems such as Euclidian and non-Euclidian geometry. At this level, the geometry is understood as an axiomatic system in the broadest sense and the student’s knowledge is not bound to this level. We place emphasis on the adaptation of the methods of school geometry to make children accept other geometrical representations and think abstractly about systems later on, not to make them see the Euclidian geometry as the only existing geometry.

We assumed that pre-school children and 4th grade students at elementary school would mostly show signs of the first two Van Hiele levels (visualization and analysis). We tried to map specific signs of these levels in our conditions. For the pre-school children, these signs were mainly the language specifics in their description of the shape and its characteristics as was at a level with the development of their first language. Of 4th grade students, more could be expected as the introduction of (national) professional terminology could exert an influence on the students’ ability to think at the next Van Hiele level.

3. Objectives and methods of the research

The aim of the research was to recognize the ideations and geometric misconceptions of pre-school children and 10 year old pupils about the shapes and their characteristics. The mission was to seek out the evidence of misconceptions in children and present an argument for the needs of deeper analysis in the context of national curricular documents and educational approach in the field of geometric shapes and their characteristics.

The research sample consisted of two groups of children. One group contained children of pre-school age (4½ to 6 years) and the other group consisted of children attending their 4th year in elementary school (approximately 10 years old). The methodology of the research was adjusted in both groups according to their age.

The research method of pre-school children was a semi-structured interview recorded to a video file. The aim of the interview was to find out whether children knew simple shape terminology (triangle, square, oblong, and circle) and whether they were able to identify the shapes

based on their visual properties. Moreover, the questions were: How do children distinguish between different types of shapes that are in different positions or sizes? How do children assign the shape to a concrete category? The research tool was a collection of real models (manipulation tools) of the planar geometric shapes and printed templates with drawn models of the planar geometric shapes. More than 53 videos were analysed and recorded from November 2015 until January 2016. The results are described in the fourth part of the research.

The research method used on the 4th grade pupils was an unstandardized test based on the prescribed curricular standards (national educational program) in geometry that was created to fit the Van Hiele levels of geometric thinking. The sample consisted of 80 children from one chosen elementary school and the data collection took place between February and March 2017. For the purposes of the research, only the results of the items that concerned the same shapes as examined in pre-school children were published (see the 5th part of the research). Therefore, the analysis of the tasks which were mainly focused on the identification of the elementary shapes (e.g. triangle, square, oblong and circle) was ultimately published. The aim was to find out what types of misconceptions were present in the pupils and how that compared with the level of imagination in pre-school children. Mutual comparison will allow identification, not only of the most common misconceptions, but also an approximation of their intensity.

4. Analysis of the results of pre-school children

In this part of the study, the results of the pre-school children are presented. The sample consisted of 53 children from four and a half to six years old. All of the children were about to enter primary school and the indirect observed via a semi-structured interview. The analysis was applied directly to the video file coding and a coding control was implemented based on the written transcript. Both qualitative and quantitative phenomena and their categories were observed. From the qualitative point of view, language tools that were most commonly used by children when describing a geometric figure and other verbal comments were observed. Quantitative analysis was focused on the rate of success in identification of the shape.

Children's perception of four shapes (triangle, square, oblong and circle) was observed and evaluated. These shapes were chosen because they are part of the national standards defined for graduates of pre-primary education. We were focused on two aspects: the ability to define a shape that provides a clear assignment of the shape name to its model and vice versa.

Therefore, two identification skills were observed: model of the shape => name of the shape, and name of the shape => model of the shape. When attempting to elicit the name of the shape from the child, the most common question asked was: "What type of shape are you holding in your hand?" or "What can you see in the picture?" and so on. When hoping to elicit the physical, instead of verbal, identification of the shape, questions such as "Could you show us all squares that are in the picture?" or "Choose a triangle" and so on were asked. In the research activity we used two types of research tools: paper or wooden models of the geometric shapes (see Fig. 1) and printed models and non-models of the shapes in different sizes and positions (see Fig. 2).



Fig. 1. Models of the geometric shapes

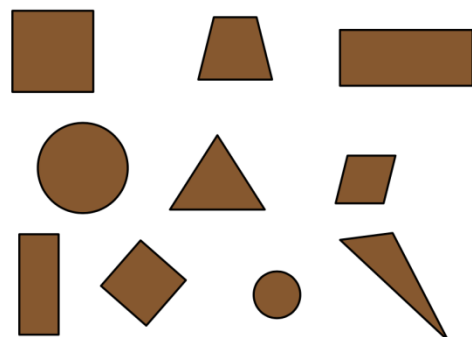


Fig. 2. Models and non-models of the shapes in different positions

It was assumed that manipulation with models of the shapes would help children with the process of identification because it gives children an opportunity to rotate shapes until it evokes a


mental prototype for the shape. The set of the models contained different colours and sizes of shapes. Models of triangles and oblongs were placed in the set in different forms.

All of the examined children were familiar with the name “oblong” and they were able to select all the models of the oblongs from the set. However, the set didn’t contain models of oblongs with too big of differences between adjacent sides. The name “circle” was recognized by children as well and only two children named circle as a sphere or spherule. Children of this age tend to label shapes as spatial shapes and it comes from previous experiences of manipulation with spatial shapes. This problem appeared to be much bigger when children were asked to name model of squares. However, the result can be considered very successful because 75 % of children correctly named models of squares and only 7 children identified models of squares as cubes. Models of triangles were named correctly by 80 % of the sample, where 6 children could not pick all of the triangles from the set of geometric shapes. The reason these children struggled may be due to variations in the shape of triangles especially in those triangles that didn’t quite resemble the triangle prototype of an equilateral triangle.

The most difficult task for a child in shape identification is to identify/volunteer the name of a shape that is a picture on paper because then the child is not allowed to manipulate it. In the pictures used for the research, there were not just models of the 4 basic shapes but trapezoids and rhombi as well. The aim of the task was not to name these shapes because that is not included as part of the Slovak national curriculum. The other shapes were integrated into the research tool to help find out whether a child can unambiguously select 4 basic shapes.

Since the circle is a shape that can be distinguished from any angle regardless of its orientation on paper, the results for this shape were not a surprise. 46 of the children used the correct term and correctly selected two models of a circle in the picture. Two children didn’t know the correct term for this shape, therefore, they named it a hole or a wheel.

The name “oblong”, on the other hand, while recognized by all of the children in the real model task, in printed pictures, the rate of success dropped to 83 %. (The oblong being equally displayed in both vertical and horizontal positions.) It is clear that the manipulation of the shapes made the cognitive process much easier for pre-school children and therefore, in primary teaching, the manipulation of objects is to be recommended for its efficacy.

Squares in a standard position (with sides running horizontally and vertically) were named correctly by 38 children. In a rotated position  the ability to name this shape decreased: only 29 children were able to recognize it as a square. Mostly, the children tended to name the square as a cube. For the square in a rotated position, 2 children used the term “diamond” and one child used the term “triangle”. This exchange (square vs. cube) is quite common in Slovakia; not only in children, but in adults as well. The squared paper is very often called cubed paper and a checked shirt is often called a cubed shirt. These terms are incorrect but people use these terms in such a commonplace manner that they do not realize the inherent incorrectness. This is part of the reason younger children have problems with identifying squares.

In the identification of other geometric shapes, 10 children named the model of a trapezoid as a square and one child called it a cube. Similarly, the rhombus was named as a square by 18 children and in 6 cases as a cube.

The triangle was illustrated in the picture in two forms. One of them was an equilateral triangle in the standard position (prototype) and 88 % of children named the triangle in this form correctly. Second type, the obtuse triangle, differed not only in its type but in position as well. This type of a triangle was successfully named by 24 children.

From the qualitative point of view we introduce the most frequent words used by children when they didn’t know the correct name for the shape:

- Triangle (obtuse): kite, peak;
- Square (in basic position): cube;
- Square (rotated): cube, diamond, triangle;
- Oblongs: square, triangle, ribbon;
- Circle: wheel, small wheel, hole.

Even the fact, that the aim of the study was not to find out the ability to name the trapezoid or rhombus, we also include the words that most often children used for the identification of the

shapes. The trapezoid was mostly called: skirt, reversed flowerpot, chimney, bucket and also square.

All of the things listed above correspond to the typical characteristics of the first Van Hiele level. It is specific to our socio-cultural conditions that instead of the word “square”, the word “cube” is frequently used. It is difficult to determine whether it is simply language-specific (even though incorrectly so) or if it is a stable misconception that persists from childhood to adulthood and trickles down from the older generations to the younger one.

To verify the ability of pre-school children to define shapes with their true terminology, other printed picture templates were used (Fig. 3 – Fig. 6). For every shape one template was used with not only the models but also non-models of the shape. This variety in templates allowed the effect of the location and shape diversity to be observed as well, to see whether the sample of children would perceive the shape only holistically or if they would show signs of the next Van Hiele level.

The questions we were asking children: *Show all of the squares in the picture (triangles, oblongs, circles). How many squares can you see in the picture? Is this shape a square as well? Why is this a square? Why is this not a square?* Every interview was unique and it was modified to suit to each child’s cognitive functions and communication skills.

The results will be reported according to the shapes and in the sequence that these shapes were presented to the children on printed templates (Fig. 3 – Fig. 6).

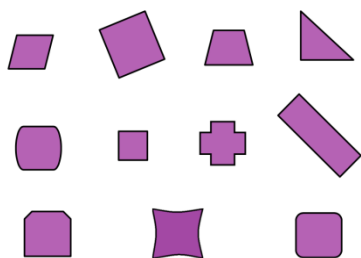


Fig. 3. Template of models and non-models for a square identification

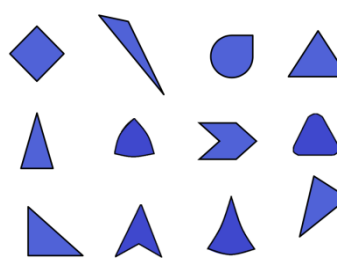


Fig. 4. Template of models and non-models for a triangle identification

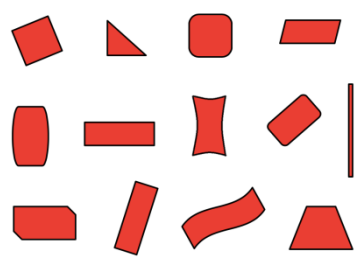


Fig. 5. Template of models and non-models for an oblong identification

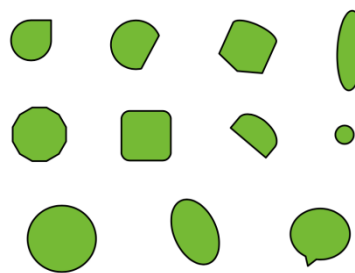


Fig. 6. Template of models and non-models for a circle identification

Models and non-models of squares

The template (Fig. 3) contains only two models of a square, one in the standard position and one moderately rotated. Other shapes were non-models of the square, although some of them had a form of a square. Quantified results of the answers of the children are listed in the table number 1.












The model of a square in its standard position was named correctly by 85 % of the children, but the rotated version was identified by 93 % of children. The results are remarkable, as it is inconsistent with previous results and theory. This disproportion can be explained by the fact that a square (Fig. 3) in a standard position was small, and therefore, the children didn’t notice it and didn’t react to it. Another reason might be that square is rotated only slightly and it doesn’t have diagonals in a horizontal and vertical position. This magnitude of a rotation is possibly acceptable for a child because the shape evokes a square enough.

Non-models of squares can be divided into two groups. Non-models of squares that holistically evoke a square, but don’t meet at least one of the defined characteristics are in the first

group. Mostly it is a deformation of the sides of the shape or deformation in the vertices. The second group of the non-models consists of triangles, oblongs, trapezoid and rhombus. We assumed that identification of the first group as a group of non-models would be much easier. This assumption was supported by our research, with the exception of rhombus identification.

Our findings showed that in first examined non-model group the biggest problem for pre-school children was to identify a shape with a square form with rounded vertices. 83 % of children identified this shape as a square, which is quite natural for children of this age. The reason is that children perceive the shape holistically and significant elements (such as sides and vertices) are neglected, or even ignored.

Table 1. Identification of squares













| squares | success rate | nonmodels (1. group) | success rate | nonmodels (2. group) | success rate |
|---|--------------|---|--------------|--|--------------|
|  | 92,59% |  | 96,30% |  | 88,00% |
|  | 85,19% |  | 75,00% |  | 85,19% |
| | |  | 54,17% |  | 80,00% |
| | |  | 45,83% |  | 30,43% |
| | |  | 17,39% | | |

The most common arguments children used for reasoning for their identification were following characteristics of the square: “it must have 4 identical sides”, or “can’t be rounded” and they tended to compare it to the cube.

Models and non-models of triangles

Five models of triangles were illustrated on a template (Fig. 4): equilateral triangle, right triangle, 2 isosceles triangles (one of them in standard position, with baseline in horizontal position) and one obtuse triangle. The other shapes were not triangles. The results of the identification of the shapes are stated in table 2.

Table 2. Identification of triangles














| triangles | success rate | nonmodels | success rate |
|---|--------------|---|--------------|
|  | 96,15% |  | 100,00% |
|  | 96,00% |  | 87,50% |
|  | 96,00% |  | 84,00% |
|  | 88,46% |  | 70,83% |
|  | 61,54% |  | 62,50% |
| | |  | 54,17% |
| | |  | 36,36% |

The observable reasoning in children for assigning the shape to the category of triangles were: “it is a triangle because it looks like a roof”, “it reminds me of a triangle” or “it is peaked”. Therefore, we conclude that similarity of a shape to its prototype is the most important thing for a child when it comes to reasoning. Children ignore details of a shape and they perceive shapes holistically. Most common reasons for rejection to assign the shape to triangle category where: “it is not a triangle because it is too much peaked” or “a triangle must have identical this (sides)”. Some of these children accurately identified non-models of triangles and commented that “a triangle can’t have a curve”. This argument is typical of a higher level of visualization because significant aspects of a triangle were noticed.

Models and non-models of oblongs

Three models of oblongs were on a template (Fig. 5). The other shapes were non-models of oblongs. It is obvious from the results (Table 3) that the arrangement corresponds with perception of the oblongs and therefore it is typical of a high visualization level. Half of the children didn't correctly identify the third model of oblong as an oblong with a reason that "it can't be an oblong because it is a bar" or "a stick", "it is too thin" or "narrow", "it is a path", "line".

Table 3. Identification of oblongs

| oblongs | success rate | nonmodels | success rate |
|---|--------------|---|--------------|
|  | 100,00% |  | 100,00% |
|  | 96,15% |  | 100,00% |
|  | 50,00% |  | 95,65% |
| | |  | 92,31% |
| | |  | 62,50% |
| | |  | 60,87% |
| | |  | 52,17% |
| | |  | 39,13% |
| | |  | 37,50% |
| | |  | 21,74% |












The biggest problem in this group of non-models of the oblongs (Table 3) was to identify a rhomboid that holistically looked like an oblong. Approximately 78 % of children identified a rhomboid as an oblong. Triangles and squares were easily and correctly identified as non-models of oblongs and they didn't have any problem with their identification.

Models and non-models of circles

Only two models of circles were situated on a template (Fig. 6) and they differed in size. A model of a circle with a larger radius was identifiable for all of the children. The children's ability to identify a smaller circle was reduced. Only 81 % of children identified a smaller circle. Therefore, *the size of a circle may have an influence on the ability to identify a shape.*

Table 4 shows the rate of success in identification of non-models of circles. The biggest problems were to identify ellipses and a regular dodecagon because these shapes were often considered to be circles. These are the shapes that resembled circles and therefore, they identified these as circles. As an interesting fact we reveal a reasoning of one child why an ellipse is not a circle: "this is not a circle because it is rectangular circle". The comparison of a shape with a prototype of a circle is evident here, moreover, the details of a shape are noticed which is characteristic for another level of cognition.

Table 4. Identification of circles

| circle | success rate | nonmodels | success rate |
|---|--------------|---|--------------|
|  | 100,00% |  | 100,00% |
|  | 80,77% |  | 95,83% |
| | |  | 95,83% |
| | |  | 87,50% |
| | |  | 76,00% |
| | |  | 75,00% |
| | |  | 60,87% |
| | |  | 57,69% |
| | |  | 57,69% |

We assume that identification of circles is the easiest for pre-school children. A circle is a shape that they come into a contact with at this age and it is not angular. That is why children justified an identification of a circle like this: “because it is rounded”, “because it is bulbed” “can’t have any peak”, “it is like a wheel (marble, hole)”. The final summary of the results with other notes from a video file analysis in a more general level is shown in Section 6.

5. The analysis of results of 4th graders

In this part we are focusing on the analysis of responses of 4th graders – pupils the age of 10. We interpreted the responses to the questions of the knowledge test from several points of view. These are the percentages correct answers in the sub-questions, the coefficient of correlation and implication graph obtained using the statistical program C.H.I.C. This graph enables us to find implicative logical relationships between the sub-answers, where the intensity of the relationship is expressed by the colour of the arrow in the graph. The values of correlation coefficient were relatively small, so it didn’t indicate stronger relations between the items of the test in terms of regression analysis.

The results – task 1

The first task in the test was focused on the identification of the shape in the picture and if the pupils know correct names of the shapes.

Task 1: For each planar shape write its correct name (see Fig. 7).

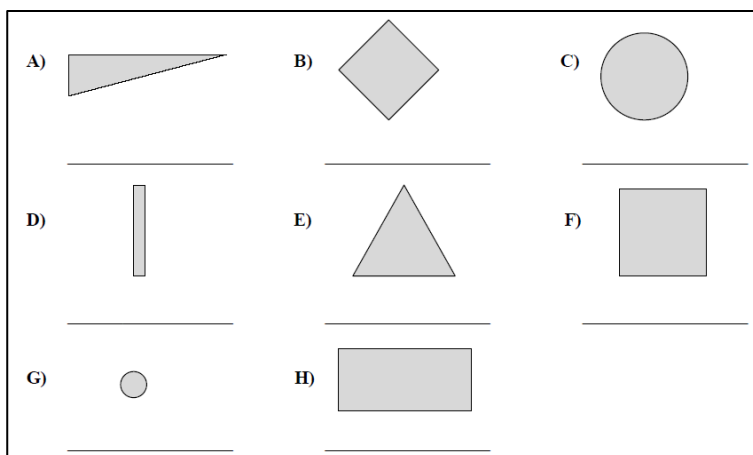


Fig. 7. Plane geometrical figures for the task 1

The percentages of correct answers of 4th graders in this task are illustrated in the following picture (Fig. 8).

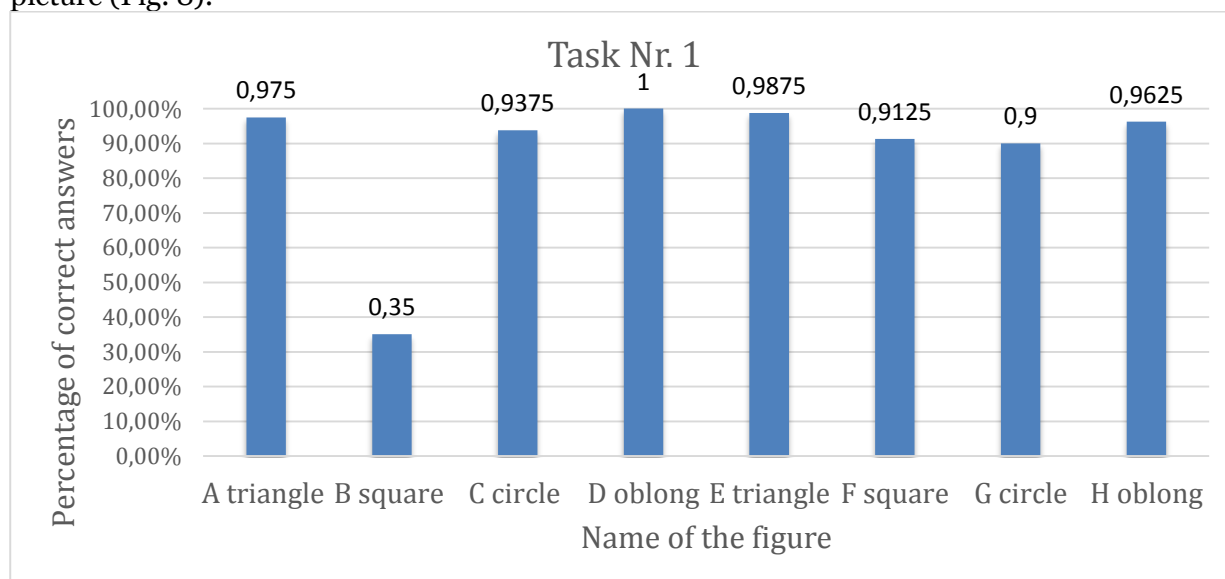




Fig. 8. Percentage of correct answers for the task 1

The least correct answers are for square  (B). The reason is that the sides of a given square were not in the position as in the square  (F). The square is not in the standard position, the angle of rotation is 45° and therefore pupils had problems with its identification. This phenomenon was expected but not to this extent. The success rate of 4th graders at the identification of rotated square is only at the level of 35 %, which is considered to be extremely low. When naming this shape pupils shown only the signs of the level of visualization. Interestingly, the most of correct answers in the first task is for the item (D) – more than for item (H), although both are rectangles. It is assumed that the reason is the ratio of the sides of an oblong as it is more significant for the item (D) and thus this item corresponds more to the pupils' prototype of an oblong. For the 4th graders the identification of triangles and oblongs was easier than the identification of squares, where the rotated square significantly decreased the success rate as the pupils often called it other names.

The implicative graph for the items in this task (Fig. 9) shows mutual relationships between the pupils' answers to the presented items and their strength.

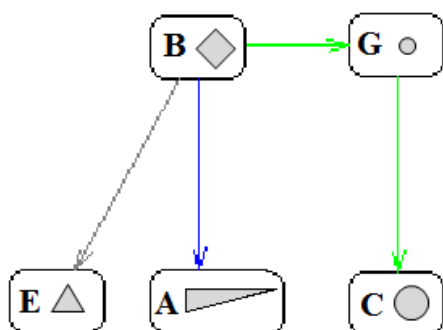


Fig. 9. The implicate graph for the items in the task 1 – the strength of implication: blue arrows 70 %, green arrows 60 %, grey arrows 50 %

From the implicative graph follows that if a pupil correctly names the item B, he also correctly named item A. A similar relationship exists between items B, G and C. This means that if the pupil correctly identified the square in non-standard position, he also correctly identified other shapes. From the result it is clear that the most difficult shape for pupils to identify, respectively to name, was the rotated square. The strongest implicative relationship is between square and triangle in non-standard positions. This result confirms the theory that the prototype shapes are easier identified and thus the shapes in non-standard positions cause problems for the pupils.

The results – task 2

The aim of the second task was to find out the ability of 4th graders to distinguish between models and non-models of a circle with the help of printed pictures.

Task 2: Mark whether the following shapes are circles (see Fig. 10). Circle the correct answer.

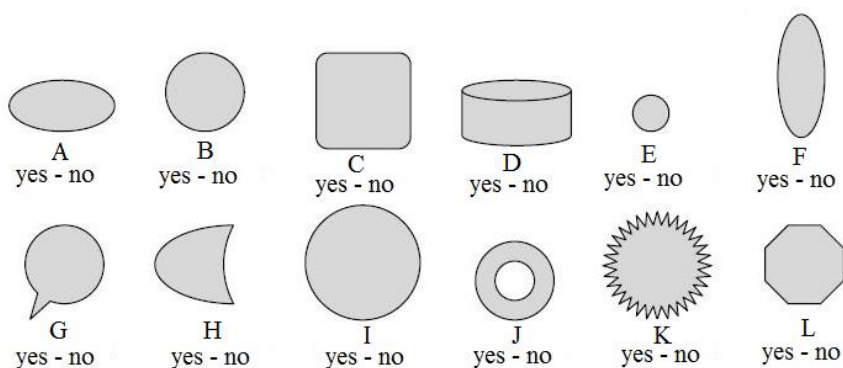


Fig. 10. Plane geometrical figures for the task 2

The results of answers to task 2, and specifically the percentage of the correct answers, are displayed in Fig. 11.

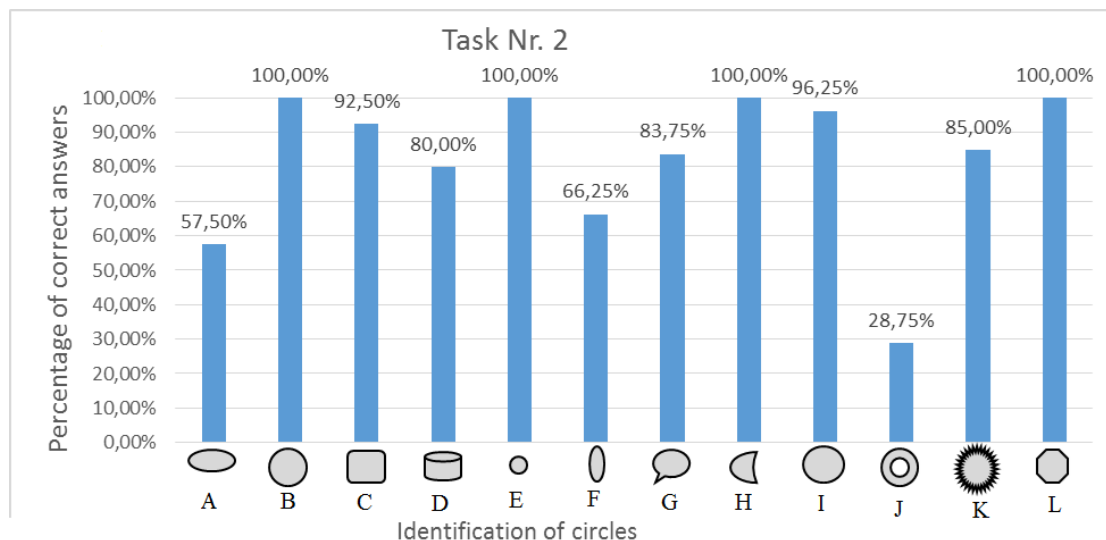


Fig. 11. Percentage of correct answers for task 2

The students were the least successful at identification of shapes A, F, J. The lowest success rate was determined in the item J, which is a very specific shape. With respect to the indisputableness of the displayed shape and low success rate we recommend to omit the shape J from the measuring tool in the future. Another reason is that it doesn't provide sufficient informative value and distinguishing ability. Very low success rate in the shapes of elliptic form (A and F) means that the pupils do not sufficiently distinguish between circle and ellipse. We assume that this phenomenon is caused by the absence of the shapes of similar type in the textbooks and workbooks of mathematics in the primary education. On the other hand, 4th graders managed to safely identify models of circles (B and E), with a slightly lower success rate than the biggest model of circle I. The result can be influenced by either the lack of concentration of the pupils or the size of the model, and we are not able to determine whether it has some effect on the result. In terms of the easiest identifiable non-models of circles we noticed H and L as the shapes with the highest success rate.

The following implicative graph illustrates the relationships between shapes created according to the pupils' answers (Fig. 12).

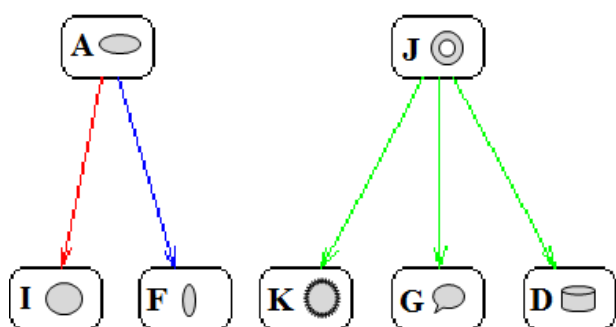


Fig. 12. The implicative graph for the items in task 2 – the strength of implication: red arrows 90 %, blue arrows 80 %, green arrow 70 %

The results displayed with the help of implicative graph showed that there is relatively strong implicative relationship between items A => I, A => F. From this relationship and from the position of the items in the graph it is clear that the most difficult shape for identification for pupils

was elliptically formed non-model of a circle A. Its success rate in identification also determines the success rate in identification of shapes I and F. A similar but not so strong implicative relationship exists between items J, K, G and D where the most difficult from this group is the shape J described above. All of the shapes in this group are non-models of circles. Therefore, we assume that the absence of tasks designated to distinguish between models and non-models of circles (examples and counterexamples) in the textbooks of mathematics for primary education can determine the ability of pupils to improve their imagination about circles. This fact should be important for the teacher of mathematics to perform activities in math education in which the pupil can obtain personal experiences with models and non-models of the shapes.

The results – task 3

The aim of the third task was to find out the ability of 4th graders to distinguish between models and non-models of squares with the help of printed pictures.

Task 3: Which shapes are not squares? Circle the letters. (see Fig. 13)

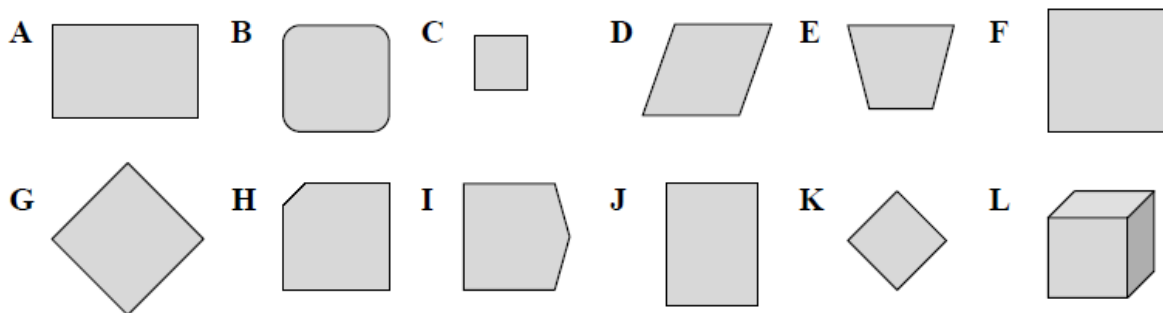


Fig. 13. Plane geometrical figures for the task 3

The results of the answers of 4th grader, respectively the success rate of correct answers in this task can be found in the Fig. 14.

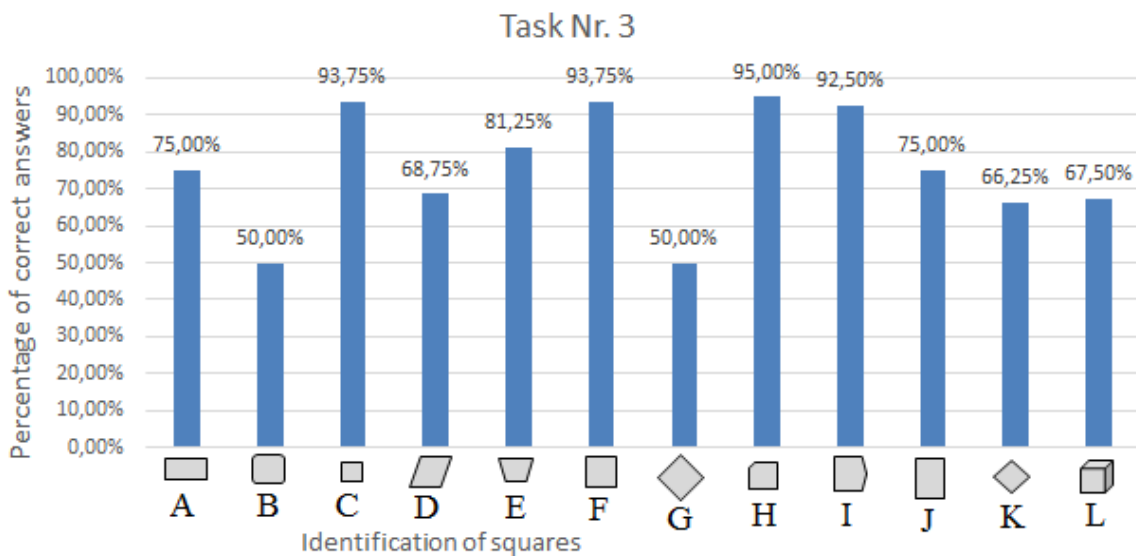


Fig. 14. Percentage of correct answers for the task 3

The most problematic representations of models and non-models of squares were shapes B, G and K. The ability to identify shape B is not to perceive the shape holistically but to notice its important elements. From this it's clear that half of the sample does not have correct visualization about squares or its important elements, which are vertices and sides. The shape B is perceived as a shape with squared form but not as a square. Half of the 4th graders still perceive the square holistically thus only at the level of visualization.

Similarly to task 1, the shapes G and K are models of a square rotated by 45°. The change in position of models of squares caused problems with their identification. Similarly, there was problem with the identification of shape L that represents spatial shape – a cube. A relatively big part of pupils (32 %) denoted a cube as a square.

Pupils didn't have problems with the identification of squares with sides in horizontally vertical position and they correctly identified small and big square (C and F).

The experience from earlier stages of education showed that pupils often denote the rhombus (shape D) as a model of a square. Looking at 4th graders' success rate of this shape (68.75 %), we find out that these misconceptions are still present. One of the reasons could be the fact that pupils do not encounter the concept of angle, especially right angle, within the primary math education in Slovakia. There are some representations of squares in a square grid, however the pupils of 4th grade are probably missing the experience of using it to compare shapes or detect perpendicularity of the shape's sides.

The implicative graph of results of tasks about models and non-models of square is in figure 15. A special group is formed from the shapes G and H, which were mentioned earlier. The question is whether the size of a shape really plays a role in correct identification of square because from the picture it is clear that the bigger rotated square was more difficult for identification than the smaller one.

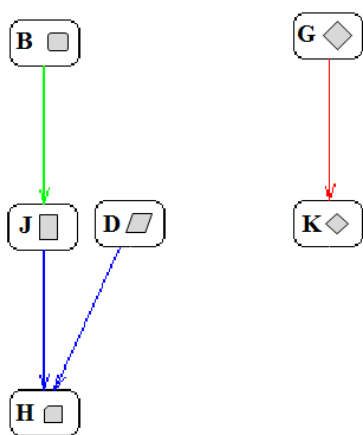


Fig. 15. The implicative graph for the items in task 3 – the strength of implication: red arrows 80 %, blue arrows 70 %, green arrows 60 %

Other relationships found in the implicative graph were in the group of shapes B, J, D and H. Again, all these shapes are non-models of a square. Shape D does not have internal angles right, shape J does not have all sides equilateral and shape H is in fact a pentagon. This means that each of them has a different property, which excludes it as a model of square. The easiest shape from these for identification was shape H and the most difficult was shape B.

It was shown that 4th graders do not know the important elements and basic properties of a square and their decisions on identification of models and non-models of squares are based only on their holistic perception.

The results – task 4

The aim of the fourth task was to find out the ability of 4th graders to distinguish between models and non-models of triangles with the help of printed pictures.

Task 4: Choose the shapes in the picture that are triangles (see Fig. 16). Circle the correct answer.

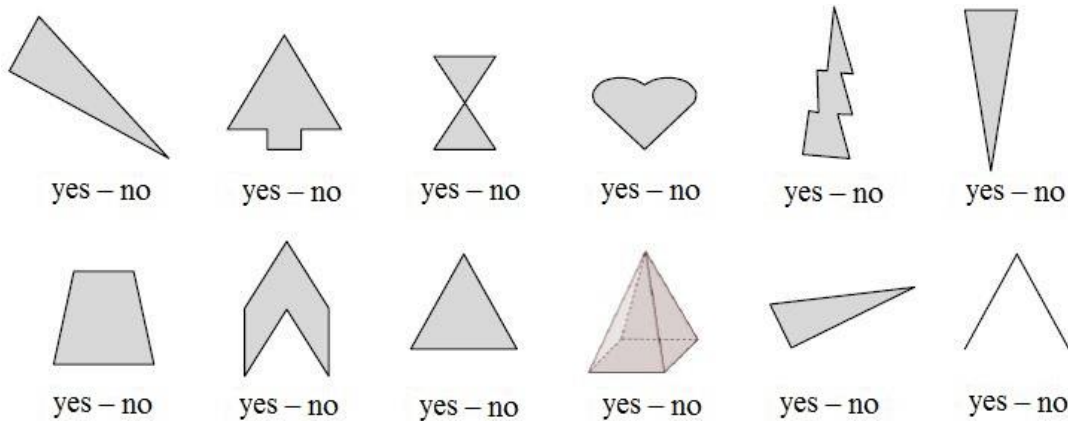


Fig. 16. Plane geometrical figures for task 4

The success rate of the 4th graders in task 4 about identification of models and non-models of triangles is illustrated in the Fig. 17.

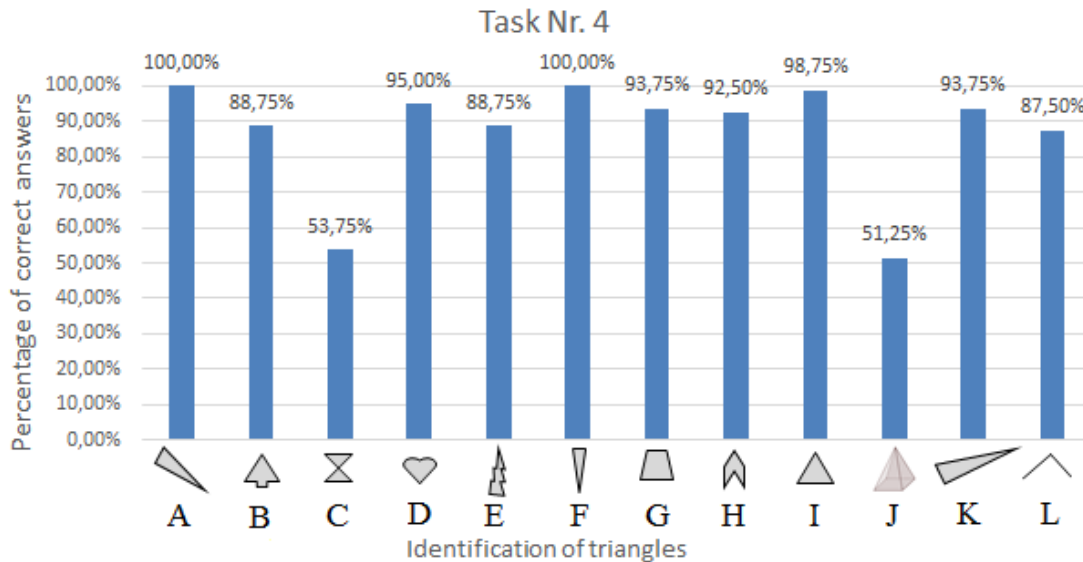


Fig. 17. Percentage of correct answers for task 4

The lowest success rate was for the shapes C and J. It is not possible to provide a relevant interpretation for the shape C as the results can be biased – pupils could perceive this shape as two triangles and therefore denoted them as models of triangles. Hence, this shape will be eliminated from the research tool in the next research. Relatively surprising information was the frequent identification of planar shape J as a model of a triangle. The fact that the faces of the pyramid are triangles could confuse the pupils.

Almost every 4th grader correctly identified models of triangles A, F and I. These shapes clearly illustrated a triangle as they presented a model of polygon with three sides and three vertices.

The implicative graph for the items of this task is illustrated in the Fig. 18.

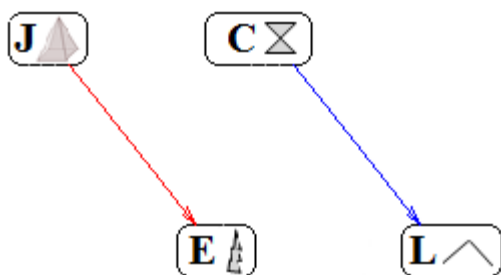


Fig. 18. The implicative graph for the items in task 4 – the strength of implication: red arrows 90 %, blue arrows 80 %

From the implicative graph follows that if a pupil knew the answer of item J, he or she also knew the correct answer for item E where the item J was more difficult for the identification. If the pupil answered correctly the item C his or her answer for the item L was correct as well. Even in this task was shown that 4th graders perceive and distinguish between models and non-models of triangles holistically. They notice the important elements of a triangle (sides and vertices) only a little, on the other, the position of a triangle is very important to them and they are not aware of the differences between the pyramid and a triangle. Besides reasons mentioned above (small proportion of non-models in the study materials in Slovakia) the results could be influenced by extremely small proportion of tasks developing the knowledge about spatial solids. In the first four years of education pupils do not get any information concerning solids; therefore they identify a solid based on the form of its faces.

The results – task 5

The aim of the fifth task was to find out the ability of 4th graders to distinguish between models and non-models of oblongs with the help of printed pictures. Compared to the previous task this task is formulated in the form negation.

Task 5: Which shapes are not oblongs? Circle the letters. (see Fig. 19)

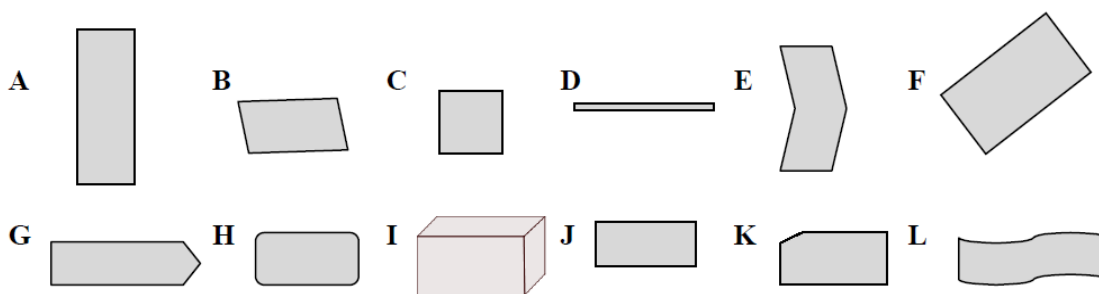


Fig. 19. Plane geometrical figures for task 5

From Fig. 20 (the success rate of 4th graders in identification of models of oblongs) it is clear that pupils had problems only with three shapes (B, H, I).

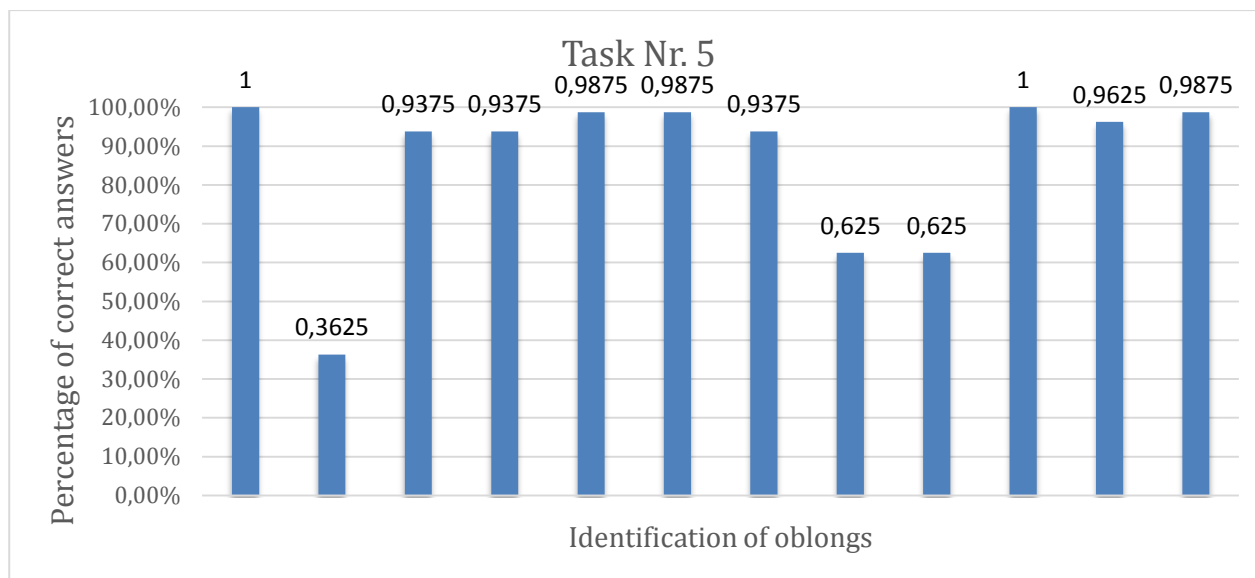


Fig. 20. Percentage of correct answers for task 5

The lowest success rate was for shape B. It is assumed that it is the similar problem as was described for the identification of a square. Younger children often identified this shape as an oblong with a reason that it is long. If we take into consideration the problem of Slovak curriculum, in which the thematic part about right angles is missing from primary education, then this result is not surprising at all.

The items H and I had only 62,5 % success rate. There were shown identical problems as described in the interpretation of previous results. Results for the item I indicate the problem with substitution of planar and spatial shape. This item is cuboid even though its lateral faces are oblongs. For the item H it is clear that the pupils perceive it holistically as an oblong and not as a shape with oblong form - which is in fact not an oblong.

The implicative graph for the items of this task (Fig. 21) illustrates the most important implications between identification of shapes.

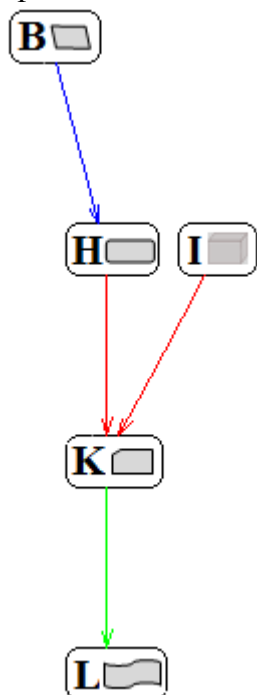


Fig. 21. The implicative graph for the items in task 5 – the strength of implication: red arrows 90 %, blue arrows 80 %, green arrows 70 %

From the implicative graph follows that the answer to the question concerning item H implicatively determines the answer concerning the item K and the identification of K was easier for pupils than the identification of H and I.

Furthermore, in the graph is seen logical line of shapes B, H, K and L. These shapes are not oblongs, they are non-models of oblongs. The importance of knowledge about properties of oblong as a planar shape, respectively polygon with four vertices, four sides and all internal angles right, was shown again. The internal angles of the shape B are not right, but despite that pupils and younger children tend to identify rhomboid as an oblong. This shape showed to be the most difficult for its identification as a non-model of an oblong.

6. Results and discussion

Considering the aim of the research about the findings of the evidence of the misconceptions in children we publish the most important results and findings from both groups of the sample.











We assumed that the conceptions of pre-school children would correspond with Van Hiele visualization level. This assumption was supported by our results, moreover, some of the children showed signs of thinking in a higher Van Hiele level. Children noticed some of the details that were often crucial for their decision-making. However, we can conclude that pre-school children perceive shapes holistically and they do not notice the deformations of the shapes. The most important findings about conceptions in pre-school children about the elementary planar shapes are as follows:



1. Manipulation of shapes makes it easier for children to identify a shape. Identification of a physical model of the shape is easier for children than identification of a shape from the picture.
2. Slovak names of shapes (square, oblong, triangle and circle) are difficult to pronounce and therefore are often being slurred. This fact was considered during the process of evaluation of the results and the language imperfections were respected.
3. Pre-school children often used their own language and terms when they were about to identify a shape. These terms are mostly logical and understandable among the children.
4. A square is often called a cube. Already in this age the exchange in the terms of planar and spatial shapes is present.
5. In identification of rectangular shapes children often assigned a rhombus and rhomboid to the group of square and oblong models.
6. The easiest shapes in the terms of correct identification for pre-school children are circles.

Overall, *the position and the size of the shapes have influence on the recognition of the shapes*. Identification of models of the shapes corresponds to holistic perception and comparison to the existing prototypes of the shapes.

From the fourth grade students testing we conclude that when children were asked to identify shapes (squares, triangle, circle, oblong), most of the correct answers was present in those shapes that correspond to the prototype of these shapes. This finding also corresponds with van Heel theory about geometrical thinking. However, we expected that the level of geometrical thinking will be higher for fourth grade students of elementary school and they will at least achieve the level of analysis.

After the data analysis we formulated the following findings (categories) about the misconceptions of children and the biggest identification problems:

1. A significant problem is caused by confusion with spatial and planar shapes when the cube is considered to be a square, pyramid considered to be a triangle and cuboid is considered to be an oblong. ( )
2. The greatest difficulties with the identification of models of squares cause squares with the diagonals in vertical and horizontal position. ( )
3. When identifying rectangles (squares, oblongs) the greatest difficulties are caused by shapes with holistic resemblance of rectangles without vertices. ( )
4. During rectangles shape identification (squares, oblongs) pupils often choose the shapes that are without right inner angles and therefore, these are not models of rectangles. ( )
5. The identification of triangles showed that children do not notice relevant parts of the triangle (sides and vertices). They often choose a shape that is not the model of triangle as it does not meet any of the defining attributes of the triangle and identify it as a triangle. ( )

6. For children the elliptical shapes cause the greatest difficulty in identification of circles. ( )

When we compare the results of the pre-school children and results of the fourth grade students from the elementary school, all of the present misconceptions are usually identical. It means, that the initial imaginaries (pre-concepts) are very strong, stable and last longer during life.

These findings show that it is important to present to children the elementary school models of the shapes in different positions and also “counterexamples” (non-models) of the concrete shape. These can be shapes that resemble the prototype but do not meet at least one of the criteria of the shape. A multitude of experiences and the use of terminology have potential to offer to children an environment where they can re-evaluate their preconceptions and create correct mental representations of the abstract concepts from the planar geometry field.

7. Conclusions

The aim of our research activities is to find out the evidence of misconceptions of pre-school and younger school aged children and to find arguments for the need of further analysis in the context of national curricular documents and educational approaches in the sphere of planar geometrical shapes and their properties. Within this goal we tried to identify the most common misconceptions of children in pre-school and younger school age about triangles, squares, oblongs and circles. These misconceptions occur already in pre-school age of children and the question is whether the primary education of mathematics sufficiently contributes to their successive elimination.

Implicative graphs with the graphs of success rates of pupils in identification of models and non-models of elementary planar geometric shapes enabled us to identify those shapes that caused bigger problems to the pupils; respectively pupils have misconceptions about them.

We assume that the cause of these misconceptions can be the fact that the pupils and children have only little experiences with the manipulation with the shapes. It is important to provide not only models but also non-models of these shapes. At the same time, it is very important to discuss the properties of planar shapes, especially those that determine the definition of the shape. It is not sufficient if the pupil knows only the name of the shape. Knowing and naming its elementary properties is a must for the pupil in order to differentiate the shape from other planar shapes. It is useful to focus on models and non-models of individual shapes from real life. Furthermore, it is needed to distinguish between the shape and a form. For examples, if a shape is really a triangle or it just has a triangular form (a traffic sign “Give way” does not have to be a good example for illustration of a model of a triangle but it is a good example of a shape with triangular form).

These recommendations are addressed especially to the teachers in primary education. To reduce the problems mentioned above in the teaching process at the pre-primary and primary education, special attention should be paid in preparation of future teachers ([Çontay and Duatepe Paksu, 2012](#); [Fujita and Jones, 2006](#); [Marchis, 2012](#)), not only from the professional but also from the didactical point of view.

Examined facts are consistent with the standards of performance for primary education in Slovakia which states that the pupil is able to “distinguish between planar geometric shapes: triangle, circle, square and oblong”. The problem is that educational materials often show just the samples of models of shapes and very often only in standard positions. At the same time, it is necessary to note that a detailed methodology for this sphere of education is missing in Slovakia. Based on the discovery of misconceptions of pupils about geometric shapes it is possible to prepare appropriate methodical materials for teachers at primary stage of education, include appropriate tasks into textbooks and handbooks of mathematics, as well as to suggest source materials to expand mathematical content of National educational program ISCED₁ which would eliminate presence of identified misconceptions (see [State Educational Curriculum, 2009](#)).

8. Support and acknowledgement

This article is written within the framework of a study supported by the grant VEGA 1/0440/15 “Geometric Conceptions and Misconceptions of Preschool and School Age Children”.

The article was copy-edited by volunteers MB Van Veen (Canada) and Lynette Kruger (South Africa). Without their kind and selfless assistance this publication would not be possible.

References

[Çontay, Duatepe Paksu, 2012](#) – *Çontay, E. G., Duatepe Paksu, A. (2012). Preservice Mathematics Teachers’ Understandings of the Class Inclusion between Kite and Square. *Procedia – Social and Behavioral Sciences*. 55. Vol. 55, 782-788.*

[Fujita, Jones, 2006](#) – *Fujita, T., Jones, K. (2006). Primary Trainee Teachers’ Understanding of Basic Geometrical Figures in Scotland. Proceedings 30th Conference of the International Group for the Psychology of Mathematics Education. Prague: PME. Vol. 3, 129-136.*

[Hejný et al., 2006](#) – *Hejný, M. et al. (2006). Creative Teaching in Mathematics. Prague: Charles University.*

[Marchis, 2012](#) – *Marchis, I. (2012). Preservice Primary School Teachers’ Elementary Geometry Knowledge. *Acta Didactica Napocensia*. Volume 5, Number 2, 33-40.*

[Musser et al., 2001](#) – *Musser, G. L., Burger, W. F., Peterson, B. E. (2001). Mathematics for Elementary Teachers. New York: John Wiley*

[Van Hiele, 1986](#) – *Van Hiele, P. M. (1986). Structure and Insight. A theory of Mathematics Education. Orlando: Academic Press Inc.*

[Van Hiele, 1999](#) – *Van Hiele, P. M. (1999). Developing Geometric Thinking through Activities that Begin with Play. *Teaching Children Mathematics*, Vol. 5, 310–316.*

[De Villiers, 2010](#) – *De Villiers, M. (2010). Some Reflections on the Van Hiele Theory. Invited plenary from 4th Congress of teachers of mathematics. Zagreb. Retrieved from: <http://frink.machighway.com/~dynamicm/vanhiele-reflection.pdf>*

[Usiskin, 1982](#) – *Usiskin, Z. (1982). Van Hiele Levels and Achievement in Secondary School Geometry. (Final Report of the Cognitive Development and Achievement in Secondary School Geometry Project.) Chicago, Illinois: University of Chicago.*

[Žilková, 2013](#) – *Žilková, K. (2013). Teória a prax geometrických manipulácií v primárnom vzdelávaní. Praha: Powerprint.*

[State Educational Curriculum, 2009](#) – *State Educational Curriculum. (2009). Štátny vzdelávací program Matematika (Vzdelávacia oblasť: Matematika a práca s informáciami) Príloha ISCED 1. Bratislava: Štátny pedagogický ústav. Retrieved from: http://www.statpedu.sk/sites/default/files/dokumenty/statny-vzdelavaci-program/matematika_isced1.pdf on 10-04-2017.*



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.

All rights reserved.

Published in the Slovak Republic

European Journal of Contemporary Education

ISSN 2304-9650

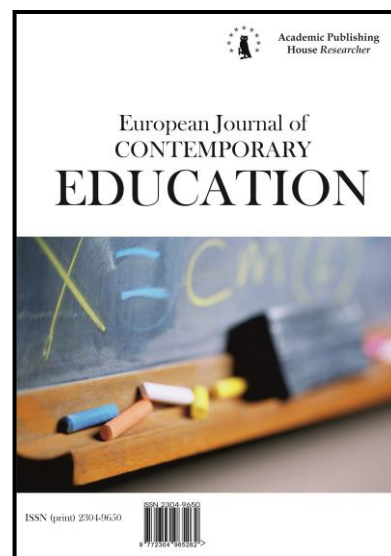
E-ISSN 2305-6746

2017, 6(3): 516-529

DOI: 10.13187/ejced.2017.3.516

www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



The Problems of Contemporary Education

Directions, Objectives, and Author's Concepts of Audiovisual Media Interpretations of School and University Theme in the Soviet Cinema of the "Thaw" Period (1956–1968)

Alexander Fedorov^{a, *}, Anastasia Levitskaya^b, Olga Gorbatkova^a, Anvar M. Mamadaliev^c

^a Rostov State University of Economics, Russian Federation

^b Taganrog Institute of Management and Economics, Russian Federation

^c International Network Center for Fundamental and Applied Research, Russian Federation

Abstract

The "thaw period" films (1956–1968) on the school/university topic can be conditionally divided into two stages: early (1956–1963) and late "thaw" (1964–1968), although, naturally, there was a somewhat diffusion between these periods. The "thaw" audiovisual texts about school and university life, according to the authorities, were to support the main course of the state policy in the educational and socio-cultural spheres of the time, that is, to show that the Soviet education and culture system is being reformed: 1) the educational process is out of the strict Stalin's framework (while retaining general communist landmarks and a rigid anti-religious orientation); 2) the relationship between teachers and students is becoming more democratic, to some extent, creative, based on the experience of Soviet educators / innovators of the 1920s; 3) there are problem zones at school and university (for example, the taboo was removed from the previous interpretation of a Soviet teacher's image as almost an ideal representative of the most educated part of the people). The first "thaw" stage was more or less characterized by a romantic reliance on the pedagogical experience of revolutionary Soviet pedagogy of the 1920s and the creation of touching lyrical stories, where, despite minor difficulties, the harmony of good teachers and,

* Corresponding author

E-mail addresses: 1954alex@mail.ru (A. Fedorov), a.levitskaya@tmei.ru (A. Levitskaya), gorbatkova.olga@yandex.ru (O. Gorbatkova)

sometimes, flawed and misled at the beginning, but later good students, won. In the course of the second stage of the "thaw", new tendencies began to manifest themselves more often: on the one hand, the crisis, the disappointment and fatigue on the part of teachers, and on the other, the pragmatic cynicism of students.

Keywords: audiovisual text, film, the USSR, school, university, students, pupils, teachers, cinema.

1. Introduction

In this article, we address the goals, objectives, and author's concepts of audiovisual media interpretations of school and university in the Soviet cinema of the "thaw" period (1956-1968). Here, as in our previous work (Fedorov et al., 2017), relying on the technologies developed by C. Bazalgette (Bazalgette, 1995), A. Silverblatt (Silverblatt, 2001: 80-81), W.J. Potter (Potter, 2001) and U. Eco (Eco, 1998; 2005: 209), we conduct a general hermeneutic analysis Soviet feature films, taking into account such key concepts of media education as "media agencies", "media/media text categories", "media technologies", "media languages", "media representations" and "media audiences".

2. Materials and methods

The material of our research is comprised of audiovisual media texts on the theme of school and university. The main method is a comparative hermeneutic analysis of Soviet films of the thaw era (1956–1968) concerning this subject (including: analysis of stereotypes, ideological analysis, identification analysis, iconographic analysis, plot analysis, character analysis, etc.). We also review and analyze books and articles related to school and university in films (Anninsky, 1991; Arcus, 2010; Grigorieva, 2007; Zharikova, 2015; Mitina, 2015; Mykhailin, Belyaeva, 2012; Paramonova, 1975; Pukhachev, 2008; Romanova, 2012; Soloveitchik, 1975; Fedorova, 2012; Shipulina, 2010; Youngblood, 2012; Prokhorov, 2007, etc.).

3. Discussion

The "thaw" (1956–1968) in the USSR quite significantly changed media interpretations of school and university. A characteristic feature of the this period was the so-called "return to Lenin's norms of life," which in practice meant that, politicians tried to take, from their point of view, the most valuable aspects of the 1920s policy. As for the schools – it meant democracy elements in the educational process, a certain, albeit constrained by ideology, creative freedom of teachers and students. As A. Prokhorov aptly notes, films about school in the 1960s reflected the general spirit of the revived utopianism (Prokhorov, 2007).

In this context, it is interesting to compare two films of the 1960s depicting schools of the 1920s: *Beat, the Drum!* (1962) and *Republic of SHKID* (1966).

The first of these films, made during the "early thaw" period, is a mixture of naive (although perhaps timeserving disguised as "naive") ideas of the authors about the total rightness of the communist reformers of the school system (young characters organizing the pioneers' community) and the negative image of the representatives of the old gymnasium (the teacher of mathematics and the best, well-born students of the class).

The second one, on the contrary, (also somewhat naively, but sincerely) asserts the possibility of integration of the best representatives of the pre-revolutionary intelligentsia (the principal of school for orphans named after Dostoevsky – Viktor Nikolayevich Sorokin, nicknamed VikNikSor) in the process of creating a new school. VikNikSor in the filigree performance by S. Jursky is "a great idealist and utopian. Vikniksor believes that a person is unique, and the collective of unique people can be an association of creative individuals who do not have to give up themselves and freedom to be together" (Arcus, 2009).

Both films were shot in black and white for a reason, so that the image on the screen reminded viewers of the surviving chronicles of the 1920s. However, against the mediocre visual background of *Beat, the Drum!*, the picture of the *Republic of SHKID* was sophisticated and esthetic, an excellent play of light and shadow referring the audience to the silent film classics. Equally extraordinary was the film montage. Actors' performance in the *Republic of SHKID* was significantly superior to the straightforward interpretation of the characters in *Beat, the Drum!*

As for the use of black and white picture in films depicting schools, in our opinion, it was not always justified. Of course, the intention of the authors of *Beat, the Drum!* (1962) and the *Republic of SHKID* (1966) to produce films resembling a newsreel from the 1920s is understandable. But what drove a director to choose to film in black and white a merry satirical comedy "*Welcome, or No Trespassing!*"? Most of the other films depicting school and university (*Spring in the Riverside Street*, 1956, *See You Next Spring*, 1960; *My Friend, Kolka*, 1961; *Mishka, Serega and I*, 1961; *Wild Dog Dingo*, 1962, *We Love You*, 1962, *Come Tomorrow*, 1962, *Call, open the door*, 1965, *I Loved You ...* (1967), *We'll Live Till Monday*, 1968, *The Transitional Age*, 1968, *The Man-to-Man Talk*, 1968, etc.) could have been color. Apparently, there are good reasons why in the XXI century with the help of computer processing (I think, without any damage to the artistic expression), color versions of the popular films were created – *Spring in the Riverside Street* (1956) and *Come Tomorrow* (1962).

Presumably, Soviet cinematographers of the 1960s were too susceptible to the fashion for the black-and-white stylistics of the French "new wave" and "cinema-verite", believing that modern films about schoolchildren should be as close as possible to the "chronicle" image.

The film *Mishka, Serega and I* (1961) is a vivid example of the school's film interpretation in the initial phase of the "thaw" period. Two conflicts unfold concurrently: 1) an eighth grade boy Igor now and then makes mistakes, taking up with punks, then with a selfish and foppish boxing trainer; 2) a young class teacher cannot establish contact with his eighth grade. In the course of the film viewers see obvious signs of a deficit of socialist times: a queue to buy a TV is so long that shoppers have to come daily to register in the waiting list, and builders fail to finish an apartment house by May 1 without the help of high school children who work there as electrical installers after school. However, conflicts are resolved by the end of the film: the young teacher becomes schoolchildren's favourite, and Igor gives his friends the word to be an exemplary Komsomol member. Notably, before this promise he utters a lofty monologue: "For people like me, there is no place in communism! But without communism I will not live! ... And without the Komsomol I can not live!". Most likely, this phrase appeared in the film as a reaction of scriptwriters to the adoption by the 22nd CPSU Congress (1961) of the Charter of the CPSU, including the Moral Code of the builder of communism, whose material base was promised to be created by 1980.

By the way, the rhetoric about communism in the thaw films depicting education system underwent a curious transformation. While in the picture *Mishka, Serega and I* (1961) these words sound quite seriously, and the drama about parents and children *Big and Small* (1963) ends with pretentious narrative comment: "Why did you not ask yourself: Was I a communist in my family life?", the film *Citizens and Organizations, please note* (1965), produced only two years later, features a high school student who comes up with a device activated by the movement of students along the school corridor which immediately plays a recording of a cheerful voice: "Stop! Are you ready to live and work in communism?", shown with an obvious irony. Two years later the authors of *Valentin Kuzyaev's Personal Life* (1967) went further: in the key episode of the film, located in the television studio, the then popular band "Singing Guitars" is performing a cheerful pro-Communist song with the words: "Do you want to go camping? Yes! Do you want a million? No!", while the main character, a not very intelligent high school student Kuzyaev listens to it without any enthusiasm and, contrary to previous school film standards, he never becomes better than he is by the end of the film.

L. Arcus, in our opinion, very accurately noticed the characteristic feature of the thaw period films about schoolchildren: in the 1960s, not all of them portrayed a non-conformist character being corrected under the influence of mentors, peers and parents. For example, in the film *My friend, Kolka!* (1961) "there is a class of children. There is a boy standing out of the crowd, Kolka Snegirev. But this time he is not a renegade and egoist, but on the contrary – a bright individuality, an artist, a man who searches for truth, and not a form, for real, not imaginary. He requires breathing from life, and sincerity from the people. He is clearly loved by authors and spectators. His class wants to help him, get over troubles – but without the intention to change him, to assimilate with others. They like him the way he is. It's not a fantasy genre, it is a "thaw" period film with its charming ability of wishful thinking" (Arcus, 2009). The truth is, the film did not escape from some treacle, especially in a touchingly happy ending, when Kolka, the founder of the SSoCS (Secret Society of C-Students), deftly defeats carnappers and deserves the gratitude of the police and a vigorous pioneer song of classmates.

Non-standard students with strong personality and subtle inner world were the main characters in many other school films of the 1960s: *Wild Dog Dingo* (1962), *Call, open the door* (1965), *I loved you ...* (1967), *We'll Live Till Monday* (1968), *Transitional Age* (1968), *The Man-to-Man Talk* (1968).

The cinema images of Soviet teachers changed in the thaw period, too. Very important in this respect is the image of a school teacher from the melodrama *Spring in the Riverside Street* (1956). Here, perhaps, for the first time in the Soviet cinema, a story of the student's love for his teacher appeared. Actually, the authors of the film made sure that there was nothing shocking in this situation: the love story unfolds within the walls of the evening school, the students of which are although young, but grown-up people – workers of the metallurgical plant.

Despite the lyrical melodrama of this story, it contained a kind of ideological overtone: in fact, according to the then ideological doctrine, the working class was "the main component of the structure of Soviet society, the bearer of knowledge necessary for Soviet people" and therefore could "teach the teachers (the intelligentsia) what is impossible to learn in any institution: to be a real Soviet person" (Grigorieva, 2007). And the main character – the teacher of the evening school Tatiana – is so young and inexperienced, that is really likely to fall in love with a charming Sasha, her, so-to-speak, "mentor" from the working class. On the other hand, thanks to the talent of the film's creators, the situation was ambiguous: "in a typical melodrama of the 1930s, Sasha would be entrusted with saving Tanya from herself, but *Spring in the Riverside Street* boldly leaves the question of who has improved who open (Youngblood, 2012: 177).

In the earlier mentioned film *My Friend, Kolka!* (1961) the previously unshakably positive image of a teacher / mentor appears in the form of two rival characters: a liberal one and a conservative one. A conservative is the teacher Lydia Mikhailovna. In fact, she and a chairman of the pioneer council Valera Novikov "could become the ideal heroes for films in the previous decades. Always with some unfortunate young character who tore himself away from the collective and placed own interests above the interests of the class and school, there appeared to a number of wiser and more reasonable teachers and comrades ready to teach a harsh moral lesson, threatening to expel from school or exclude from pioneers or Komsomol members. But Lydia Mikhailovna and Valera Novikov are not portrayed as ideal carriers of collective wisdom" (Artemieva, 2015: 54-55): an active public figure and an excellent student Valera is a cynical informer, while a teacher is an avid party functionary (she coordinates all her work with the opinion of the district committee of the CPSU) and a retrograde.

Liberal vs. conservative pedagogical conflicts arose later in the films *My name is Kogea* (1963), *Trains go past the windows* (1965), *We'll live till Monday* (1968) and many others.

In particular, in the drama *Trains Go by the Windows* (1965), the headmaster of a provincial boarding school, remarkably performed by L. Krugly, at first seems to be a positive democrat and a wise mentor for children and teens, while a traditional duo of a conservative middle aged school teacher and a young teacher (a recent graduate of the university) unfolds along. However, gradually, the image of the ironic headmaster gives away the authoritarian features of a tough, soulless manager, and he turns out to be much more dangerous for a young heroine than explicit conservatives.

Seemingly an outspoken conservative and a negative character in the satirical comedy *Welcome, or No Trespassing!* (1964) – the principal of the pioneer summer camp Dynin, brilliantly performed by Y. Evstigneev, is also not so straightforward: he sincerely desires that the institution entrusted to him is kept in order (though supported by denunciations), so that schoolchildren get full nutrition (and not chat while eating), play active games (but quietly), bathe in the river (under supervision and in shallow parts), watch movies in the evenings (but without love episodes).

Another negative image of a teacher, however presented more harshly, appeared in the film *What if it's love?* (1961). There's a scandal at school: a strict teacher of the German language gets a love letter, written by a high school senior Boris addressed to his classmate Ksenia. Ideologically brought up Maria Pavlovna is certainly very worried: honour and moral standards of Soviet school are challenged. Thus, due to her interference, relationships of Ksenia and Boris are being discussed by school faculty, their classmates, parents, and neighbours.

Today the conflict of the film by Y. Raizman *What if it's love?* seems to be trifle: school seniors date, so what? However in 1961 things were different. The problem of the first teenage love,

that fell under the social pressure, was discussed earnestly in almost all press. In a word, this film had about the same resonance in the 1960s, as *Little Vera* in the end of the 1980s.

Sexual motif was, perhaps, the boldest one in the Raizman's film, because strict Stalin's censorship that ruled in the 1930s-1950s, did not let premarital sexual contacts between school students (and youth in general) on the screen. It was only in the NEP (New Economic Policy in Russia in the 1920s) period that Soviet cinema could afford making such a film as *A Prostitute* (1927). In the sound Soviet cinema (until the Perestroika), love affairs of young women could only be depicted in retro period films, such as film adaptation of Leo Tolstoy's (*Resurrection*) and Panas Mirny's *Hooker*, where main characters were young "fallen" women, but action took place, naturally, during the times of "hated Tsar's regime".

We agree with an opinion that the motif of sexual guilt was born by the Soviet culture's Puritanism, grounded in the 1930s both socialistically and socially realistically. In the 1960s the love language was slowly rehabilitated, but the sex language only remains to exist within medical or obscene vocabularies. According to Maria Pavlovna and Ksenia's mother, sex before marriage is something catastrophically amoral. "Better" characters (for example, a young teacher) clean Boris and Ksenia's love of suspicions in "this". The thaw period film criticism followed the same route" ([Romanova, 2012: 192](#)). Sexual context in school films was so important for Soviet society and state, that it was argued about in the Central Committee of CPSU, in the Ministry of Culture and The Cinematographers' Union. As a result, the film scene of intimacy between Boris and Ksenia was cut shorter and voiced over.

Lev Anninsky wrote that "the message of Raizman's film is that he plunged the plot in the atmosphere of thick everyday life, social force, rigid predetermination, small pinpricks that people stung, killed the feeling with" ([Anninsky, 1991: 82](#)). Iconographic analysis of the drama *What if it's love?* reveals its other differences from "thaw" optimism. Black-and-white visual picture distinctly portrays gloomy ill-provision, as though borrowed from the famous black sequence of Polish cinema of the late 1950s: black windows of the new, still not inhabited flats, dusty grounds around apartment buildings, windy emptiness around the new neighbourhood ([Romanova, 2012: 194](#)). Moreover, it turns out that a lot of secondary film characters are united not because of mutual positive values, but because of their desire to hurt the feelings of vulnerable teens in love.

Surprisingly, a melodrama *Story of the First Love* (1957), produced 4 years earlier, did not give rise to such censorship tornado, although it contained such plot twists that in our opinion, could have shocked the chaste Soviet public: 1) a ninth grader falls in love with his classmate and he wins her affection, too; 2) a PE teacher openly pesters his pretty student; 3) defending his girlfriend's honour, the main character courageously fights against an indecent teacher. One has to agree that no Soviet film about school until the 1980s depicted anything like the second and the third point. However, unlike Y. Raizman's film, *Story of the First Love* didn't contain any sexual scenes, and most importantly, all the plot's rough angles were smoothed by the soft lyricism of a melodrama, where even the "bad guy" PE teacher sincerely sings a hit song "Why, oh, why, I don't know, I believed your blue eyes..." The actors' age, performing ninth graders was deliberately distanced from school: J. Osmolovskaya was 19, K. Stolyarov – 20, and V. Zemlyanikin – 24.

The film made by the end of the thaw period – *We'll live till Monday* (1968), defined the authors' understanding of the Soviet school crisis as a model of the state crisis. L. Arcus accurately points out that a History teacher Melnikov in this drama is a kind of a white crow, an outsider: "almost invisible ripple of anguish runs through his face: because of ignorance ("There is no such a verb in the Russian language, my dear, save our ears"), because of vulgarity ("Baratynsky is a poet of the secondary importance"), of silliness ("Folly should be a fool's private property"), of lies and profanation of his subject ("Look at the textbook published this year"). In rendering it sounds like dissidentism, but Tikhonov succeeds most in expressing the state of hopeless torment when he's silent. It's amazing, what acting school we have lost! There are a lot of close-ups in the film, and one can write a book about the ways Tikhonov *watches*. The way he looks at his students: at a poet Genka Shestopal, he sees himself as if in the mirror; at a cynical handsome guy Batischev – seeing an eternal opponent. He watches his whole class at the end of the film having a presentiment of what is going to happen to each of them, and being aware that nothing could be changes. The main colour of his portrait is ash fatigue" ([Arcus, 2009](#)). This having no alternative weariness explains why a bachelor Melnikov is not in a hurry to return affection of a pretty English teacher, why in

spite of his intense longing for a different job, he continues teaching History lessons, subjected to political climate.

On the other hand, there's something "unprofessional" about Melnikov. He looked at school as if from the outside, and he taught a lesson as though it was his first day in class and he came across the emotional deafness of pupils for the first time" (Soloveichik, 1975).

Though his main pedagogical opponent, a Literature teacher Svetlana Mikhailovna is "limited, teaches her subject "from here to here", dryasdust, self righteous, and avidly follows instructions, apart from other film teachers in the past, she has neither jolly enthusiasm, nor fanaticism. Only loneliness and again, fatigue" (Arcus, 2009).

Thus, *We'll live till Monday* no less than M. Khutsiev's masterpiece *July Rain* (1966), finely demonstrated the crisis (or even the collapse) of "thaw" ideals in Soviet intelligentsia, who sharper than others felt the essence of regressive political, social and cultural tendencies in the USSR.

Nevertheless, the major "thaw" school film, in the allegoric form having depicted the bureaucratic model of the authoritarian Soviet state, was a bold comedy *Welcome, or no Trespassing!* directed by Elem Klimov based on the script by Semyon Lungin and Ilya Nusinov.

Perhaps we can agree with the opinion that the main technique in the film is an oxymoron, a combination of the incongruous: "the film's title is positioned in the frame as a political satire: the sign "Welcome" with a shining sun adorns the tightly closed gates of the camp (the most deft, however, know where you can climb through a hole in the fence). Lower is an peephole with the suspicious word "or"; and, finally, at the bottom – "No Trespassing"; all together is a typical example of foreign policy of the socialism times. The word "or" allows one to assume a choice between both parts of the name, and equate them with the meaning "that is" (Fedorova, 2012: 218).

Soviet censorship, of course, went through this film of E. Klimov with his unwavering ideological hand, but did not succeed in deciphering the essence of the satirical film text to the full extent.

For example, many scenes of E. Klimov's film feature a persistent overhead slogan: "Children are the masters of our camp!", that, on the one hand, caused associations with the state, built by the camp type, and on the other hand, it hinted at the sheer hypocrisy of using the word "masters" in it, since in the USSR the real masters of life were party bosses and bureaucrats, and not workers, peasants and their children.

Unlike the period of the 1920s – early 1950s, the Soviet cinema of the "thaw" era increasingly touched upon the subject of university. Sometimes in the comedic genre (*Come Tomorrow*, 1962, *Madness*, 1965), but mostly in the (melo) dramatic (*Different Fates*, 1956, *They Met on the Way*, 1957, *The City lights up*, 1958, *Peers*, 1958, *1, Newton Street*, 1963).

In the films *Different Fates* (1956), *The City lights up* (1958) and *Peers* (1958), the theme of the university played a marginal role. In the melodrama *They met on the Way* (1957) – is was the key one. The girl who successfully entered the pedagogical college gives a helping hand to the worker who failed the entrance exams, as a result, the young tutor and her student fall in love with each other, and the latter, of course, becomes a successful student next year. In between, a cute career-centered student deserves public condemnation, and a gray-bearded "old school" professor sings songs together with his students. In a word, the film, although from the "thaw" period, was absolutely tied (both by the plot and style) to the late Stalin's epoch.

In the popular musical comedy *Come Tomorrow* (1962) a provincial girl Frosya, thanks to innate vocal abilities, enters the conservatory and, despite all sorts of obstacles and absurdities, eventually becomes a favorite of a wise teacher. A film with such a simple story and with such a heroine could have also appeared in the late 1940s, 1950s, and even in the 1970s.

Another film about students is *1, Newton Street* (1963). It also tells a story of a provincial guy who enters a university in the capital, but in the genre of a drama. Student Timothy faces a serious life test: his scientific work, written together with a classmate, wins a prestigious competition, but ... soon it turns out that it contains an awkward mistake. A weak classmate begs Timofey not to tell anyone about this, but he rejects this dishonest proposal and leaves for his hometown, where, he works on a new version of scientific work. Perhaps, there are no particular hallmarks of the thaw period. Stories about high tones students, for whom the truth is the most valuable asset, often unfolded in (audiovisual) texts both in Stalin's times and in post-thaw times, too. Only some details in *1, Newton Street* give us a hint about its historical background: poets performing at the Mayakovsky's monument, Y. Kim's songs and expressive camera work.

4. Results

The "thaw period" films (1956–1968) on the school/university topic

Place of action, historical, social, cultural, political, and ideological context

1. *Historical context (dominant concepts: "media agencies", "media categories", "media representations" and "media audiences").*

a) features of the historical period when media texts were created, market conditions that contributed to the idea, the process of creating media texts, the degree of influence of that time on media texts.

The timeframe for the historical period of the "thaw" has been defined conditionally from 1956 (denunciation of Stalin's personality cult at the XX Congress of the CPSU) to 1968 (the invasion of Soviet troops in Czechoslovakia).

The main characteristics of this historical period:

- condemnation of Stalin's personality cult;
- end of mass terror of the state's citizens, while maintaining a "milder" struggle (which, as a rule, did not involve prolonged imprisonment and physical extermination) with dissenters (like Boris Pasternak, Andrei Sinyavsky, Alexander Solzhenitsyn, and others);
- the continuation of the process of industrialization (mainly heavy and military industries);
- agricultural reforms (development of virgin lands, creation of economic councils, etc.);
- realization of the state program of mass housing construction;
- a successful start of the "space era" (launching the world's first satellite, the world's first cosmonaut);
- renewal of the communist ideology, oriented to the works of V. Lenin and post-Stalinist ideologists, with less intense than, for example, in the 1920s, but still open fight against religion;
- official theses about the established unified community of the Soviet people and the absence in the USSR of class, ethnic, national, and racial problems;
- the rejection of the idea of the world revolution and the proletariat's dictatorship, replacing it with the idea of a "peaceful coexistence of socialist and capitalist systems" (which, of course, did not exclude the ideological confrontation against bourgeois states, the militarization, unleashing local military conflicts, intervention in Hungary (1956) and Czechoslovakia (1968), military and economic support of pro-communist regimes in developing countries, for example, in Cuba).
- a drastic growth of film production, the resumption of the Moscow International Film Festival;
- expansion (still with censorship) of scope of creative freedom in the cultural sphere, including literature, theater and cinema;
- the gradual curtailment of the "thaw" tendencies (including the cinema), the reduction of the criticism of Stalinism (after Leonid Brezhnev came to power in October 1964) against the backdrop of solemn celebrations of Soviet communist jubilees on a national scale.

"The Law on Strengthening the School's Contact with Life and on the Further Development of the Public Education System in the USSR" (1958) began another reform of the Soviet educational system. The obligatory education was 8 years. An 11-year program incorporating vocational (two days a week) as well as academic training replaced the traditional ten-year primary and secondary general school. The role and share (up to 15 %) of vocational training in the educational process sharply increased. It was assumed that schoolchildren will work twice a week in special training workshops (or plants/factories), and General Certificate of Education will be supplemented with a certificate of the acquired vocational qualification. By 1962 all seven-year-schools were turned into eight-year schools. However, it soon became clear that enhancement of labor training had a negative effect: the level of knowledge of students in basic subjects dropped. That is why, in September 1966, the Soviet school returned to a ten year program again, and the idea of professional training within the school curriculum, was left behind.

Table 1. Key dates and events in the USSR and the world in the "thaw" period (1956–1968): politics, economy, and culture

| Years | Key dates and events in the USSR and the world in the "thaw" period (1956–1968): politics, economy, and culture |
|-------|--|
| 1956 | <p>Khrushchev's secret speech, denouncing the deceased Joseph Stalin made to a closed session of the 20th Congress of the Communist Party of the Soviet Union: February 25.</p> <p>Pro-Stalin's riots in Tbilisi: March.</p> <p>"Cominform" (Communist Information Bureau) was dissolved: April 17.</p> <p>Resolution of the CPSU Central Committee "On Overcoming the Personality Cult and Its Consequences": June 30.</p> <p>The cancellation of tuition fees in the senior classes of secondary school, as well as in secondary special and higher educational institutions of the USSR : September.</p> <p>The Hungarian Revolution: October 23 – November 9.</p> <p>The Suez crisis in Egypt: October 30 – December 22.</p> <p>The High Courses for Film Directors (higher education establishment) opened in Moscow: November.</p> |
| 1957 | <p>Letter of CPSU Central Committee about "Fostering political work of party organizations among masses and suppression of attacks of anti-Soviet hostile elements": January.</p> <p>Plenum of CPSU Central Committee on Literature and Art: June 22-29.</p> <p>The exclusion from the leadership of the CPSU of the "anti-party opposition" (G. Malenkov, V. Molotov, L. Kaganovich, D. Shepilov): June 29.</p> <p>World Festival of Youth and Students in Moscow: July 28-August 11.</p> <p>A test of the first Soviet intercontinental ballistic missile capable of reaching the territory of the United States.</p> <p>The successful launch of the world's first artificial satellites: October - November.</p> <p>The publication in the western countries of the novel by B. Pasternak <i>Doctor Zhivago</i>: November.</p> |
| 1958 | <p>The Soviet film <i>The Cranes Are Flying</i> is awarded the main prize of the Cannes Film Festival – Palme d'Or: May.</p> <p>Exhibition of American abstractionists in Moscow.</p> <p>The opening of the monument of V. Mayakovsky in Moscow, where poets freely performed: July.</p> <p>The award of the Nobel Prize for Literature to Boris Pasternak - "For significant achievements in contemporary lyrical poetry, as well as for the continuation of the traditions of the great Russian epic novel" (<i>Doctor Zhivago</i>). The denunciation of Boris Pasternak by the USSR authorities and the leaders of the Union of Soviet Writers: October.</p> <p>Boris Pasternak is expelled from the Soviet Writers' Union: October 27.</p> <p>"The law on strengthening the school's connection with life and the further development of the system of public education in the USSR": December 24.</p> <p>Adoption of the "Fundamentals of Criminal Legislation", abolishing the concept of "enemy of the people", raising the age of criminal liability from 14 to 16: December 25.</p> |
| 1959 | <p>The victory of pro-communist revolutionaries in Cuba: January 1.</p> <p>Order of the Minister of Culture of the USSR "On serious shortcomings of ideological and educational work in the All-Union State Institute of Cinematography": January 18.</p> <p>XXI Congress of the CPSU: the proclamation of the complete and final victory of socialism: January 27 – February 5.</p> <p>Opening of the American exhibition in Moscow: July 25.</p> <p>The First Moscow International Film Festival: August 3–17.</p> <p>Negotiations between Nikita Khrushchev and D. Eisenhower in the United States: September 15–27.</p> |
| 1960 | <p>Resolution of the Central Committee of the CPSU "On the tasks of party propaganda in the modern conditions": January 9.</p> |

| | |
|------|--|
| | <p>The U.S. spy plane, piloted by G. Powers is shot down: May 1. The election of L.I. Brezhnev as the Chairman of the Presidium of the Supreme Soviet of the USSR: May 4. Opening of the Higher two-year scriptwriters' courses in Moscow: November 1.</p> |
| 1961 | <p>Soviet note of protest to US President J. Kennedy, related to the the anti-Castro landing in Cuba: April 8. Launch of the world's first Soviet spacecraft with a man on board: April 12. Decree of the Presidium of the Supreme Council of the USSR "On Strengthening the Struggle Against Persons Who Avoid Socially Useful Work and Lead an Antisocial Parasitic Way of Life": May 4. The beginning of the construction of the Berlin Wall: August 13. XXII Congress of the CPSU. Adoption of the new Program and the new Charter of the CPSU. Decision on the removal of Stalin's remains from the tomb in Mausoleum: October 7–31.</p> |
| 1962 | <p>The increase in prices for meat (by 30 %) and milk (by 25 %) in the USSR: June 1. The demonstration of Novocherkassk workers who protested the increase for food prices is dispersed by gunfire: June 2. Decree of the Central Committee of the CPSU "On measures to improve the leadership of the artistic cinematography": July 19. Resolution of the Central Committee of the CPSU "On increasing the effectiveness of statements by the Soviet press": September 18. After the start of the installation of Soviet missiles in Cuba, the US declares a sea blockade of the island. The politically tense Caribbean crisis begins, which forces the USSR to remove missiles from Cuba in exchange for the US promise to abandon the occupation of the "Island of Freedom": October 14 – November 20. "New World" journal publishes Alexander Solzhenitsyn's novel <i>One Day of Ivan Denisovich</i>: November. Nikita Khrushchev visits an exhibition of Moscow artists in the Manege (today Moscow Art Exhibition): December 1.</p> |
| 1963 | <p>The meeting of the leadership of the CPSU with the creative intelligentsia of the USSR in the Kremlin: March 7–8. Resolution of the Central Committee of the CPSU and the Council of Ministers of the USSR "On measures for the further development of higher and secondary education": May 9. Reaching the agreement between the USSR and the United States on creating a "hot" telephone line between Moscow and Washington: June 20. Resolution of the plenum of the Central Committee of the CPSU "On the forthcoming tasks of the party's ideological work": June. Jamming of the Voice of America, BBC and German Wave programs in Russian on the territory of the USSR ceased. The assassination of the US President J. Kennedy in Dallas: November 24.</p> |
| 1964 | <p>Report of the KGB to the Central Committee of the CPSU on the anti-Soviet attitudes of VGIK students. Resolution of the Central Committee of the CPSU "On the film studio Mosfilm": February 3. The US starts the war in Vietnam: August 2. Plenum of the Central Committee of the CPSU removes Nikita Khrushchev from power and elect Leonid Brezhnev the First Secretary of the CPSU Central Committee: October 14.</p> |
| 1965 | <p>Alexey Leonov, leaving his spacecraft for 12 minutes, becomes the first person to walk in space: March 18. The USSR supplies missiles to North Vietnam: April 5. David Lean's film of <i>Doctor Zhivago</i>, starring Omar Sharif and Julie Christie, is released: December.</p> |

| | |
|------|--|
| 1966 | France withdraws from the NATO military organization: February 21. XXIII Congress of the CPSU: March 29 – April 8. The visit of French President General de Gaulle to Moscow: June 20 – July 1. |
| 1967 | Six-day war in the Middle East, breaking diplomatic relations between Israel and the USSR: July 5–10. Resolution of the Central Committee of the CPSU "On measures for the further development of social sciences and enhancing their role in communist construction": August 14. Solemn celebration of the 50th anniversary of Soviet power: November. |
| 1968 | Order Committee on Cinematography of the USSR "On the purchase and rental of foreign films" (for the purpose of excluding the penetration of bourgeois propaganda on the Soviet screen): July 31. "Student Revolution" in Paris: May. The resumption of the USSR jamming the broadcasts of "Voice of America" and other western radio stations in Russian on the USSR territory: August 20. The invasion of Soviet troops in Czechoslovakia: August 21. The publication of A. Solzhenitsyn's <i>The First Circle</i> abroad: December. |

Soviet "thaw" audiovisual texts on the subject of school and university, according to the authorities, were supposed to support the main lines of the then state policy in the educational and socio-cultural spheres, that is, to show that the Soviet system of education, upbringing and culture is being reformed, and namely:

- the educational process goes beyond the previous strict framework of the Stalinist rules (while maintaining common communist landmarks and a rigid anti-religious orientation);
- the relationships between teachers and students are becoming more democratic, creative, based on the experience of Soviet pedagogues – innovators of the 1920s;
- there are some problem zones at school and university (in particular, the interpretation of the image of the Soviet teacher as an ideal representative of the educated part of the society was de-idealized).

Genre modifications of school and university subjects: drama, detective, less often – melodrama, comedy.

b) how does the knowledge of true historical events of a particular period help to understand the given media texts, examples of historical references in these media texts.

In the films *Flags on the Towers* (1958), *Beat, the Drum!* (1962), *The First Teacher* (1966), *Republic of SHKID* (1966), the pioneer movement of the 1920s and the pedagogical direction of Soviet teachers (like A. Makarenko, V. Soroka-Rosinsky, etc.) was shown as a positive approach. The films *Clouds over Borsk* (1960), *Miraculous* (1960), *Sinful Angel* (1962), consistently reflected the anti-religious state policy. The films *Welcome, or No Trespassing!* (1964), *Trains Go by the Windows* (1965) and *We'll Live till Monday* (1968), featured some teachers with serious professional flaws. *Story of the First Love* (1957), *What if it's love?* (1961), *Wild Dog Dingo* (1962), *I Loved You...* (1967) depicted the problem of love relations between high school students.

In the Soviet films of the "thaw" period, schoolchildren, of course, could be featured sitting in meetings, condemning someone for misconduct (for instance, religiosity or laziness). But on the whole, the cinematic focus of the interpretation of the school and university theme shifted towards the ordinary school life, to the development of the personality (*Wild Dog Dingo*", 1962, *The Gulf Stream* (1968), *We'll Live Till Monday*, 1968, *The Man-to Man Talk*, 1968, *Transitional Age*, 1968, etc.), to the examination of the inner world of teachers (*Trains Go by the Windows*, 1965, *The First Teacher*, 1966, *We'll Live Till Monday*, 1968, *Literature Lesson* (1968), etc. At the same time, schoolchildren (unlike their film counterparts in the 1920s and 1930s) no longer appeared on the screen as some sort of conductors of the communist tomorrow, leading the lost adults on the right track.

2. *Socio-cultural, ideological, religious context (dominant concepts: "media agencies", "media categories", "media representations" and "media audience").*

a) *ideology, directions, goals, objectives, world outlook, the concepts of the media texts' authors in the socio-cultural context; ideology, culture of the world, depicted in these media texts.*

In the period of the thaw, communist ideology (including anti-capitalist, anti-religious orientation, the theory of socialist realism) in the USSR continued to dominate. Filmmaking was also under censorship (albeit less strict than in the 1930s and 1940s). Therefore the authors of the majority of audiovisual media texts on the school-university theme were to comply with these rules of the game. In fact, in some films (such as, *Welcome, or No Trespassing!*, 1964, *We'll Live Till Monday*, 1968, *Literature Lesson*, 1968), these rules were violated by certain oddities that arose, as it seemed, in spite of the genre or thematic field, say - whimsical rhythms, fancies of intonation, figurative accents in "wrong" places or seemingly irrelevant artistic arrangement of the narrative. Film viewers who anticipated to watch another innocent drama soon began to feel uncomfortable. They could not help feeling that though everything seemed to be clear and correct in the film, yet something was wrong, something was subtly annoying and makes the perception unsettled (Kovalov, 2016: 11).

b) the world outlook of the characters in media texts about school

In general, the worldview of the characters of audiovisual media texts on the theme of school and university during the thaw, as in the previous three decades, was optimistic, at that time the optimism was connected with the prospects of building "socialism with a human face". Students - vivid personalities were often ridden by doubts (*Wild Dog Dingo, I loved you...*, *We'll live till Monday*, etc.). Doubts and reflections were also characteristic of screen teachers, too (*Trains go by the windows, We'll Live Till Monday, Literature Lesson*, etc.).

At first glance, the hierarchy of values, according to this world view, has remained the same: communist ideology, collectivism, diligence, honesty, atheism, willingness to give a helping hand to good or flawed people. But there were also new colors: audiovisual media texts virtually didn't portray hatred of the internal class enemies, the heroism of the students gave way to everyday events (including first school love); at the same time, the level of critical reflection of reality has noticeably risen. For example, a school teacher from the witty comedy "Literature Lesson" not only openly dislikes his randomly chosen profession, but sets himself the task of living for at least one day ... without lying (of course, it was for this seditious intention that the film was banned for screening).

Thus, it was the model of "socialism with a human face," rather than classical communist ideals, that determined the world view of the characters in the audiovisual "school world" of the thaw period. And it was this model that quickly began to disappear when the end of the thaw by the Brezhnev regime after the events in Czechoslovakia in 1968, when Soviet tanks were brought into Prague in fear that "socialism with a human face" could win in a single state.

3. Structure and narrative modes in media texts (dominant concepts: "media categories", "media technologies", "media languages", "media representations")

Schematically, the structure, plot, representativeness, ethics, genre modifications, iconography, characters of audiovisual media texts about school and university in "thaw" period can be presented as follows:

a) *the location and time period in media texts*. Leaving aside the plots where schoolchildren and students appeared (often episodically) only outside the walls of educational institutions (let us recall, Valery, the schoolboy from the *Elusive Avengers* who, fighting the enemies of Soviet state, actually never appear at school), one can say that the main location in films on the school theme of the "thaw" era is school classes and corridors, and the plot is set mostly (if it's not a retro about 1920s) at the time when the film is made.

b) *the environment typical for these media texts, household items*: the furnishings and household items of school films are still modest, at times ascetic (as, for example, in *The First Teacher*).

It is very indicative that in Soviet films on the school topic in many cases "there is no private space for a teenager – his room. Most often because of its actual absence due to the poor housing situation in the country, but even when the room is there, nothing there characterizes the owner. It's just a room with a bed and a desk, there is not the slightest attribute of its owner. ... The commitment for intellectual and high culture and the neglect of interior and decor. The same reason is why a fashionably dressed character is almost always negative" (Zharikova, 2015: 62).

c) *genre modifications: mostly drama, sometimes melodrama or comedy*.

d) *(stereotyped) devices to depict reality*: positive characters are less often shown as idealized, while negative ones, on the contrary, have deeper dimensions than just a caricature.

However, relapses, of course, are possible. For example, in the professionally helpless *Boys* (1959), a cheesy teacher brings to the class a model of the space satellite, thus causing a sensation in the class only consisting of diligent and perfect schoolchildren. And in the detective story *Shadows of an Old Castle* (1966), a super-positive teacher who instantly finds contact with schoolchildren takes a job in an Estonian boarding school located in an ancient castle, very soon finds out that the key faculty members (presented rather grotesquely) are former Nazis and treacherous enemies of Soviet power.

e) *character typology (character traits, clothing, physique, vocabulary, facial expressions, key gestures, presence or absence of the stereotypical manner of representing the characters in these media texts):*

- the age of characters: the age of schoolchildren is in the range of 7–17 years, however, teenagers are more common. The age of the adult characters (teachers, parents, grandparents, etc.) can be anything, but adults below 60 prevail;

- the education level: for schoolchildren it corresponds to their class; the teachers presumably graduated from higher education institution, supporting characters can have any level of education;

- social status, occupation: the financial situation of the students is approximately the same, they can be either from the families of workers and farmers, or from the intelligentsia. The professions of their parents are in a fairly diverse range.

- the marital status of the characters: schoolchildren, naturally, are not bound by marriage; adult characters are mostly married, however, single teachers appear in film more frequently;

- appearance, clothes, body build, features of their characters, vocabulary: the appearance of schoolchildren and students in the films of the "thaw" period is in the framework of then popular ideas about how the students should look (for example, wearing school uniform was obligatory).

A shot from the movie *What if it's love?* (1961) gives a good idea of the appearance, clothes, physique of characters – schoolchildren.

School children in the thaw films are mostly not so purposeful, bold, polite and active as their peers from the moving pictures in the 1930s, but on the whole they remain optimistic about life. However, more and more often negative characters appear, the hopes for reformation of whom are not as big as they used to be.

Teachers from the films of the early thaw period look similar to those in the 1930s and 1940s: they were distinguished by modesty in clothes. Teachers' clothes don't follow fashion. They look more like a uniform: a dark suit, a skirt/trousers and a jacket with a white or light blouse, classical shoes. Classical hairdo for a female teacher is a hair bun (Tatiana Sergeevna (a teacher from the film *Spring in the Riverside Street – A.F. & A.L.*) at home walks around with loose hair, but she gathers it in a bun every time she goes to work)" (Grigorieva, 2007).

Late thaw film teachers are no longer perceived by unambiguous symbols of the struggle for communism, they have lost an ideal halo, and more often they are in doubts, discontent with their life. Another serious, symptomatic for modern culture as a whole, a social problem, articulated by Soviet cinema, is a social gap decrease between a teacher and a student (Shipulina, 2010). In particular, in the comedy *Literature Lesson* (1968), a young teacher is on back-slapping terms with a struggling student.

A shot from the movie *We'll Live Till Monday* (1968) reflects the appearance, clothes, physique of the characters-teachers of the late thaw years.

Negative image of school and teachers of the "tsarist regime" in the thaw period occupied a marginal place in Soviet cinema (*The First Bastille*, 1965).

f) *a significant change in the life of media characters:* schoolchildren live a normal life, but among them there are students who: learn poorly (*Big and Small*, 1963, *Attention, Citizens and Organizations*, 1965; *Three and a half days from the life of Ivan Semyonov, a second-grader and a repeater*, 1966), behave badly (*My name is Kogia*, 1963, *Three and a half days from the life of Ivan Semyonov, a second-grader and a repeater*, 1966), are exposed to bad influence (*Mishka, Serega and I*, 1961), become religious (*Clouds over Borsk*, 1960, *Miraculous*, 1960), lay hands on other people's money (*We love you*, 1962), fall in love earlier the due age (*Story of the First Love*, 1957, *What if it's love?*, 1961, *Wild Dog Dingo*, 1963, *I loved you*, 1967).

j) *the challenge that the characters face:* disturbance of the habitual life, because a character, for different reasons not fitting into the standard framework of school life, shows up.

i) *solving the problem*: early thaw period: "correct" characters (schoolchildren, teachers, parents) individually or together, return nonconformist schoolchildren to ordinary life (*My Name is Kogia*, 1963, *Three and a half days from the life of Ivan Semenov, a second grader and a repeater*, 1966, *Mishka, Serega and I*, 1961, etc.); peak and decline of the thaw: negative characters (conservative teachers, parents, counselors and other retrogrades) successfully or unsuccessfully try to restore the status quo (*What if it's Love*, 1961, *My friend, Kolka!* .. 1961, *Welcome, or No Trespassing!*, 1964, *Trains Go by the Windows*, 1965).

5. Conclusion

In summary, the "thaw period" films (1956–1968) concerning school/university can be conditionally divided into two stages: early (1956–1963) and late (1964–1968), although, of course, there was a certain diffusion between the cinematography of these periods.

These audiovisual texts, according to the authorities, were supposed to support the main state policy in the educational and socio-cultural spheres, that is, to show that the Soviet system of education, upbringing and culture is being reformed: 1) the educational process goes beyond the previous strict framework of the Stalinist rules (while maintaining common communist landmarks and a rigid anti-religious orientation); 2) the relationships between teachers and students are becoming more democratic, creative, based on the experience of Soviet pedagogues – innovators of the 1920s; 3) there are some problem zones at school and university (in particular, the interpretation of the image of the Soviet teacher as an ideal representative of the educated part of the society was de-idealized).

The early thaw stage was characterized by a romantic reliance on the pedagogical experience of the revolutionary Soviet pedagogy of the 1920s and the creation of touching lyrical stories, where, despite minor difficulties, the harmony of good teachers and, at first, stumbling but in the end, good students, won.

During the second stage of the thaw, new tendencies were manifested increasingly frequent: on the one hand, the crisis, the disillusionment and fatigue of teachers, and on the other hand, the pragmatic cynicism of students.

6. Acknowledgements

This research was funded by the grant of the Russian Science Foundation (RSF, project No. 17-18-01001) at the Rostov State University of Economics. Project theme: "School and university in the mirror of Soviet, Russian and Western audiovisual media texts". Head of the project is professor Alexander Fedorov.

References

- Anninsky, 1991 – Anninsky, L. (1991). *The sixties and we*. Moscow: Cinema Center, 255 p.
- Arcus, 2010 – Arcus, L. (2010). Adventures of a white crow: evolution of a "school film" in Soviet cinema. *Seance*. June, 2. <http://seance.ru/blog/whitecrow/>
- Artemieva, 2015 – Artemieva, E.A. (2015). Typology of images of adolescents in the Soviet film drama 1960s–1980s. PhD Dis. Moscow, 2015.
- Bazalgette, 1995 – Bazalgette, C. (1995). *Key Aspects of Media Education*. Moscow: Association for Film Education.
- Eco, 1998 – Eco, U. (1998). *Lack of Structure. Introduction to Semiology*. St. Petersburg: Petropolis, 432 p.
- Eco, 2005 – Eco, U. (2005). *The Role of the Reader. Studies on the Semiotics of the Text*. St. Petersburg: Symposium, 502 p.
- Fedorov et al., 2017 – Fedorov, A.V., Levitskaya, A.A., Gorbatkova, O.I. (2017). School and university in the mirror of audiovisual media texts: basic approaches to the research problem. *Media education*, № 2.
- Fedorova, 2012 – Fedorova, M. (2012). *Welcome, or No Trespassing (1964)*. Noah's Ark of Russian Cinema. Moscow: Globus-Press, pp. 218–222.
- Grigorieva, 2007 – Grigorieva, O. (2007). The image of the teacher in the Soviet cinema: from the "Spring" thaw to "Big break". *Visual anthropology: new views on social reality*. Saratov: Scientific book, 223–239.
- Kovalov, 2016 – Kovalov, O.A. (2016). *Studies of the strange*. St.-Petersburg: Séance, 328 p.

[Mikhailin, Belyaeva, 2012](#) – *Mikhailin, V., Belyaeva, G.* (2012). The historian in hysterics. Teacher of History in the Soviet cinema of the 1960s–1970s. *Involuntary stock*. No. 5 (85).

[Mitina, 2015](#) – *Mitina, T.S.* (2015). The image of a teacher in the Soviet cinema of the "thaw" period. *Siberian Scientific Bulletin*. N 4, pp. 150-156.

[Paramonova, 1975](#) – *Paramonova, K.K.* (1975). Films for children, its specifics, and educational functions. Moscow: Publishing House of the Institute of Cinematography, 51 p.

[Potter, 2001](#) – *Potter, W.J.* (2001). Media Literacy. Thousand Oaks – London: Sage Publication, 423 p.

[Pukhachev, 2008](#) – *Pukhachev, S.B.* (2008). Evolution of the teacher's image in the Russian cinema (the experience of analyzing the cultural memory of the generation). Soviet culture in the modern social space of Russia: transformations and perspectives. Ekaterinburg.

[Report..., 1961](#) – Report of the cultural department of the CPSU Central Committee on Y. Raizman's film *And if it's love?*, 1961.

[Romanova, 2012](#) – *Romanova, O.* (2012). *And if this is love?* Noah's Ark of Russian Cinema. Moscow: Globe-Press, pp. 190-194.

[Shipulina, 2010](#) – *Shipulina, N.B.* (2010). The image of a teacher in Soviet and modern Russian cinema. *Izvestiya of Volgograd State Pedagogical University*, № 8 (52), pp. 4-16.

[Silverblatt, 2001](#) – *Silverblatt, A.* (2001). Media Literacy. Westport, Connecticut – London: Praeger, 449 p.

[Soloveichik, 1975](#) – *Soloveichik, S.L.* (1975). Teacher: a profession and fate. Soviet screen. N 20.

[Youngblood, 2012](#) – *Youngblood, D.* (2012). *Spring in the Riverside Street*. Noah's Ark of Russian Cinema. Moscow: Globus-Press, pp. 175-179.

[Zharikova, 2015](#) – *Zharikova, V.V.* (2015). Chronotope school in the Russian film. *Historical, philosophical, political and juridical sciences, cultural studies and art history. Theory and practice*. № 5 (55): Part II. pp. 59-62.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.

All rights reserved.

Published in the Slovak Republic

European Journal of Contemporary Education

ISSN 2304-9650

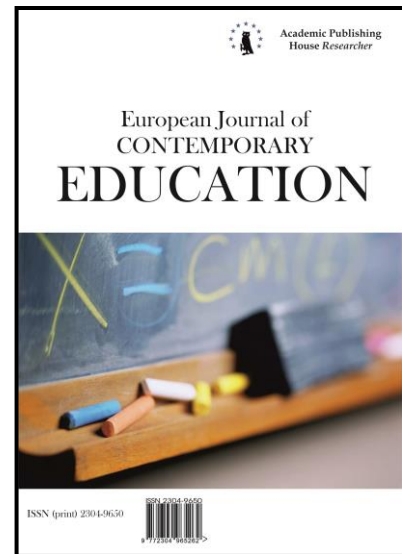
E-ISSN 2305-6746

2017, 6(3): 530-541

DOI: 10.13187/ejced.2017.3.530

www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



Education and Knowledge in the Use of Financial Products and Services in Bachelor's Degree Students

Arturo García-Santillán ^{a,*}, Elena Moreno-García ^a, Violetta S. Molchanova ^b

^a UCC Business School, Universidad Cristóbal Colón, Mexico

^b International Network Center for Fundamental and Applied Research, Russian Federation

Abstract

This study seeks to determine a university student's knowledge and culture in relation to money; the way they plan their budget, their economic independence and consumer habits, the level of debt, and the use of financial services and products. The instrument designed by Aravena-Collao and Mendoza-Letelier (2010) was used for the query among the students of different universities in the conurbation of Veracruz-Boca del Río, México. Findings show that young students maintain an acceptable level of knowledge in basic concepts like credit, savings, investment, and budgets. However, knowledge and use of financial products like savings accounts, credit, and debit cards are almost non-existent.

Keywords: financial knowledge, university students, financial habits.

1. Introduction

The low level of financial literacy has been a worrisome topic in recent years. Today's markets' volatility and uncertainty require better-prepared people, with a broader knowledge that allows them to confront economic challenges.

The knowledge level regarding financial terms and products significantly influences saving and investment decisions. Good or bad habits in personal finance are determined by certain variables that have been identified in several studies (Moreno-García, García-Santillán and Munguía (2013).

According to studies by Lusardi and Mitchel (2009), young adults in the United States don't have sufficient knowledge to make financial decisions. Only 27 % of the youth population have a clear knowledge of topics such as inflation, risk diversification, and simple interest calculation.

* Corresponding author

E-mail addresses: agarcias@ucc.mx (A. García-Santillán), elenam@ucc.mx (E. Moreno-García), v.molchanova_1991@list.ru (V.S. Molchanova)

It was proven in a research with high school students from the Valley of México, that 60% of students understand the concept of inflation. 45.3 % responded correctly regarding risk diversification and only 22.2 % to compound interest (Villagómez, 2016).

This study aims to determine the level of knowledge university students have on basic financial products and services, as well as their use; being that during this stage the majority of people enter the Mexican financial system through bank institutions and commence to develop planning abilities for the use of money. From what is previously stated, factors derived from the students' knowledge can be analyzed regarding finances and decisions made on this matter.

2. Problem statement

The need for a financial education has become increasingly important. While the basic concepts remain the same, the offered products and services are in constant evolution. In accordance with data provided by the World Bank (2015), 38 % of adults worldwide do not make use formal financial services. Furthermore, in studies conducted by the Organization for Economic Co-operation and Development (OECD, 2016) about financial behavior and attitudes in adults, specifically about their financial literacy, evidence shows they have little knowledge which reflects on poor financial decisions; mainly on topics such as budget, future planning, choosing products, and seeking private counseling.

According to Lusardi and Mitchell (2009), having financial knowledge affects people's behavior in their financial decisions, which is why knowing the level of financial knowledge and habits of university students is considered important.

Because of the latter and considering the empirical work of Moreno-García, García-Santillán and Munguía (2013), a pertinent question is if the student has knowledge over money, its uses and applications.

3. Objective

Determine the knowledge and culture regarding money that university students have, belonging to the conurbation of Veracruz-Boca del Río in México; the way they plan their budget, their economic independence, consumer habits, the level of debt, and their use of financial products and services.

4. Literature review and thesis statement

Financial culture deals with a concept that has been researched in different scenarios and times. Vit (2001) defines it as "the ability to read, analyze, manage and communicate about the conditions of personal finances that affect economic wellbeing. This includes the ability to differentiate between financial options, discuss in an educated way topics related to finances and money, being able to plan for the future and answer competently to daily events involving personal decisions of a financial nature".

In various research works, there has been evidence about the effects of having a financial culture, as mentioned by Lusardi (2008), and Lusardi and Mitchell (2009), there is a close relationship between the level of financial education with people's capacity and tendency towards saving and investment, and consequently with personal richness.

A study conducted by the Bolivian Catholic University determines the characteristics of attitudes towards money, in function of sociodemographic factors. It is observed in the study that men have a more positive attitude toward money than women. "Men think that money is a part of happiness, this is directly related to men's view of money as a means to obtain a better life, feeling well with themselves, and above all as a masculinity indicator" (Ledesma, Lafuente, 2005).

In present times financial education is more important than ever before, due to the accelerated growth of markets, the increase of more complex financial products and changes in the pensions system. Which is why there has to be a commitment within organizations for its development and promotion (AMB, 2008).

Financial education, according to the Organization for Economic Co-operation and Development, is defined as "the comprehension process of financial concepts and products, as well as their risks, benefits, opportunities, and abilities that improve decision making and allow a greater economic wellbeing in society. It functions as a tool to promote economic growth, by improving consumers' confidence and stability in institutions" (OECD, 2005).

As a result of the importance the topic of financial literacy has had, the OECD applied a survey in fourteen countries regarding the knowledge levels in this topic. The study was conducted by Atkinson and Messy (2012), and they corroborate that the lack of financial knowledge and other aspects, resulting from the lack of the same, are a reality in various cultures.

A survey applied to Latin-American and Caribbean countries, in terms of financial education initiatives, indicates that even though measuring different cultures' needs in this regard is difficult; Mexico along with Colombia and Brazil have better designed and executed financial education strategies than other countries (García et al., 2013).

According to Castro and García (2009), Latin-American central banks have worked with their own initiatives based on their economies' particular characteristics. But, taking advantage of successful experiences of other international central banks. They place Argentina, Brazil, Chile, and Mexico as the Latin-American countries with more programs and initiatives in favor of financial education in public and private sectors. Financial education is an activity that supports the improvement of this task, which also brings gradual benefits in the context of individual, family, social and economic growth. Discussing also the importance of it being taught by professors through a formal education (Coates, 2009).

These studies demonstrate the relevance that the concepts of financial education and culture have in recent years, and in what way financial inclusion has been a priority subject in Mexico.

The Pontifical Bolivian University through a field study from the researchers Huchín and Simón (2011), conducted a financial education diagnosis in students of three primary schools in Tuxtepec, Oaxaca. For this matter, a survey with 7 variables and 35 questions was applied. The results show on a scale, that the surveyed possess acceptable knowledge regarding financial education. The given recommendations were: to design educational strategies that reinforce the participants' knowledge and elaborate teaching strategies in accordance with the characteristics of the school (rural or urban) to strengthen financial knowledge.

By applying a study directed specifically to teens, Llanos, Denegri, Abello, and Amar (2001) observe that the level of knowledge comprehension of banking services is greater in the middle to high socioeconomic levels and among teens living in multi-financial cities. They mention that a higher ignorance and incomprehension of the aspects evaluated is present in subjects from a low socioeconomic level and cities with an average and limited financial performance. By living in a consumer society, it is discussed that youths have not been adequately prepared and the lack of knowledge will affect their future economic behavior.

Lusardi (2008) states there exists a low financial literacy in the United States within specific demographic groups. Such groups encompass those with low education level, women, African-Americans, and Hispanic. Additionally, they do not receive help from experts or financial advisors in order to make saving or investment decisions. This condition is limiting the ability to save and ensure a comfortable retirement. It is concluded that financial education programs can help improve the saving and financial decision making, but so much more can be done to improve the efficiency of these programs.

Analyzing high school level students in the United States through a 31 item questionnaire, Mandell (2008) identified there is a very low financial education level in comparison to past years. This same instrument was applied to university students, which are near to being an economically literate population.

This study's conclusion is that financial education in high school students is not relevant because the knowledge acquired is forgotten in a short time. Even though the university community is positioned at a high level of knowledge regarding these concepts, they represent only 25 % of youths in America. Which is why the lack of financial literacy is a persisting problem and on the rise among the youth population.

To the observation made above, the study conducted by Villagómez (2016) about the level of financial literacy in high school students can be added. He concluded that men, contrary to women, are more familiar with financial terminology and products.

Another important reference to descriptive studies in financial education and culture in Mexico is the project named "Cultura financiera en México" (Financial culture in Mexico). This study analyses the level of knowledge and perception people have of different savings and credit instruments and the know-how of financial services and products. As well as identifying the attitudes and values regarding these topics. With a target population classified by social strata,

family, businesses and public entities this study concludes, among other topics, there is a nonexistent short or long-term vision in financial topics for the majority of the population; priorities in the family budget are to cover immediate necessities; banks are not viewed as a first option, the reason being that acquiring financial instruments is at the bottom of the seven investment options judged by the interviewees. Being their priority to establish their own business or the possession of real estate (Meraz and García, 2008).

In a more recent study conducted by García-Santillán, Moreno-García & Gutiérrez-Delgado (2016) to 115 students from Business and Economy Division bachelor's degrees of the UCC Business School at Cristóbal Colón University in Veracruz, Mexico; it was proven that students have the knowledge and ability to elaborate a budget, but score a very low level of knowledge in the remaining variables evaluated.

According to the foregoing, the guiding hypothesis for the study is as follows:

H₀ = University students do not have knowledge of the financial concepts of culture and money, planning and budget, economic independence and consumer habits, level of debt, and they do not make use of financial products and services.

5. Methodology

This is a descriptive study whose objective is to determine the level of knowledge of financial concepts and the use of basic financial products in university students with varying profiles and institutes in the Veracruz-Boca del Río area. The study is non-experimental because no manipulation of the independent variables was conducted, and because data was collected in a specific time period it is transversal, the time period for the study is 2017.

The study centers in university students with varying profiles and from different institutes located in the metropolitan area Veracruz-Boca del Río and surrounding municipalities, during the months of February and March 2017. The convenience sampling method was used with the student population registered in the state of Veracruz during the school period of 2015 to 2016, comprised of 178,397 students. The population could not be stratified for each municipality for the purpose of applying the formula for finite populations. The reason was that data for each municipality could not be acquired, neither by Institute or city, that allowed a population stratification and sample calculation.

The data gathering was conducted electronically and in person. Students and their classmates were invited through social networks, so as to create a snowball effect with the purpose of increasing the sample size. A starting and closure date was established before the application. The database was validated once the threshold of 150 observations or cases was surpassed. The criteria for the database are: linearity, normality, homoscedasticity. The established criterion for the sample gathering was to only survey university students from educational institutes from the state of Veracruz. A total of 189 surveys were answered, 95 of them were answered online and 94 in person. The questionnaire of Aravena-Collao and Mendoza-Letelier was used. It measures the level of financial knowledge in university students.

Said instrument is divided into 5 sections: Culture and money, planning and budget, economic independence and consumer habits, the level of debt, use of financial products and services.

To compare the working hypothesis, the hypothesis test of proportion (H₀: p < 0.5, H₁: p > 0.5) was conducted, afterward the percentage for every case that falls within that range was calculated from each item with the following consideration:

$$Z = \frac{\hat{P} - p}{\sqrt{\frac{pq}{n}}}$$

Where:

X = sample proportion, n = sample $\hat{P} = \frac{x}{n}$

To be able to undergo the hypothesis test they were operationalized by item groups for each dimension, then the Z value was calculated to compare the hypothesis. The operationalization of the involved variables in this research is detailed in Table 1 to 1.e.

Table 1. Variable culture and money

| Dimensions | Indicators / Variables | Categories |
|-------------------|---|--|
| Culture and Money | The concept of saving. | Saving money; Emergency money; Not spending; Money in the bank; Economic security; Future anticipation; Does not know; Others. |
| | Origin of their concept of saving. | Family; High school education; Higher education; Does not know; Others. |
| | Concept of investment. | It is a saving; Future benefit: Acquire assets to obtain gains; Create a business; Does not know; Others. |
| | Concept of credit. | A debt; A loan paid in installments; Investing; Problems; A loan that generates interest; Does not know; Others. |
| | Credit risks knowledge Instruments used for their money management. | Pay high interests; Get into debt and lose assets; Being unable to pay; Does not know; Others. Cash; Credit card; Debit card; A check; Others |

Source: own

Table 1.b Variable planning and budget

| Dimensions | Indicators / Variables | Categories |
|---------------------|--|--|
| Planning and Budget | Budget elaboration knowledge. | Yes; No. |
| | The habit of using budgets (debt registry, expenses, saving, income). | Yes; No. |
| | Most common financial envelope registries. | Saving; Expenses; Debts; Income; Other |
| | Expense control: Are the expenses incurred within their financial possibilities? | Yes; No. |
| | The frequency for which their income does not cover their expenses. | Frequently; Not that frequently; Rarely. |

Source: own

Table 1.c Variable economic independence and consumer habits

| Dimensions | Indicators / Variables | Categories |
|---|---------------------------------|---|
| Economic independence and consumer habits | Housing situation: Cohabitation | His Parents; Family; Partner; Friends; Alone; Others |
| | Housing situation: location. | Own house; Family's house; Pension; Tent; Other |
| | Main income sources. | Parents' contribution; Steady job; Odd jobs; Partners contribution; Other family members; Scholarships; Grants; Other people; Investments; Others. Others |

| | |
|--------------------------------------|---|
| Level of income. | 0 - \$1,000; \$2,000 - \$4,000; \$5,000 - \$8,000; \$9,000 - \$12,000; \$13,000 - \$15,000; More than 15,000 |
| Distribution of income | Food; Housing; Health; Education; Entertainment; Academic expenses; Clothing; Technology; Investments; Saving; Other |
| Future distribution of income. | Saving; Clothing; Investment; Own house; Car; Education; Preventive health care; |
| Future income expectation. | Less than \$6,000; \$6,000 – \$9,000; \$10,000 – \$12,000; \$13,000 – \$15,000; \$15,000 – \$20,000; \$20,000 – \$25,000; \$25,000 – \$30,000; More than \$30,000 |
| Saving habit. | Saving; have saved before; No |
| Saving motivation. | To acquire a product or service; Travel; Investment; As a precaution; Other |
| Bank savings | Yes; No. |
| The reason for not saving in a bank. | Low-interest rate; Unknown subject; Mistrust; Many requisites; Not interested; Others |

Source: own

Table 1.d Variable use of financial products and services

| Dimensions | Indicators / Variables | Categories |
|--|--|--|
| Use of financial products and services | Frequency of reading or searching of information about financial products. | Frequently; Not that frequently; Rarely. |
| | Means of conducting financial operations | Bank branch; ATM; Internet; All; None. |
| | Knowledge of the product credit card | Yes; No. |
| | Use of credit card | Yes; No. |
| | Perception of credit card sales | Security; Promptness; Practicality; Other; None. |
| | Use of credit card | Yes; No. |
| | Type of credit card. | Department stores; Multi-store; Bank; Supermarket; Others. |
| | Perception of credit card sales | Ease of payment; Purchasing power adjustment; Security; Expense planning guarantee; None; Others |

Source: own

Table 1.e Variable level of debt

| Dimensions | Indicators / Variables | Categories |
|---------------|------------------------------|---|
| Level of debt | Who do you have a debt with? | Bank; Family member; Department stores; Friends; Partner; Others. |
| | Magnitude of debt | 0 – \$2,000; \$2,001 – \$5,000; \$5,001 – \$7,000; \$7,001 – \$10,000; More than \$10,000 |
| | Student loan | Yes; No. |
| | Type of student loan | Bank; Government; Solidarity loan; Other |
| | Perception of student loan | A debt; Investment; Both; None. |

Source: own

6. Data Analysis

The results that were found are presented below. The information is divided by each section considered in the survey, so is the general information.

Table 2. General data

| | | | |
|--------------|--------|-------------------------------|------|
| General Data | Age | 18 to 20 | 57 % |
| | | 21 to 23 | 39 % |
| | | 24 or more | 5 % |
| | Gender | Female | 52 % |
| | | Male | 48 % |
| | Origin | Local (Veracruz-Boca del Río) | 60 % |
| Foreign | | 40 % | |

Source: Own

It is observed that the most representative range regarding age is located in students with ages from 18 to 20 years. The majority are women native to Veracruz or Boca del Río, representing 60 % of the sample total.

Table 3. Academic Background

| | | |
|-------|-------------------------|------|
| Areas | Economic-administrative | 56 % |
| | Humanities | 7 % |
| | Biological | 11 % |
| | Exact | 26 % |

Source: own

As shown in Table 3, the surveyed students of the economic-administrative area represent 56 % of the sample. The smallest proportion of surveyees being the humanities area with 7 %. The test for the working hypotheses established with the (Z) statistical method for the cases H₁.....H₃₅ is presented below.

Considering a normal distribution:

| | | | |
|------------------------|------|---|--|
| n: | 189 | $Z = \frac{\hat{P} - p}{\sqrt{\frac{pq}{n}}}$ | |
| p: | 0.5 | | |
| q: | 0.5 | | |
| | | | |
| Significance α: | 0.05 | | |

Hypotheses Testing

Variable: Money Culture

- H1: The majority of students have a concept of saving.
- H2: The majority of students acquired their concept of saving only in the family nucleus.
- H3: The majority of students have a concept of investment.
- H4: The majority of students have a concept of credit.
- H5: The majority of students consider paying high interests as the main risk of credit.
- H6: The majority of students manage their money in cash.

Table 4. Result H_1 to H_6

| | x | n | Value of Z | Critical value | Value of P (1- critical value) | Decision |
|-------------------------|-----|-----|--------------|----------------|-----------------------------------|------------------|
| H_1 | 189 | 189 | 13.747 | 0.9999 | 0.0001 | Reject H_0 |
| H_2 | 113 | 189 | 2.691 | 0.9964 | 0.0036 | Reject H_0 |
| H_3 | 189 | 189 | 13.747 | 0.9999 | 0.0001 | Reject H_0 |
| H_4 | 186 | 189 | 13.311 | 0.9999 | 0.0001 | Reject H_0 |
| H_5 | 81 | 189 | -1.9639 | 0.0251 | 0.9750 | Not reject H_0 |
| H_6 | 132 | 189 | 5.455 | 0.9999 | 0.0001 | Reject H_0 |

Source: own

The results show evidence enough to reject the null hypotheses 1, 2, 3, 4 and 6, not so with 5. The latter allows to point out that the student mainly knows what saving is, given that within the family nucleus this concept has been promoted. Furthermore, the investment and credit topics are familiar to them. However, in terms of credit and the risks inherent to it, apparently the payment of high interests is not one of the main underlying variables associated with the risk contracted when acquiring a credit; in any case, they consider other associated variables to this effect such as the loss of assets or simply not being able to repay the debt.

Lastly, we were able to learn that of the surveyed population the majority of students manage their money in cash, more so than any other instrument like a credit card. This is logical if we reason that the student is no a likely candidate to qualify for a credit. Attributable to the fact that they are not someone with a stable job who can prove to have their own income, on the contrary, they depend on their family's support for their education.

Variable: Planning and budget

H_7 : The majority of students know how to elaborate a budget.

H_8 : The majority of students have a register of their financial items (debt, expense, income, and saving).

H_9 : The most important registry for students is that of expenses.

H_{10} : The majority of students maintain a level of expenses according to their income.

H_{11} : The students' expenses rarely exceed their income.

Table 5. Result H_7 to H_{11}

| | x | n | Value of Z | Critical value | Value of P (1-critical value) | Decision |
|----------------------------|-----|-----|--------------|----------------|----------------------------------|------------------|
| H_7 | 149 | 189 | 7.9285 | 0.9999 | 0.0001 | Reject H_0 |
| H_8 | 116 | 189 | 3.1277 | 0.9999 | 0.0001 | Reject H_0 |
| H_9 | 80 | 189 | -2.1094 | 0.0179 | 0.9821 | Not reject H_0 |
| H_{10} | 160 | 189 | 9.5288 | 0.9999 | 0.0001 | Reject H_0 |
| H_{11} | 99 | 189 | 0.6546 | 0.7422 | 0.2578 | Not reject H_0 |

Source: own

With the exception of the null hypotheses 9 and 11, the result gives enough evidence for the rejection of the null hypotheses 7, 8 and 10. Based on this information it is possible to say that a big portion of the surveyed population consider they have the ability to do a budget and have a registry of their financial items. A fact that allows them to maintain a level of expense in accordance with their income.

It is also possible to identify that students give importance not only to the registry of their expenses but also to their income or savings. In spite of this, it was also found that in various occasions their expenses surpassed their income.

This proves that, even though the surveyed students have knowledge in the matter of financial planning and creating budgets, their tools are not the most adequate; as many times their expenses exceed the planned budget.

Variable: Economic independence and consumer habits

H12: The majority of students live with their parents.

H13: The majority of students live in their own house.

H14: The majority of students have income because of parents' contributions.

H15: The range of income for the majority of students is located between \$2,000.00 to \$4,000.00.

H16: The main item their income is destined for is food.

H17: The majority of students aim to destine their future income to the procurement of their own house.

H18: The majority of students consider that after graduating they will maintain an income between \$13,000.00 to \$15000.00.

H19: The majority of students save.

H20: The main motivation for saving among university students is to obtain a product or service.

H21: The majority of students keep their money in a savings account.

H22: The main reason for not having a savings account is because of the students' lack of interest.

Table 6. Result H12 to H22

| | <i>x</i> | <i>n</i> | <i>Value of Z</i> | <i>Critical value</i> | <i>Value of P</i> (1- <i>critical value</i>) | <i>Decision</i> |
|------------|----------|----------|-------------------|-----------------------|--|-----------------|
| H12 | 136 | 189 | 6.0373 | 0.9999 | 0.0001 | Reject Ho |
| H13 | 88 | 189 | -0.9456 | 0.1736 | 0.8264 | Not reject Ho |
| H14 | 154 | 189 | 8.6559 | 0.9999 | 0.0001 | Reject Ho |
| H15 | 74 | 189 | -2.9823 | 0.0014 | 0.9986 | Not reject Ho |
| H16 | 166 | 189 | 10.4017 | 0.9999 | 0.0001 | Reject Ho |
| H17 | 110 | 189 | 2.2549 | 0.9878 | 0.0122 | Reject Ho |
| H18 | 25 | 189 | -10.1107 | 0 | 1.0000 | Not reject Ho |
| H19 | 121 | 189 | 3.8551 | 0.9999 | 0.0000 | Reject Ho |
| H20 | 91 | 189 | -0.5091 | 0.3085 | 0.6915 | Not reject Ho |
| H21 | 78 | 189 | -2.4003 | 0.0082 | 0.9918 | Not reject Ho |
| H22 | 48 | 189 | -6.7647 | 0 | 1.0000 | Not reject Ho |

Source: own

According to the results obtained, there is not enough evidence in order to allow the rejection of the null hypotheses 13, 15, 18, 20, 21 and 22, not so with 12, 14, 16, 17 and 19. These data indicate that the majority of students do not own a house and live in their parents' house, who continue to be their main source of income.

The income for each student depends on the socioeconomic level of their family. Which is why it can't be assured that the income for the majority is between \$2,000.00 to \$4,000.00 as was assumed at the beginning. Proving that for the majority the item food is the one they destine the greater part of their income.

Regarding their aspirations, the majority of students believe they will earn less than \$10,000.00 after graduating. A result higher than \$13,000.00 was expected. However, the majority coincide in destining their future income in acquiring their own house.

Lastly, it was found that the majority of the surveyed students have the habit of saving in order to acquire a product or service. As well as for different ends such as investment or travel. Even so, they are not interested in having a savings account, they lack the necessary information about this product offered by financial institutions.

Variable: Level of debt

H23: The majority of students is indebted to a family member.

H24: The debt range maintained by the majority of students is between \$0.00 to \$2,000.00.

H25: The majority of students do not have a student loan.

H26: The student loan that is most common is the bank student loan.
 H27: The majority of students consider student loans as a debt.

Table 7. Result *H23* to *H27*

| | <i>x</i> | <i>n</i> | <i>Value of Z</i> | Critical value | Value of P (1- critical value) | Decision |
|------------|----------|----------|-------------------|----------------|-----------------------------------|---------------|
| H23 | 31 | 189 | -9.2378 | 0 | 1.0000 | Not reject Ho |
| H24 | 157 | 189 | 9.0924 | 0.9999 | 0.0001 | Reject Ho |
| H25 | 157 | 189 | 9.0924 | 0.9999 | 0.0001 | Reject Ho |
| H26 | 26 | 189 | -9.9652 | 0 | 1.0000 | Not reject Ho |
| H27 | 11 | 189 | -12.1474 | 0 | 1.0000 | Not reject Ho |

Source: own

There was not enough evidence found in the results to reject the null hypotheses 23, 26 and 27, which indicates the students' level of debt is low. Because of their restricted access to financial products, their families become their main financing source. In the same manner, it is proven that they do not have a bank loan for their university studies, they do not even qualify one. However, in the case of hypotheses 24 and 25, there is enough evidence to reject both null hypotheses. The latter allows highlighting that students have mainly low debt levels, which does not exceed a maximum limit of \$2,000.00 pesos.

Likewise, it was found that the majority of students do not have a student loan, which is in agreement with the level of personal debt and the source of their financial culture. This is explained by the fact that their parents and tutors are the ones that finance their studies, and they themselves are the ones that transmit financial knowledge and habits.

Variable: Use of financial products and services

H28: The majority of students frequently research about savings accounts, investments, credit, and retirement funds.

H29: The majority of students conduct their financial operations through the Internet.

H30: The majority of the students have knowledge about what a debit card is.

H31: The majority of students make use of a debit card.

H32. The majority of students consider the main advantage of the credit card is its practicality.

H33: The majority of students use a credit card.

H34: The majority of students have a credit card issued by a bank.

H35. The majority of students consider the main advantage of the credit card is the ease of installments they provide.

Table 8. Result *H28* to *H35*

| | <i>x</i> | <i>n</i> | <i>Value of Z</i> | Critical value | Value of P (1- critical value) | Decision |
|------------|----------|----------|-------------------|----------------|-----------------------------------|---------------|
| H28 | 32 | 189 | -9.0924 | 0 | 1.0000 | Not reject Ho |
| H29 | 52 | 189 | -6.1828 | 0 | 1.0000 | Not reject Ho |
| H30 | 173 | 189 | 11.4200 | 0.9999 | 0.0001 | Reject Ho |
| H31 | 130 | 189 | 5.1644 | 0.9999 | 0.0001 | Reject Ho |
| H32 | 68 | 189 | -3.8551 | 0 | 1.0000 | Not reject Ho |
| H33 | 56 | 189 | -5.6009 | 0 | 1.0000 | Not reject Ho |
| H34 | 46 | 189 | -7.0557 | 0 | 1.0000 | Not reject Ho |
| H35 | 43 | 189 | -7.4921 | 0 | 1.0000 | Not reject Ho |

Source: own

With the exception of hypotheses 30 and 31, the result does not give enough evidence to reject the remaining null hypotheses belonging to the use of financial products and services dimension. The aforementioned allows the affirmation that the majority of students do not research savings accounts, investments, credit, and retirement funds.

As a result, they do not make use of different banking tools and products such as using the Internet to conduct financial operations or signing a contract for a credit card; so that by doing so they could discover the advantages provided by this financial product. We were able to find that from the surveyed population the majority of students have knowledge about what a debit card is, besides also making use of it, for which it can be concluded that for the studied population the debit card is a more accessible product and with a higher demand than a credit card.

7. Conclusions

It is concluded that students have knowledge of financial concepts such as saving, investment, credit, and they know how to establish a budget. Most of them acquire this knowledge within their family, not in school or by self-learning. These results are in line with studies conducted by author (2016), showing that university students have the knowledge of financial services and products; and know how to make a budget but lack the knowledge of other financial concepts that would be useful for financial decision making. The lack thereof is an indicator that financial education in students is deficient.

Regarding independence and consumer habits in students, it was observed that financial operations conducted by youths are usually in cash and rarely through the Internet. The most common financial product is the debit card, but the benefits of the credit card are unknown to them.

Therefore, they do not make use of the credit card. These instruments would allow them access at an early age to the Mexican financial system, allowing them better a judgment to counteract future economic risks. This behavior is a reflection of their lack of financial education.

Furthermore, many of them expect to have a low salary after graduating from a bachelor's degree. In spite of that, they intend to acquire a house of their own. By prioritizing housing in their plans, they procrastinate important subjects such as long-term saving and investment.

The foregoing agrees with the studies conducted by Llanos, Denegri, Abello and Amar (2001), who establish that youths are not being adequately prepared, which will influence their future economic behaviors.

References

- AMB, 2008 – AMB (2008). “Programa de educación financiera de la Asociación de Bancos de México: Acciones y retos” Retrieved from <http://www.banxico.org.mx/publicaciones-y-discursos/publicaciones/seminarios/modernizacion-e-inclusion-financiera-en-america-la/%7BD7A93048-E8D6-B567-FC12-13E8A568B29E%7D.pdf>
- Atkinson, Messy, 2012 – Atkinson, A., Messy, F. (2012). “Measuring Financial Literacy: Results of the OECD/ International Network on Financial Education (INFE) Pilot Study”, *OECD Working Papers on Finance, Insurance and Private Pensions*, núm. 15, OECD. Retrieved of: <http://dx.doi.org/10.1787/5k9csfs90fr4-en>
- Coates, 2009 – Coates, K. (2009). “Educación financiera: Temas y desafíos para América Latina. Retrieved from website of the international conference oede – brasil sobre educación financiera. Rio de Janeiro. <http://www.oecd.org/dataoecd/16/20/44264471.pdf>
- Castro, García, 2009 – Castro, F., García, N. (2009). “La educación económica y financiera en los bancos centrales de América Latina” *Revista del Banco de la República*, 82(984).
- García-Santillán et al., 2016 – García-Santillán, A., Moreno-García, E., Gutiérrez-Delgado, L. (2016). Level of financial education in higher education scenarios: An empirical study on students of economic-administrative area. *IEJME*, 11(8), 3149-3159.
- García et al., 2013 – García, N., Grifoni, A., López, J. C., Mejía, D. (2013). “La educación financiera en América Latina y el Caribe. Situación actual y perspectivas. Serie Políticas Públicas y Transformación Productiva”, 12, Caracas: CAF. Retrieved from: <http://scioteca.caf.com/handle/123456789/379>
- Huchín, Simón, 2011 – Huchín, F., Simón, J. (2011). “La educación financiera en estudiantes de educación básica. Un diagnóstico comparativo entre escuelas urbanas y rurales” *Revista Ciencias Estratégicas de la Universidad Pontificia Bolivariana*. 19(25), pp. 11–34.

Ledesma, Lafuente, 2005 – Ledesma, C., Lafuente, J. (2005). “Actitudes hacia el dinero en jóvenes de 18 a 23 años” *Ajayu. Órgano de Difusión Científica del Departamento de Psicología de la Universidad Católica Boliviana "San Pablo"*, vol. 3, núm. 1, 2005, pp. 0-21 Universidad Católica Boliviana San Pablo La Paz, Bolivia.

Lusardi, 2008 – Lusardi, A. (2008). “Household Saving Behavior: The Role of Financial Literacy, Information, and Financial Education Programs”. *National Bureau of Economic Research*, 13824, pp. 00-44.

Lusardi, Mitchell, 2009 – Lusardi, A., Mitchell, O. (2009). “Financial Literacy among the Young”. *Journal of Consumer Affairs*. Vol. 44(2), pp. 358-380.

Llanos et al., 2001 – Llanos, M., Denegri, M., Abello, R., Amar, J. (2001). “La comprensión del funcionamiento bancario en la adolescencia ¿Crónica de un sobreendeudamiento anunciado?” *Psicología desde el Caribe*, julio-diciembre, 94-109.

Mandell, 2008 – Mandell, L. (2008). “The Financial Literacy of Young American Adults: Results of the 2008 National Jump Start Coalition Survey of High School Seniors and College”. *The Jump Start Coalition for Personal Financial Literacy*. Washington, DC.

Meraz, García, 2008 – Meraz, P., García, L. (2008). “Primera Encuesta Sobre Cultura Financiera en México Banamex-UNAM” *Educación Financiera Banamex*, I Marzo, 10-34.

Moreno-García et al., 2013 – Moreno-García, E., García-Santillán, A., Munguía, J. (2013). Some aspects about financial knowledge of undergraduate students. *International Journal of Management and Sustainability*. Vol. 3. Is. 4. pp. 40-62.

OCDE, 2005 – OCDE. (2005). *Principios y buenas prácticas para la concienciación y Educación Financiera*. Retrieved of: <http://www.oecd.org/finance/financial-education/35108560.pdf>

Villagómez, 2016 – Villagómez, A. (2016). “Alfabetismo financiero en jóvenes preparatorianos en la Zona Metropolitana del Valle de México” *El Trimestre Económico*, LXXXIII (3). Julio-Septiembre, 677-706.

Vit, 2001 – Vit, L. (2001). *Personal Finance and the Rush to Competence: Financial Literacy in the U.S.* Middleburg, VA.: The Fannie Mae Foundation.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.

All rights reserved.

Published in the Slovak Republic

European Journal of Contemporary Education

ISSN 2304-9650

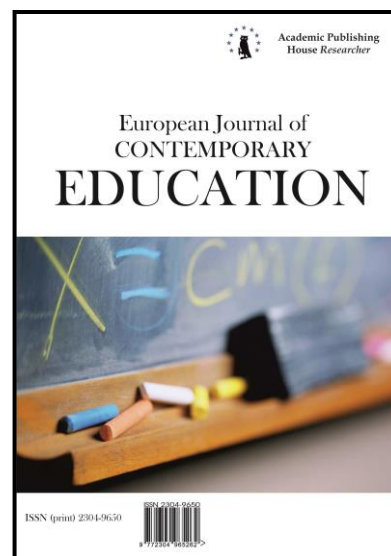
E-ISSN 2305-6746

2017, 6(3): 542-556

DOI: 10.13187/ejced.2017.3.542

www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



The Study of Relationship between Women Teachers' Career Barriers and Organizational Silence: Viewpoint of Women and Men Teachers

Yusuf İnandı ^{a,*}, Meryem Evşen Gün ^b, Fahrettin Gılıç ^c

^a Department of Educational Sciences, Mersin University, Turkey

^{b, c} Ministry of National Education, Turkey

Abstract

The purpose of the study is to reveal the relationship between women teachers' career barriers and their organizational silence, and also whether career barriers predict their silence.* Study group is comprised of 522 teachers working at elementary and high schools in central districts of Mersin. In this descriptive study, data were collected through "Women Employees Career Barriers Scale" (WECBS) and "Organizational Silence Scale" (OSS). It is understood according to research results that there is a medium level relationship between women teachers' career barriers and their organizational silence. Furthermore, women teachers' career barriers are a significant predictor on dimensions of organizational silence.

Keywords: women teachers, career barriers, organizational silence.

1. Introduction

Teaching profession is one of the leading professions attributed to women. It appeals to women in that teaching is identified with motherhood roles, it has flexible working hours, weekend and summer holidays, which is suitable for social gender roles. For that reason, women face no obstacle in teaching profession. However, the number of women in high-level administrative positions is at a very low rate. It is no doubt that there are various reasons for preventing women from attaining high-level positions. These barriers are mentioned in the literature as social gender stereotypes; domestic barriers; glass ceiling barriers; working hour, age, marital status and economic barriers; women's own viewpoints; and school- and environment-led barriers. Do these barriers result in women's feeling of silence in their organization? It has been discussed in this study what kinds of effects are seen if the barriers aforementioned lead to women's silence. In this

* Corresponding author

E-mail addresses: inandiyusuf@gmail.com (Y. İnandı), meryemevsen@hotmail.com (M.E. Gün), fgilic@yahoo.com (F.Gılıç)

sense, organizational silence can be defined that organizational employees are not willing to express their ideas on purpose within organization. It is certain there are quite a number of variables causing organizational silence. For instance, employees can experience silence because organizational administrators exhibit an absolute autocratic attitude and mobbing behaviours, employees have too much work load, feel burnout, face obstacles or don't meet their expectations.

In addition, the hopelessness that employees believe nothing will change leads to their silence. In light of the information given, women cannot promote higher positions and can feel hopeless in career process. They may also develop negative attitudes such as not expressing their ideas and show silence on purpose if they have a thought that they are undermined. In this regard, the aim of the study is to reveal the relationship between career barriers women teachers experience and their organizational silence, and also to determine whether career barriers affect organizational silence.

Career Barriers of Women Teachers

Gender is considered as a significant variable in working life. The proportion of men and women varies in all sectors and the variance shows a great increase in particular sectors and positions to the detriment of women. The number of women decreases considerably as level of positions rises in hierarchy (İnandı, Tunç, 2012). Though there is no restriction in women's being a teacher, they face some kinds of barriers in professional promotion and development once they have started teaching. As İnandı (2009) explains in his study, these barriers are listed as glass ceiling, social gender stereotypes, women's viewpoints of administration, education, working hours, age, marital status and economic barriers, school- and environment-led barriers and domestic barriers.

The concept of "glass ceiling" was first pronounced in the USA in 1970s. Wirth (2001) defines it as invisible and impassable barriers that are created through organizational prejudices and stereotypes and prevent women from promoting to higher level administrative positions regardless of their proficiency. These barriers are internalized through time, which results in fear of "insufficiency, weakness and failure" in women about administration. Women administrators' statement that they are forced by their family and people around in their decision to be administrator (İnandı et al., 2009) refers to a reflection of this situation. Glass ceiling, which is experienced by the women who want and struggle to attain higher positions in public, private, educational or non-profit organizations can be shortly described as uncertainty (Aycan, 2004) and perceptual feature of career barriers that women suffer.

Social gender stereotypes reflect women's underlying viewpoint of the barriers they encounter during career life, and the prejudices against women's promotion to administrative positions and the resistance system built up by these prejudices restrain women from administrative positions (Çelikten, 2004). Patriarchal structure and the social roles belonging to this culture allocate occupations according to gender and thus women are directed to maternal occupations such as teaching and nursing while men are deemed suitable of administrative tasks which require power.

Therefore, the prejudices based on gender get strengthened, and the women grow in an environment of such prejudices. Their desire about working life are influenced by such factors that they don't have a role model while growing up, they think of negative effects of an advanced career on family life, and they experience role conflicts between the roles they've learnt during socialization process and expectations of working life (the dilemma between mother-wife role and businesswoman role) (Crampton, Mishra, 1999). The fact that these effects have been seen in all periods and cultures of history of humanity (Gough, 2012) is an indicator for deep impact of social gender stereotypes on our mental and practical world today.

Women's viewpoints of administration are the barriers that they themselves created. The women growing up in patriarchal families have never been allowed to think of themselves and given self-confidence support while male dominance is made felt for ages, which leads women to be passive individuals in society (Merle, 1999; Zafarullah, 2000). This shows up in women's emotions and thoughts as anxiety for damage to family life, disbelief in promotion and thus lack of self-confidence, and regarding members of own gender as rivals (Şiyve, 2004).

Working hour, age, marital status and economic barriers constitute a significant part of disadvantages in career process of women. It is considered to be a barrier for career development

that women over a particular age think it is no longer time to do a career (Gündüz, 2010). The women in working life feel obliged to choose between career and family, and hold off their desire to have a child; on the other hand, men tend to both do a career and have a child (Ackah, Heaton, 2003). When men come home after work at the end of the day, it takes long to adapt to domestic life while it is very short for women (Douglas, Judith, 1988). In other words, women feel obliged to do housework like cooking, cleaning or doing washing as soon as they arrive home, and this shortens their adaptation time and negatively affects their interest in career. It is known that career development process of women is different and more complicated than of men and it is because of different and frequent interaction between domestic and working life (Linehan, Scullion, 2001).

School- and environment-led career barriers refer to prejudiced attitude and behaviours that women experience at their schools. Women teachers are discouraged and prevented from doing career due to the barriers originating from these prejudices (Gündüz, 2010). Social norms and judgements underlining that male teachers need to be administrators are reproduced and maintained in formal organizations like schools (Thomson, 2003). Atay (1998) points out that men in higher positions feel uneasy to work together with women and this is one of the most significant and abstract barriers that women suffer in working life. He also adds that male administrators have prejudices against women teachers.

Domestic barriers are described as the ones stemming from women's responsibilities they take on at home. It is generally accepted that men, especially in traditional family structures, don't tend to agree on women's working in higher positions than themselves. For that reason, they mostly see women as rivals to themselves and try to push women into domestic and family affairs. What they demand from women gets much and they cause women to feel guilty in domestic works, which stands as a barrier against women's career development. The women feeling guilty think that they have neglected their husband, children and housework and thus want to give up at the very beginning of career process. The men who increase their domestic demands from women make them feel guilty and create a serious problem for women (Ayan, 2000). All these reasons mentioned above prove the presence of a lot of serious barriers for women. Each of these barriers may lead women teachers to exhibit various affective behaviours, for example, they may become alienated to their organizations. Besides, women teachers who feel precluded are likely to experience organizational silence.

Organizational Silence

Organizational silence is defined that employees don't express their opinions when they face a problem in their organizations or they withhold their knowledge and ideas for improvement of their work and organization purpose (Morrison, Milliken, 2000; Brown, Blackmon, 2003; Slade, 2008). As in all other organizations, it is important for educational organizations that employees freely share their ideas and knowledge in order to realize organizational goals in an effective manner. It is of the primary conditions of educational success that teachers who play an important role in shaping the society are able to share their ideas and suggestions about actualizing educational goals with their administrators. It is quite important for the future of society that ideas of teachers are respected, their self-confidence is not discouraged and they should be convinced of their significance for school. On the other hand, education process and students are negatively influenced and achievements of school goals are hindered if the teachers cannot utter the problems at school, they feel stressed and suppressed, and feel unable to overcome the current problems (Özdemir, 2015). Therefore, the teachers need to express their opinions especially about their subject domains and the administrators should provide opportunity for this. However, an employee who feels uneasy may have fear of facing a negative reaction in the organization and generally become unwilling to share his/her knowledge and suggestions. Such kind of unwillingness depicted by the employees may result in wrong organizational decisions and negative effect on employees' trust, morale, organizational commitment and job satisfaction. What is more, it constitutes an impediment against well-practice of organizational functions and innovation and improvement of organizational processes (Milliken et al., 2003). As a result of all these, not only does school efficacy and efficiency decrease but also employees feel unhappy at work. The final effect of these is on students. It doesn't appear sensible to expect that unhappy teachers will contribute to students' academic successes and education life. It becomes a threat for ensuring

continuity of organizations when employees don't share their constructive and positive ideas and suggestions with their administrators on purpose.

Employees prefer to remain silent for a variety of reasons. Morrison and Milliken (2000) ground the reason why employees choose silence on two important beliefs: they think it isn't worth exerting an effort to overcome the problems in the organization and there will be dangerous results when they express their ideas about the problem. Organizational silence is defined at this point that employees don't have an ideas or suggestion about the problem, and they purposely withhold their opinions about technical or behavioural issues of the work or workplace for improvement of employees because of lack of trust (Çakıcı, 2007; Durak, 2012). However, it would be wrong to immediately define as silence if the employee doesn't communicate at all about the issue because silence is a conscious decision (Dyne et al., 2003). The fact that employees have no information or idea about the issue should not be confused with organizational silence. It seems important to study and correctly understand the silence (Özdemir, 2015) so as to prevent such cases as low performance of employees and leaving the job, and also not to cause disruption at work. It is possibly to study organizational silence of employees under various categories; however, it is taken in this study under the categories of consent silence, defensive silence, prosocial silence and other reasons.

Acquiescent Silence – Accepted Silence: The concept "accepted" reminds of "Abilene Paradox" in literature. This paradox refers to general acceptance of ideas in a group even though they contradict to one's individual ideas (Harvey, 1988). It is stated that the individual as a group member tend to agree the decision even if it is a bad or wrong one; however, the inability to manage the agreement stands as a major source of organization dysfunction. This paradox is often seen in organizations where communication is not strong and healthy, employees cannot state their ideas and suggestions in freedom, and autocratic administration culture reigns (Özdemir, 2015). Dyne et al. (2003) describe acquiescent silence as a passive behaviour exhibited consciously. Though employees have idea, knowledge and suggestion to solve the problem, they prefer to stay silent as they think they will not be able to change the current situation. Individuals in this group don't give effort to change the situation and overcome the problem; on the contrary, they give in the problem and go on working. Employees try to adapt to current situation by ignoring the alternatives in this type of silence based on quiescenting. Employees prefer through their experiences that they stay silent and don't mind the current situation since they believe expressing ideas loud will make no difference in organization. Act of silence for a particular purpose is one of the biggest barriers against change and innovation (Özdemir, 2015). If all the employees keep silent in this group, the administrators are likely to have the idea that whatever they do is right, and thus they may continuously make mistakes and endanger the organization. For that reason, it is essential that a participative administration should be exhibited in organization and employees should be given opportunity to express their ideas.

Defensive Silence – Self-protective Silence: This type of silence is defined as that employees do not express their thoughts because of the negative consequences they will have when they express their feelings and thoughts (Pinder, Harlos, 2001). They prefer to stay silent so that they would avoid financial and emotional damage or not be charged with the existing problems in organization. This type of silence is a strategy that employees have developed against dangers from immediate and remote surroundings of the organization. They assume that expressing their ideas and knowledge will not bring them anything. Moreover, the individuals who keep silent to protect themselves may be in a stressful and nervous mood. Such conflicts make them uneasy and reduce their motivation (Brinsfield, 2009). Therefore, it is of great importance that leading the organization in a democratic sense and participating employees in decisions contribute to efficiency of organization and happiness of employees.

Prosocial Silence – Protective Silence: This kind of silence is defined as the silence of one person for the benefit of other employees and the organization in any organization (Dyne et al., 2003). Described as positive social silence, prosocial silence is that employees avoid uttering their ideas and suggestions because of organizational citizenship behaviours such as benevolence and thinking of others' happiness. As in defensive silence, employees are aware of alternatives in positive social silence as well. However, this type of silence, different from defensive silence, is characterized with worry for others rather than fear from negative, personal results that may arise when expressing one's ideas (Erenler, 2010). This group can be illustrated as not sharing

organizational confidential information with outer environment and not making unsuitable words about employees' personal information (Özdemir, 2015). Organizations certainly have internal dynamics which are important for themselves, which is needed to be kept within the organization and not shared with other people or organizations.

Other reasons for organizational silence: As understood abovementioned information, employees stay silent due to various reasons. These can be listed as behaviours based on indifference and submission, on self-protection and fear, on prosocial tendency and on protecting relations. The individuals who try to exhibit such behaviours do not decide in a minute. Structure and policies of organization and administrative practices and behaviours can cause employees not to share their ideas and knowledge as to improvement of their work and organization in a conscious state (Morrison and Milliken, 2000; Özdemir, 2015). According to Kahveci and Demirtaş (2013), the reasons for organizational silence gather under 5 categories: school environment, emotion, source of silence, administrator and isolation. They state that teachers remain silent because school administrators give negative feedback and exhibit autocratic leadership style, teachers have fear of ignorance, inexperience and negative reaction from colleagues and administrators, concern of being excluded of the group and do not want to look like troublemakers and complainants.

The employees observe the norms in the organization and learn through time not to express their ideas at particular issues. There are a number of variables forming learning behaviour. One of them is active organizational communication. Insufficient and weak organizational communication leads to decrease in employees' efficiency by weakening cooperation between departments. Another factor in silence of employees is power distance. In organizations where power distance is high, employees prefer staying silent as they cannot convey their problems to their superiors (Huang et al., 2005). Employees perceive the system as in "That's life. It's inevitable" and believe that they're weak and cannot change the situation. The power perceived by the employees who are exposed to unfair behaviours of unfair administrators causes them to remain silent, too. In this sense, organizational power injustice is an important factor in employees' being silent.

Implicit belief and traditional mentality of employees are another variable causing their silence. They avoid expressing their ideas for fear of being dismissed, not being promoted, being isolated, punishment of cut from the salary, being labelled as problematic within the organization. Employees may find risky to utter their ideas about organizational issues though they have self-confidence in their work (Premeaux, Bedeian, 2003). If there lacks a free workplace, participative administration is considered dangerous and autocratic administration exists, employees will keep remaining silent and cause failure of organization by endangering its existence. Therefore, no matter why and how employees prefer being silent, the reasons for silence should be eradicated and they should be given opportunity to express themselves.

Purpose of the Study

Main purpose of the study is to investigate the relationship between women teachers' career barriers and their organizational silence, and also to determine whether these career barriers predict their organizational silence. Answers to the following questions were sought in light of the main purpose:

1. Is there a significant difference in women teachers' career barriers according to gender?
2. Is there a significant difference in women teachers' career barriers according to their desire to be administrator?
3. Is there a significant relationship between women teachers' career barriers and their organizational silence?
4. To what extent do women teachers' career barriers predict their level of organizational silence?

Limitations

This study is limited to men and women teachers in the province of Mersin in the 2016-2017 academic years. It is also limited to whether women teachers' career barriers predict their organizational silence.

2. Method

Research Model

In this study of which purpose is to investigate the relationship between women teachers' career barriers and their organizational silence, relational survey model was thought to be applicable as existing situation is first determined and then the relationships in-between are revealed. That's because most of survey studies are comprised of comparison and relation questions (Glinier et al., 2015). Survey model is also used in non-empirical studies to reveal the insight of a particular case in a specific time in addition to the variables taking place through time. Data about attitudes, activities, ideas and beliefs are collected through surveys or interviews in such researches. Basic principle of survey model is to ask people themselves if what they think is to be learnt (Christensen et al., 2015). Teachers' opinions are obtained through scales and the relationship between their opinions are examined in this study.

Population and Sample of the Study

The population of the study consists of the teachers working at primary, secondary and high schools in central districts (Akdeniz, Toroslar, Yenisehir and Mezitli) of Mersin in 2016/2017 academic year. According to official websites of district national education directorates, there are 1902 teachers in Akdeniz, 3186 in Toroslar, 2451 in Yenisehir and 1659 in Mezitli. Out of the total number, 522 teachers (129 men and 393 women) are involved in the study through non-proportional sampling. 13 scales were not included in analysis because of deficient information. According to calculation of sample size out of a population of which number of members is certain (Saunders et al., 2009), sample of the study is at 95 % confidence level and 5 % error interval, which is thought to reach a satisfactory number.

It was paid attention, during specifying the sample, to population size, proportion of teachers at schools, features of data collection tools, number of variables and analysis of data.

Data Collection Tool

Data of the study were obtained through "Women Employees' Career Barriers Scale" (WECBS) by İnandı (2009) and "Organization Silence Scale" (OSS) by Kahveci and Demirtaş (2013).

In the first part of WECBS developed by İnandı (2009), there are 9 items about personal information while there 27 items about women employees' career barriers in the second part. WECBS is comprised of 5 dimensions: "domestic barriers" (6 items), "school-environment-led barriers" (6 items), "education, working hour, age, marital status and economic barriers" (7 items), "social gender stereotypes" (5 items) and "women's viewpoint of career" (3 items). There are no reverse items in the scale.

According to reliability analysis done by İnandı (2009) for WECBS, Cronbach Alpha was found to be .92 for the scale while it was .91 for domestic barriers, .87 for school-environment-led barriers, .82 for education, working hour, age, marital status and economic barriers, .83 for social gender stereotypes and .81 for women's viewpoint of career. It was found in this study that Cronbach Alpha is .96 for the scale while it is .96 for domestic barriers, .95 for school-environment-led barriers, .93 for education, working hour, age, marital status and economic barriers, .91 for social gender stereotypes and .91 for women's viewpoint of career.

Organizational Silence Scale developed by Kahveci and Demirtaş (2013) consists of 18 items and 5 dimensions: "School Environment" (4 items), "Emotion" (3 items), "Source of Silence" (5 items), "Administrator" (3 items) and "Isolation" (3 items).

According to reliability analysis done by Kahveci and Demirtaş (2013) for OSS, Cronbach Alpha was found to be .89 for the scale while it was .74 for school environment, .81 for emotion, .80 for source of silence, .79 for administrator and .83 for isolation. It was found in this study that Cronbach Alpha is .86 for the scale while it is .80 for school environment, .81 for emotion, .80 for source of silence, .83 for administrator and .83 for isolation. As a result, both of the scales were considered suitable and applied in the study.

Data Collection

Data of the study were collected in fall semester of 2016/2017 academic year in central districts (Akdeniz, Mezitli, Toroslar and Yenisehir) of Mersin. All of the schools included in the sample were tried to be reached during data collection process. Apart from the on-leave, patient or reluctant teachers, all the others are given information about the study and applied the data collection tool.

Data Analysis

T-test, one of the parametric tests which examines the difference between means, was used to determine whether there is a significant difference in the opinion of men and women according to gender and women teachers' administrative desire. In order to determine whether the parametric test can be used or not, it was determined whether the dependent variable is normally distributed in each condition of the independent variable. For this purpose, the size of the sample, normality tests and the standard values of the skewness of the data were taken together. It was inferred from data analysis that the number of units per each condition of the independent variable was $n > 30$, that dependent variable of organizational silence had a normal distribution, and that t-test was appropriate to be employed as the other factors were found to be in the range of -3 and +3 in the standard values of the skewness (Büyüköztürk, 2005; Klein et al., 2000).

Correlation analysis was applied to determine if there is a significant relationship between women teachers' career barriers and their organizational silence. In addition, regression analysis was done to reveal if women teachers' career barriers predict their organizational silence level. The results are interpreted and discussed in line with these analyses. Significance level is accepted as $p < 0.01$ and $p < 0.05$ in the study.

3. Findings

The findings obtained through analysis of the relationship between women teachers' career barriers and their organizational silence can be seen in this part. The results of the t-test on career barriers experienced by women teachers according to gender variable are given in Table 1:

Table 1. t-Test results of women teachers' career barriers according to gender

| Career Barriers | Gender | N | \bar{X} | SD | t | p |
|--|--------|-----|-----------|------|-------|------|
| Domestic Barriers | Women | 393 | 3,36 | 1,05 | -,194 | ,846 |
| | Men | 129 | 3,38 | ,97 | | |
| School-Env. Barriers | Women | 393 | 3,33 | ,99 | -,143 | ,886 |
| | Men | 129 | 3,35 | ,94 | | |
| Edu., Age, Marital Status & Econ. Bar. | Women | 393 | 3,44 | ,84 | ,062 | ,950 |
| | Men | 129 | 3,43 | ,80 | | |
| Social Gender Stereotypes | Women | 393 | 3,52 | ,88 | ,243 | ,808 |
| | Men | 129 | 3,50 | ,86 | | |
| Women's Viewpoint | Women | 393 | 3,49 | ,95 | -,242 | ,809 |
| | Men | 129 | 3,51 | ,89 | | |

According to Table 1, gender variable does not make a significant difference in "domestic barriers" ($t = -.194$; $p > .05$), "school-environment-led barriers" ($t = -.143$; $p > .05$), "education, working hour, age, marital status and economic barriers" ($t = .062$; $p > .05$), "social gender stereotypes" ($t = .243$; $p > .05$) and "women's viewpoint of career" ($t = -.242$; $p > .05$).

The results of the t-test on the career barriers experienced by women teachers according to the variables of administrative desire of women teachers are given in Table 2:

Table 2. t-Test results of women teachers' career barriers according to their administrative desire

| Career Barriers | Administrational Desire | N | \bar{X} | SD | t | p |
|--|-------------------------|-----|-----------|------|------|-------|
| Domestic Barriers | Yes | 235 | 3,39 | 1,05 | ,670 | ,503 |
| | No | 158 | 3,32 | 1,04 | | |
| School-Env. Barriers | Yes | 235 | 3,44 | 1,05 | 2,67 | ,008* |
| | No | 158 | 3,17 | 1,04 | | |
| Edu., Age, Marital Status & Econ. Bar. | Yes | 235 | 3,51 | ,834 | 2,03 | ,043* |
| | No | 158 | 3,34 | ,848 | | |
| Social Gender Stereotypes | Yes | 235 | 3,60 | ,836 | 2,16 | ,031* |
| | No | 158 | 3,41 | ,948 | | |
| Women's Viewpoint | Yes | 235 | 3,57 | ,887 | 2,00 | ,045* |
| | No | 158 | 3,37 | 1,04 | | |

*p<.05

As seen in Table 2, there is a significant difference in “school-environment-led barriers” (t=2.677; p<.05), “education, working hour, age, marital status and economic barriers” (t=2.031; p<.05), “social gender stereotypes” (t=2.160; p<.05) and “women’s viewpoint of career” (t=2.007; p<.05) but not in “domestic barriers” (t=.670; p>.05) according to women teachers’ desire to be administrator. In all barrier dimensions excluding domestic barriers, women teachers who want to be administrator state they suffer more career barriers than the ones who are not willing to be administrator.

The results of the correlation analysis of the relationship between women teachers’ career barriers and their organizational silence are given in Table 3:

Table 3. Correlation analysis of the relationship between women teachers’ career barriers and their organizational silence

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | \bar{x} | SD |
|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--------|---|-----------|------|
| Domestic Bar. | 1 | | | | | | | | | 3,36 | 1,05 |
| School-Env. Barriers | ,678** | 1 | | | | | | | | 3,33 | ,99 |
| Edu, Age, Mar. Stat.& Econ.Bar. | ,614** | ,696** | 1 | | | | | | | 3,44 | ,84 |
| Soc. Gender Stereotypes | ,583** | ,560** | ,658** | 1 | | | | | | 3,52 | ,88 |
| Women's Viewpoint | ,535** | ,610** | ,616** | ,691** | 1 | | | | | 3,49 | ,95 |
| School environment | ,351** | ,420** | ,379** | ,373** | ,462** | 1 | | | | 3,57 | ,74 |
| Emotion | ,305** | ,347** | ,350** | ,412** | ,434** | ,658** | 1 | | | ,,60 | ,77 |
| Source of silence | ,318** | ,391** | ,391** | ,449** | ,438** | ,511** | ,682** | 1 | | 3,61 | ,75 |
| Administrator | ,299** | ,304** | ,313** | ,412** | ,381** | ,371** | ,488** | ,680** | 1 | 3,66 | ,79 |

| | | | | | | | | | | | | |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---|------|-----|
| Isolation | ,217** | ,286** | ,274** | ,312** | ,341** | ,378** | ,452** | ,576** | ,710** | 1 | 3,64 | ,82 |
|-----------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---|------|-----|

It can be seen in Table 3 that there is a significant and positive relationship between all dimensions of career barriers and all dimensions of organizational silence. The strongest relationship is found between school environment dimension of organizational silence ($r=.462, p<.05$) and women’s viewpoint dimension of career barriers while the weakest is seen between isolation dimension of organizational silence and domestic barriers dimension of career barriers ($r=.217, p<.05$).

The results of multiple regression analysis of whether women teachers’ career barriers predict their organizational silence are given in Table 4:

Table 4. Multiple regression analysis of whether women teachers’ career barriers predict their organizational silence

| Silence | School Environment | | | | Emotion | | | | Source of Silence | | | | Administrator | | | | Isolation | | | |
|--|------------------------------|------|---------|-------|------------------------------|------|---------|-------|------------------------------|------|---------|-------|------------------------------|------|---------|-------|------------------------------|------|---------|-------|
| | B | SE | β | T | B | SE | β | T | B | SE | β | T | B | SE | β | T | B | SE | β | T |
| Constant | 2,04 | ,152 | | 13,46 | 2,06 | ,161 | | 12,85 | 1,99 | ,153 | | 13,03 | 2,19 | ,168 | | 13,01 | 2,38 | ,179 | | -3,30 |
| Domestic Bar. | ,250 | ,034 | ,351 | 7,420 | ,225 | ,036 | ,305 | 6,34 | ,228 | ,034 | ,318 | 6,643 | ,226 | ,037 | ,299 | 6,18 | ,170 | ,039 | ,217 | 4,39 |
| School-Env. Barriers | ,316 | ,035 | ,420 | 9,152 | ,271 | ,037 | ,347 | 7,31 | ,296 | ,035 | ,391 | 8,405 | ,243 | ,039 | ,304 | 6,303 | ,237 | ,237 | ,286 | 5,91 |
| Edu., Age, Marital Status & Econ. Bar. | ,336 | ,042 | ,379 | 8,090 | ,322 | ,044 | ,350 | 7,38 | ,349 | ,042 | ,391 | 8,403 | ,296 | ,045 | ,313 | 6,50 | ,267 | ,048 | ,274 | 5,62 |
| Social Gender Stereotypes | ,315 | ,040 | ,373 | 7,955 | ,361 | ,040 | ,412 | 8,94 | ,381 | ,038 | ,449 | 9,941 | ,370 | ,041 | ,412 | 8,92 | ,290 | ,045 | ,312 | 6,49 |
| Women’s Viewpoint | ,362 | ,035 | ,462 | 10,30 | ,352 | ,037 | ,434 | 9,53 | ,345 | ,036 | ,438 | 9,63 | ,317 | ,039 | ,381 | 8,13 | ,294 | ,041 | ,341 | 7,16 |
| | R=,496 R ² =,247 | | | | R=,466 R ² =,217 | | | | R=,497 R ² =,247 | | | | R=,436 R ² =,190 | | | | R=,367 R ² =,135 | | | |
| | F ₍₆₋₃₃₇₎ =25,321 | | | | F ₍₆₋₃₃₇₎ =21,507 | | | | F ₍₆₋₃₃₇₎ =25,395 | | | | F ₍₆₋₃₃₆₎ =18,101 | | | | F ₍₆₋₃₃₆₎ =12,038 | | | |
| | P<.01 | | | | P<.01 | | | | P<.01 | | | | P<.01 | | | | P<.01 | | | |

Regression analysis as to whether women teachers’ career barriers predict their organizational silence is shown in Table 4. Regarding t-test results about significance of regression coefficients, it can be seen that each dimension of career barriers is significantly predictive of all dimensions of organizational silence. All of the dimensions of career barriers significantly predict school environment dimension of organizational silence ($R=.496; R^2=.247; p<.01$) accounting for 24,7 % of it; emotion dimension ($R=.466; R^2=.217; p<.01$) accounting for 21,7 % of it; source of silence dimension ($R=.466; R^2=.247; p<.01$) accounting for 24,7 % of it; administrator dimension ($R=.436; R^2=.190; p<.01$) accounting for 19 % of it; and lastly, isolation dimension ($R=.367; R^2=.135; p<.01$) accounting for 13,5 % of it.

4. Discussion, Conclusion and Suggestions

In the study, the relationship between career barriers women teachers experience and their organizational silence has been analyzed and also whether these career barriers predict their organizational silence has been revealed.

1. Is there a significant difference in career barriers women teachers experience according to their gender?”

The findings show that there is no significant difference in both men and women teachers’ views about career barriers women have. In other words, men and women teachers have similar opinions about career barriers women experience. Actually, the researches up to this study found different findings from this. It is revealed in various studies (Ayan, 2000; Usluer, 2000; Gündüz, 2010) that women teachers differ from male teachers in regards to women's career barriers.

Women teachers consider social gender stereotypes, domestic barriers, age, gender, economic reasons and educational status as barriers against women more than male teachers. In addition, in the study by İnandı et al. (2009), a significant difference in men and women teachers' opinions about career barriers can be seen, in which women teachers' views make the difference. Women teachers state that they experience career barriers more compared to men. Similar finding can as well be seen in İnandı's (2009) study. This study revealed, too, that women teachers' views are the source of difference. Women teachers consider that they face more obstacles to be administrator than men. According to the findings of another study (Örücü et al., 2007), there is a significant difference between men and women teachers' views because of the notion that women have limited qualifications of leadership and administration.

It has also been revealed from women teachers' perception of career barriers that they are most affected by social gender stereotypes of all career barrier dimensions. This barrier is followed by women's viewpoint of career, which proves that women agree on social gender stereotypes. The finding in various studies that women regard housework as their primary task supports this study indirectly (Ayan, 2000; Mohan, 2001; Köstek, 2007; Gönen & Hablemit, 2004). All of the above studies, which are not parallel to this study, generally consider female teachers' domestic obstacles and social gender stereotypes that women's primary duties are maternity, housewife and good wife, and that career development activities are perceived as male work (Ayan, 2000; Usluer, 2000). The above research results refer to the reasons in that administration requires long working hours, moving work home that never ends in the workplace, and women feel obliged at housework and especially child care. It is also stated that the teaching profession, which allows women to carry out these tasks, has traditionally been perceived as women's work (Altınışik, 1988; Usluer, 2000). For this reason, it is indicated that the teaching profession with short working hours and long holidays is accepted as women's profession by the society (Wilson, 2002). Women do not want to enter into the career development process because of the men in the top position that are superior in number to women, and the male dominant organization culture established and maintained by them (Procter, Maureen, 1999). As understood from the explanations, it can be seen that these barriers produced by the society have created a significant obstacle for women to make a career, and these obstacles are ignored by men. However, the result of this study that the views of women and male teachers are similar can be seen as a quite important development. In the developing and changing world, male teachers agree that there are domestic barriers, social gender stereotypes, age, educational situation and economic reasons in front of women, which is also agreed by almost everyone. In this respect, thinking in the same direction as women teachers is an important step. İnandı and Tunç (2012) emphasize that women should be given positive discrimination to be administrator and opportunity to practise administration even though it doesn't seem easy because improving women's self-confidence is based on a long historical background and a strong social origin. They also state that there will be lots of models for women as the number of women administrators increases and women will be able to develop their self-confidence in administration. At this point, the development of the consciousness level of the men can also be regarded as very important.

2. Do career barriers women teachers experience differentiate according to their desire to be administrator?

The women teachers willing to be administrator state about all types of barriers except for domestic barriers that they suffer career barriers more than the ones who aren't willing to be administrator. Women teachers put emphasis most on social gender stereotypes, which is again followed by women's viewpoint of career barriers. School-environment-led barriers are relatively the least effective factor. Gündüz (2010) found in his study that a similar perception occurs as social understanding is that women should help their husbands and have such occupations that they would not neglect family and housework while taking responsibility at work, achieving success and doing career are expected of men. As our society is male-dominant, important works are expected to be done by men. Regarding all these reasons indicated, it is evident that gender stereotypes accepted by the society are one of the significant factors in women's career barriers. In other words, women teachers' desire to do career while they think they suffer career barriers due to social gender stereotypes is an important indicator for their need for social support.

3. Is there a significant relationship between career barriers women experience and their organizational silence?

According to the results, there is a significant, positive and strong relationship between all dimensions of career barriers and organizational silence. Particularly “social gender stereotypes” and “women’s viewpoints of career” have stronger relationship with women’s organizational silence. The strongest positive relationship is seen between “administrator” of organizational silence and “social gender stereotypes” of career barriers. This is because of patriarchal structure of school administration. According to Newman (2002), gender roles refer to behaviours, beliefs, values, cultural expectations and socially-defined features related with men and women in a particular culture. Common culture of the society of which we are a part describes different roles for men and women. Therefore, it is seen that gender relations in society occur as a reflection of cultural structure, values and traditions (Mukhopadhyay, 1995). Such kind of gender roles are reflected and accepted in educational organizations which are of open system, and also recognized by women themselves. As these gender roles attribute success and intellectual career to men (Ersoy, 2009), they have professional interest more than women. It causes women teachers to feel themselves passive and inadequate, which develops glass ceiling syndrome. They become unable to develop a strong self-efficacy. Kahya (2015) emphasizes the relationship between self-efficacy and organizational silence in that employees with strong self-efficacy have success scenarios in their minds and thus are courageous to move and express their feelings and ideas, on the other hand, employees with low self-efficacy avoid expressing their ideas and actualising their expectations and goals. That is because the employees with low self-efficacy experience a high level of stress and fail in problem-solving (Çubukçu, Girmen, 2007). Following this, they isolate themselves from their organization through time and prefer staying silent.

Durak (2012) states that teachers may prefer silence even when they get opportunity to have impact on their administrators because their behaviours may end in negative results for their administrator or themselves. The negative results can be illustrated as negative feedback, reprimand or punishment by administrators (Akbarian et al., 2015). Çakıcı (2010) lists administrative reasons for silence as follows: fear of negative feedback from administrators, implicit beliefs of administrator about their subordinates, no support from administration for talking frankly, formal relations, distrust in administration, and non-openness of administration to different ideas. As a result of prominence of administrator and isolation dimensions in organizational silence, external reasons lead to increased stress, cynicism and dissatisfaction in employees (Bowen, Blackmon, 2003), and this in turn causes women teachers to prefer stay silent.

4. To what extent do career barriers that women experience predict their organizational silence?

It is seen according to the results that there is a linear and significant relationship between women teachers’ career barrier and organizational silence and also career barriers predict organizational silence. Career barriers are found to predict all dimensions of organizational silence: 25 % of school environment, 25 % of source of silence, 22 % of emotion, 19 % of administration and 14 % of isolation. In regard with the effects of social gender on silence stated in a similar study, the most frequently expressed reason for silence based on social gender is that women teachers have a perception that they are not taken serious because of the social gender group to which they belong (Kutanis, Cetinel, 2014). This is expected to bring some negative outcomes as their perception about themselves results in such a fear of dismissal, losing respect and trust, being labelled as a complainer, damaging organizational relations and so on (Yaman, Ruclar, 2014). It is revealed in this study that “women’s viewpoint of career barriers” is highly influential on organizational silence, especially “emotion” dimension. In short, women teachers acknowledge the existence of career barriers and these barriers lead to organizational silence. In other words, the more women teachers experience career barriers, the more they prefer to stay silent. A similar interpretation by Morrison and Milliken (2000) shows that organizational silence, with an economic and financial background, is seen widely in the organizations in which average working time is longer, common culture and individual power distance is higher, and difference (gender, ethnic origin, age) between superiors and subordinates is further. In addition,

Nartgün and Kartal (2013) found the reasons for organizational silence as the risk to speak up in school environment, autocratic behaviours of administrators, low performance of school administrators and fear of isolation. In another study by Milliken et al. (2003), it was revealed that the most frequently mentioned reason for remaining silent is the fear of being viewed or labelled negatively, and as a consequence, damaging valued relationships. These factors are related to school environment, which contributes to the findings that “school environment” dimension of organizational silence is highly effected by career barriers.

In conclusion, traditional gender stereotypes still appear in women teachers’ career barriers and these roles are accepted by women as well. It is evident that such stereotypes subsist at schools. Therefore, to break down the prejudices of both school staff and school environment against women teachers’ promoting to superior positions, it is needed that public service ads and TV series that show men’s participation in housework and standing beside women should be made in addition to other media products that may change people’s visual perceptions. That is because the stereotype masculine-feminine roles must be eradicated. Otherwise, women teachers will keep prevented from success, participation and career, which will result in their silence and loss of social labour force and human capital. Lastly, the extent to which the women teachers’ career barriers affect their organizational commitment, organizational citizenship and burnout can be studied as well.

References

- [Ackah, Heaton, 2003](#) – Ackah, C. and Heaton, N. (2003). Human resource management careers: different paths for men and women? *Career Development International*, 8 (3), 134-142.
- [Akbarian et al., 2015](#) – Akbarian, A., Ansari, M.E., Shaemi, A. and Keshtiaray, N. (2015). Review organizational silence factors. *Journal of Scientific Research and Development*, 2 (1), 178-181.
- [Akdeniz Directorate of National Education](#) – Akdeniz Directorate of National Education. Access Address: <http://akdeniz.meb.gov.tr/>. Access Date: 16.12.2016.
- [Altınışık, 1988](#) – Altınışık, S. (1988). Obstacles of women school principles. Unpublished doctoral dissertation, Hacettepe University Ankara.
- [Atay, 1998](#) – Atay, A. N. (1998). Kadın yöneticilerin kariyer boyutları ve etmenleri, 20. yüzyılın sonunda kadınlar ve gelecek. (Ed: Oya Çitçi). Ankara: TODAİE Yayınları.
- [Ayan, 2000](#) – Ayan, F. (2000). Bayan öğretmenlerin yöneticilikleri ve öğretmen görüşleri. Unpublished Master’s Thesis, On sekiz Mart University, Social Sciences Institute.
- [Aycan, 2004](#) – Aycan, Z. (2004). Üç Boyutlu Cam Tavan: Kadınların Kariyer Gelişiminde Kim, Kime, Neden Engel Oluyor? Access Address: www.aneyiz.biz/haber/haberdtl.php?hid=1809 (22.01.2017).
- [Brinsfield, 2009](#) – Brinsfield, C. T. (2009). Employee silence: investigation of dimensionality, development of measures and examination of related factors. Unpublished Phd Dissertation. The Ohio State.
- [Bowen, Blackmon, 2003](#) – Bowen, F., and Blackmon, K. (2003). Spirals of silence: the dynamic effects of diversity on organizational voice. *Journal of Management Studies*, 40 (6), 1393-1417.
- [Büyüköztürk, 2005](#) – Büyüköztürk, Ş. (2005). Sosyal bilimler için veri analizi el kitabı. Ankara: Pegem Akademi.
- [Christensen et al, 2015](#) – Christensen, B.L., Johnson, R.B. and Turner, L.A. (2015). *Research methods, desing and analysis*. (Translator Edit.Apay, A.). 2nd Ed. Ankara: Anı Yayıncılık.
- [Crampton, Mishra, 1999](#) – Crampton, S. M., Mishra, M. (1999). Women in management. *Public Personnel Management*, 28 (1).
- [Çakıcı, 2007](#) – Çakıcı, A. (2007). Örgütlerde Sessizlik: Sessizliğin Teorik Temelleri ve Dinamikleri. *Journal of Cukurova University Institute of Social Sciences*, 16 (1), 145-162.
- [Çakıcı, 2010](#) – Çakıcı, A. (2010). Örgütlerde işgören sessizliği neden sessiz kalmayı tercih ediyoruz? Ankara: Detay Publishing.

- Çelikten, 2004 – Çelikten, M. (2004). Okul müdürü koltuğundaki kadınlar: Kayseri ili örneği. *Journal of Institute for Social Sciences*, 17(2), 91-118.
- Çubukçu, Girmen, 2007 – Çubukçu, Z. and Girmen, P. (2007). Öğretmen adaylarının sosyal özyeterlik algılarının belirlenmesi. *Eskişehir Osmangazi University Journal of Social Sciences*, 8 (1), 57-74.
- Douglas, Judith, 1988 – Douglas, T. H., Judith R. (1988). Balancing work land home life: what can organizations do to help? *The Academy of Management Executive*, 2 (3), 216.
- Durak, 2012 – Durak, G. (2012). *Korku kültürü ve örgütsel sessizlik*. 1st Ed. Bursa: Ekin Basım Yayın Dağıtım.
- Dyne et al, 2003 – Dyne, L., Ang, S. and Botero, I.C. (2003). Conceptualizing Employee Silence and Employee Voice As Multidimensional Constructs. *Journal Of Management Studies*, 40(6), 1359-1372.
- Erenler, 2010 – Erenler, E. (2010). *Çalışanlarda sessizlik davranışının bazı kişisel ve örgütsel özelliklerle ilişkisi: turizm sektöründe bir alan araştırması*. Unpublished Phd Dissertation. Hacettepe University, Social Sciences Institute, Ankara.
- Ersoy, 2009 – Ersoy, E. (2009). Cinsiyet kültürü içerisinde kadın ve erkek kimliği (Malatya örneği). *Firat Üniversitesi Sosyal Bilimler Dergisi*, 19 (2), 209-230.
- Gliner et al, 2015 – Gliner, J. A., Morgan G. A. and Leech N. L. (2015). *Research methods in applied settings*, (Translator Edit. Turan, S.). 2nd Ed. Ankara: Nobel Publishing.
- Gough, 2012 – Gough, K. (2012). Ailenin kökeni. *Kadın Antropolojisi*. (Translated by Bürge Abiral). İstanbul:Dipnot Publishing.
- Gönen, Hablemit, 2004 – Gönen, E. and Hablemit, Ş. (2004). *Akademisyen kadınlar*. İstanbul: Toplumsal Dönüşüm Publishing.
- Gündüz, 2010 – Gündüz Y. (2010). Öğretmen algılarına göre kadın öğretmenlerin kariyer engellerinin incelenmesi. *Journal of Abant İzzet Baysal University*, 10 (1), 133-149.
- Harvey, 1988 – Harvey, J.B. (1988). The Abilene paradox: The management of agreement. *Organizational Dynamics*, 17 (1), 17-43.
- Huang et al., 2005 – Hung, X., Vliert, E.V.D., and Vejt, G.V. (2005). Breaking the silence culture: stimulation of participation and employee opinion withholding cross- nationally, *Management and Organization Review*, 1 (3), 459-482.
- İnandı et al., 2009 – İnandı, Y., Özkan, S., Peker, S. & Atik, Ü. (2009). Kadın öğretmenlerin kariyer geliştirme ve engelleri. *Mersin University Journal of the Faculty of Education*, 5 (1), 77-96.
- İnandı, 2009 – İnandı, Y. (2009). Kadın öğretmenlerin okul müdürü olmaları önündeki engeller (Mersin İli örneği-Türkiye). *Journal of Educational Research*, 36, 161-178.
- İnandı, Tunç, 2012 – İnandı, Y., Tunç, B. (2012). Kadın öğretmenlerin kariyer engelleri ile iş doyumları arasındaki ilişki. *Journal of Educational Sciences Research*. 2 (2), 202-222.
- Kahveci, Demirtaş, 2013 – Kahveci, G., Demirtaş Z. (2013). Öğretmenler için örgütsel sessizlik ölçeği geliştirme çalışması. *Elektronik Journal of Social Sciences*, 12 (43), 167-182.
- Kahya, 2015 – Kahya, C. (2015). Mesleki özyeterlilik ve örgütsel sessizlik ilişkisini belirlemeye yönelik ampirik bir çalışma. *Cankırı Karatekin University, Journal of the Faculty of Economics and Administrative Sciences*, 5 (1), 293-314.
- Klein et al., 2000 – Klein, K.J., Bliese, P.D., Kozlowski, S.W.J., Dansereau, F., Gavin, M.B., Griffin, M.A., Hofmann, D.A., James, L.R., Yammarino, F.J., & Bligh, M.C. (2000). Multilevel analytical techniques: Commonalities, differences, and continuing questions. K. J. Klein & S.W.J. Kozlowski (Eds.), in *Multilevel theory, research and methods in organizations: Foundations, extensions, and new directions* (p. 512-553). San Francisco, CA: Jossey-Bass.
- Köstek, 2007 – Köstek, H. (2007). Resmi ilköğretim okullarında çalışan yönetici ve öğretmen görüşlerine göre, kadın öğretmenlerin kariyer engelleri. Unpublished Master's Thesis, Yıldız Teknik University, Social Sciences Institute.
- Kutunis, Çetinel, 2014 – Kutunis, Ö.R., Çetinel, E. (2014). Kadınların sessizliği: devlet okullarındaki kadın öğretmenler üzerine bir araştırma. *Public Administration Journal*, 47 (1), 153-173.

- Linehan, Hugh, 2001 – Linehan, M., Hugh S. (2001). Selection, training and development for female international executives. *Career Development International*, 6 (6), 318-323.
- Merle, 1999 – Merle, A.M. (1999). Women's journeys to educational administration positions. Unpublished master's thesis, University of Saskatchewan, Saskatoon, SK.
- Mezitli Directorate... – Mezitli Directorate of National Education. Access Address: <https://mezitli.meb.gov.tr/>. Access Date: 16.12.2016.
- Milliken et al., 2003 – Milliken, F.J., Morrison, E.W., Hewlin, P.F. (2003). An exploratory study of employee silence: Issues that employees don't communicate upward and why. *Journal of Management Studies*, 40 (6), 1453-1476.
- Mohan, 2001 – Mohan, Y. (2001). *Kadın yöneticilerin liderlik stilleri ve bir uygulama*. Unpublished Master's Thesis, Pamukkale University, Social Sciences Institute.
- Morrison, Milliken, 2000 – Morrison, E.W., Milliken, F.J. (2000). Organizational silence: A barrier to change and development in a pluralistic world. *Academy of Management Review*, 25 (4), 706-725.
- Mukhopadhyay, 1995 – Mukhopadhyay, M. (1995). Gender relations, development practice and culture. *Gender and Development*, 3 (1), 13-18.
- Nartgün, Kartal, 2013 – Nartgün, S.E. and Kartal, V. (2013). Öğretmenlerin örgütsel sinizm ve örgütsel sessizlik hakkındaki görüşleri. *Bartın University Journal of Faculty of Education*, 2 (2), 47-67.
- Newman, 2002 – Newman, L.K. (2002). Sex, gender and culture: Issues in the definition, assesment and treatment of gender identity disorder. *Clinical Child Psychology and Psychiatry*, 7, 358-367.
- Örücü et al., 2007 – Örücü, E., Kılıç, R. ve Kılıç, T. (2007). Cam tavan sendromu ve kadınların üst düzey yönetici pozisyonuna yükselmelerindeki engeller: Balıkesir ili örneği. *Celal Bayar University Faculty of Economics and Administrative Journal of Management and Economics*, 14 (2), 117-135.
- Özdemir, 2015 – Özdemir, Ş. (2015). Sınıf öğretmenlerinin örgütsel sessizlik ve örgütsel bağlılık düzeyleri arasındaki ilişki (İstanbul ili, Ümraniye ilçesi örneği). Unpublished Master's Thesis. Yeditepe University, Educational Sciences Institute. İstanbul.
- Pinder, Harlos, 2001 – Pinder, C.C., Harlos, K.P. (2001). Employee silence: quiescence and acquiescence as responses to perceived injustice. *Research in Personnel and Human Resources Management*, 20, 331-69.
- Premeaux, Bedeian, 2003 – Premeaux, S.F. and Bedeian, A.G. (2003). Breaking the silence: the moderating effects of self- monitoring in predicting speaking up in the workplace. *Journal of Management Studies Üniversitesi*, Amerika. 40 (6), 1539-1562.
- Procter, Maureen, 1999 – Procter, I. and Maureen, P. (1999). Work orientations and women's work: A critique of Hakim's theory of the heterogeneity of women. *Gender, Work & Organization*, 6 (3), 152-162.
- Saunders et al., 2009 – Saunders, M., Lewis, P., Thornhill, A. (2009). *Research Methods for Business Students*. (5th Edition). London: Pearson Education.
- Slade, 2008 – Slade, M. R. (2008). *The adaptive nature of organizational silence: a cybernetic exploration of the hidden factory*. Published Phd Dissertation. George Washington University.
- Şiyve, 2004 – Şiyve, O. Ç. (2004). Kadın-Erkek Liderlik Tarzları ve Cam Tavan. *Tügiad Elegans Magazine*, No 66, March-April. Access Address: www.elegans.com.tr/arsiv/66/habero18.html (23.01.2017).
- Thompson, 2003 – Thompson, A. (2003). Special series on girls and women in education caring in context: four feminist theories on gender and education. *Curriculum Inquiry*, 33(1).
- Toroslar Directorate... – Toroslar Directorate of National Education. Access Address: <https://toroslar.meb.gov.tr/>. Access Date: 16/12/2016.
- Usluer, 2000 – Usluer, L. (2000). *Kadın öğretmenlerin yönetici konumlara yükseltilmeme nedenleri konusundaki öğretmen ve yönetici görüşlerinin değerlendirilmesi*. Unpublished Phd Dissertation, Ankara University, Ankara.

[Wilson, 2002](#) – *Wilson, F. M.* (2002). Management and the professions: how cracked is that glass ceiling? *Public Money & Management*, 15-20.

[Wirth, 2001](#) – *Wirth, L.* (2001). Breaking Through The Glass Ceiling: Women in Management. International Labour Office, Geneva.

[Yaman, Ruclar, 2014](#) – *Yaman, E. and Ruclar, K.* (2014). Örgüt kültürünün yordayıcısı olarak üniversitelerde örgütsel sessizlik. *Journal of Higher Education and Science*, 4 (1), 36-50.

[Yenişehir Directorate...](#) – Yenişehir Directorate of National Education. Access Address: <http://yenisehir33.meb.gov.tr/>. Access Date: 16.12.2016.

[Zafarullah, 2000](#) – *Zafarullah, H.* (2000). Through the brick wall, and the glass ceiling: Women in the civil service in Bangladesh. *Gender, Work & Organization*, 7 (3), 197-209.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.

All rights reserved.

Published in the Slovak Republic

European Journal of Contemporary Education

ISSN 2304-9650

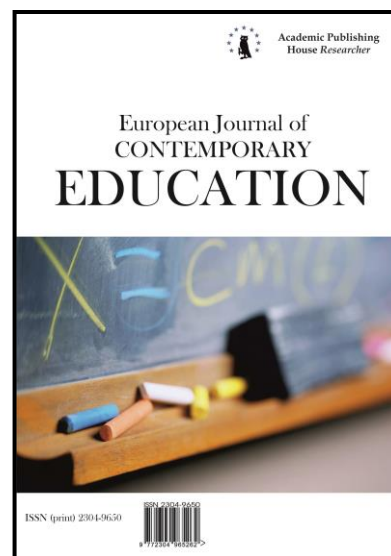
E-ISSN 2305-6746

2017, 6(3): 557-564

DOI: 10.13187/ejced.2017.3.557

www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



The Polyethnic Competence of Class Teacher as a Resource for Ensuring the Psychological Security of Pupils in a Polycultural Educational Environment

Tatyana I. Kulikova ^{a,*}, Kseniya S. Shalaginova ^a, Svetlana A. Cherkasova ^a

^a Department of Psychology and Pedagogics at Tula State Lev Tolstoy Pedagogical University, Russian Federation

Abstract

In modern world the environment of any educational institution represents a spectrum of ethnoses, subcultures; and, thereafter, in a certain way, we can talk about it as the multicultural educational environment.

Pupils who realize their national identity often demonstrate intolerance towards representatives of other nationalities which creates a threat for pupils' psychological safety.

This paper addresses the topical issue of the role played by class teachers in ensuring the psychological security of pupils within a polycultural educational environment. The authors present the findings of a study assessing the level of development of polyethnic competence in the average class teacher and establishing the interrelationship between this level and how secure psychologically a high-school student may feel within a polycultural educational environment. The study engaged 58 class teachers and 127 pupils in grades 7 and 8, ages 13 and 14. It has been suggested that fostering polyethnic competence in class teachers is taking on special significance at this time.

Keywords: polycultural education, educational environment, psychological security, class teacher, polyethnic competence.

1. Introduction

The growing interest in the issue of students' psychological security is associated with the current realities of education, which is getting increasingly polycultural. By featuring a wide spectrum of ethnic groups and subcultures, many present-day schools represent a risk factor that can jeopardize the psychological security of pupils. Present-day psychological/pedagogical science contains numerous studies devoted to exploring the educational environment (Baeva et al., 2009).

* Corresponding author

E-mail addresses: tativkul@gmail.com (T.I. Kulikova)

Some look into the interrelationships between culturological models for education and the educational environment (A.G. Asmolov, V.S. Bibler, E.V. Bondarenko, V.P. Zinchenko, S.Yu. Kurganov, V.V. Serikov, I.S. Yakimanskaya, etc.), while others explore the 'child-environment' relationship (A.A. Bodalev, V.A. Karakovskii, L.I. Novikov, N.M. Smirnov, etc.) and the relationship between the school's object environment and the emotional state of its subjects (D.Ž. Marković, N.N. Moiseev, etc.).

Of major significance to fathoming the issue of a child's psychological security in a polycultural environment are the ethnological theories and concepts developed by S.M. Arutyunyan, E.A. Bagramov, Yu.V. Bromlei, L.N. Gumilev, A.D. Alferov, E.V. Bondarevskaya, V.I. Gorova, G.D. Dmitriev, N.V. Kuz'mina, R.M. Sulichenko, V.A. Slastenin, etc., which provide insight into the ins and outs of well-directed training of new-type teachers and the content of their professional competence. Some scholars have proposed theoretical models for competence and determined its role within the area of pedagogical activity and the system of training pedagogical personnel (L.I. Belozerova, I.F. Demidova, N.E. Kostyleva, etc.) (Kulikova, 2015).

The all-round development of learners is impossible without promoting equal treatment for members of all ethnic and social communities (Makaev et al., 1999). Failure to uphold the principles of equality, diversity, and inclusion in a polycultural educational environment may create additional difficulties for high-school instructors acting as class teachers. The class teacher is a key figure in recognizing the parity of all subjects of and participants in the educational process. It is the class teacher that acts as an intermediary in building a relationship between learners, teachers, and parents and is the creator of the optimum developing micro-environment and a favorable moral/psychological climate in the class (Kulikova, 2008).

Taking a value-based and humane approach to cultural differences, being considerate of the uniqueness of other cultures, having a tolerant and positive attitude toward different behavior and thinking, and not having inflated expectations from communication with representatives of other cultures is of professional significance for a pedagogue (Khazova, Khatit, 2015). A special significance is taken on in this regard by the polycultural training of teachers and fostering in them polyethnic competence – in terms of both professional and general social, personal ethics. This kind of two-sided construal of pedagogues' polyethnic competence is due to the fact that, on the one hand, a teacher is a member of a polycultural society and, on the other hand, they must be prepared to engage in the polycultural education of a growing generation. Therefore, fostering polyethnic competence in teachers must become the critical basis for ensuring the psychological security of pupils in a polycultural educational environment. A figure that could enable this kind of system of nurturing influence is an educator class teacher (Bessarabova, 2007; Manoilova, 2009).

However, it must be acknowledged that there are currently no clear-cut requirements for polyethnic competence in class teachers in present-day schools. Starting in the late 1990s, many a researcher has focused on the study of the phenomenon of tolerance as a factor in harmonizing interethnic relations. But right now there is more to it than just tolerance, which implies readiness to accept others as they are and interact with them based on concord – and that is boosting the polyethnic competence of teachers.

2. Materials and methods

UNESCO's international documents dealing with upgrades to the content of education regard polyethnic competence as a fundamental competency of present-day man. Thus, for instance, in the 'Learning: The Treasure Within' report of the International Commission on Education for the Twenty-First Century to UNESCO J. Delors highlights some of the key global competencies – the 4 "pillars" of education: learning to know, learning to do, learning to live together, and learning to be (Delors, 1996). Scholars S.E. Shishov and V.A. Kal'nei have provided an insight into the 5 key competencies singled out by the Council of Europe, which include the competencies related to living in a multicultural society and aimed at preventing the expression (and revival) of racism and xenophobia and cultivation of intolerance: accepting differences, respect for others, and the ability to live in peace with representatives of other cultures, languages, and religions (Khazova, Khatit, 2015).

Among the scholars who construe polyethnic competence in a similar vein are Z.N. Safina, M.N. Pevzner, V.O. Buketov, O.M. Zaichenko, E.S. Den'gub, and others. In particular, E.S. Den'gub provides the following insight into the content of polyethnic competence (through intercultural

competencies): “sensitiveness to cultural differences, respect for the uniqueness of the culture of all ethnic groups, tolerance for unusual behavior, a positive attitude about the unexpected, readiness to react to changes, flexibility in making alternative decisions, and having no inflated expectations from communication with representatives of other cultures (Khazova, Khatit, 2015).

The significance of polyethnic competence from the standpoint of polycultural education has been discussed in the works of J. Raven, H. Grosch, W. Leenen, P. Van Den Berghe, L.S. Ilyushin, M.N. Lebedeva, V.P. Roshchupkin, A.I. Surygin, and others. An analysis of these works reveals the following characteristics of the phenomenon of polyethnic competence: polyethnic competence materializes during the process of people’s communication and activity on the level of subject-subject relations; includes knowing, understanding, and taking into account the system of values in interpersonal communication; forms based on criteria for tolerance; is a determinant for the formation of one’s own identity and positive identification of the different in subjects of the interaction; is manifested in situations where cultures cross and ethnic, cultural, and other differences collide with each other; is an integrated personal quality that enables you to resolve in a constructive manner your objectives related to interaction with representatives of other cultures (Kulikova, 2015).

Central to this study are the works of scholar T.V. Poshtareva, wherein polyethnic competence is viewed as a person’s objective notions of and knowledge about a particular culture which are realized through the abilities, skills, and patterns of behavior that facilitate effective interethnic mutual understanding and interaction (Poshtareva, 2009).

Based on the above, the authors construe the polyethnic competence of class teachers as an integrative personal/professional quality that ensures efficient participation in social processes within a polycultural society, effective intercultural interaction, taking account of the polycultural make-up of the team of subjects of professional activity, and utilizing its characteristics to resolve pedagogical objectives, as well as nurturing students polyculturally (Khupsarokova, Khakunova, 2011). The authors are inclined to believe that the structure of the polyethnic competence of class teachers is comprised of 3 more significant components: motivational/value-based, communicative, and social/perceptive.

The motivational/value-based component facilitates the creation of the right conditions for the class teacher to be able to employ their abilities and be oriented toward the student’s inner world and interest to learn the Different, as well as realize their personal and professional position, and comprises the following characteristics: being oriented toward another person; wanting to communicate with others; being an active part of the professional world.

The communicative component is construed as a set of abilities and skills that enable the class teacher’s interaction with the student and ensure their ability to come up with effective solutions to various communication objectives. This component within the class teacher’s social/psychological competence comprises the following characteristics: regulating interpersonal relations among students in the class; enabling effective interaction between instructors and students; facilitating an overall favorable psychological climate in the class.

The social/perceptive component implies the class teacher being prepared to perceive their students in an unconditioned, non-judgmental, and positive manner. In addition, the social/perceptive component is manifested in the class teacher’s high and flexible self-appraisal, optimal anxiety levels, and adequate expression of their emotions.

A class teacher who has achieved high levels of polyethnic competence is an active subject of the polycultural educational process with well-developed professional/personal qualities that enable them to effectively resolve all kinds of communication objectives and be successful in performing their pedagogical activity.

Psychological security is associated with taking account of the student’s personal characteristics and psychological stability, with its key characteristics being level-headedness, adequacy, fortitude, stability, and resistibility (Eliseeva, 2011; Kulikova, 2015). The authors’ theoretical analysis helped establish some of the key criteria for the psychological security of pupils, which are as follows:

- 1) a sense of being protected (based on experiencing support from one’s teachers and parents and a nice attitude from one’s classmates (friendliness and non-violence) and behavioral manifestations associated with that);

2) a sense of satisfaction (experiencing subjective well-being, emotionally positive treatment on the part of one's teachers and classmates, the class's referentiality, and a sense of satisfaction with one's learning activity and behavioral manifestations associated with that);

3) a sense of confidence in oneself (the ability to deal with a sense of alarm at school and handle tough situations that may arise in learning and communication and behavioral manifestations associated with that).

At various stages of work aimed at resolving the main and particular objectives in your research into levels of development of polyethnic competence in class teachers, you may want to make use of a set of specific methods for collecting and processing factual material:

1) theoretical: analysis, synthesis, systematization (theoretical analysis of the literature and system analysis and synthesis of scholarly concepts will help gain an insight into the essence of the polyethnic competence of class teachers, including its structure and key components);

2) empirical: ascertaining experiment, psychodiagnostic assessment, questionnaires, surveys, testing (conducting the ascertaining experiment will help diagnose and assess the level of development of class teachers' polyethnic competence and determine the psychological /pedagogical conditions for fostering pedagogues' polyethnic competence).

To assess the level of development of class teachers' polyethnic competence and establish the relationship between that level and pupils' sense of psychological security in a polycultural educational environment, the authors conducted a special correlation study. The study featured 58 class teachers and 127 pupils in grades 7 and 8, ages 13 and 14, in 3 schools in the city of Tula. All of these schools are polycultural and multinational. The number of non-native born students in them is 35–65 %. The study was conducted in 2 stages. The 1st stage determined students' current sense of psychological security, and the 2nd one – the level of development of class teachers' polyethnic competence.

To determine one's current sense of psychological security, the authors employed a special questionnaire known as 'Psychological Security in the Educational Environment', developed by scholar I.A. Baeva (Baeva et al., 2009). The authors' analysis of the data obtained revealed that all the groups of research subjects demonstrated a comfortable and favorable atmosphere among classmates ($r=0.49$). Most of the students were found to have adapted well within the class team, which represented some kind of value to them ($r=0.52$). Based on the research subjects' appraisal of the significant characteristics of the educational environment, it is worth noting that a high level of satisfaction was recorded both on average and in each sample ($r=0.61$). These findings lead to the conclusion that a positive student attitude toward the school's educational environment ($r=0.45$) determines one's satisfaction with the school environment ($r=0.47$), as well as one's positive appraisal of the relationship with teachers and students ($r=0.42$), which is a crucial condition for the success of the educational and nurturing processes.

To explore the key components of class teachers' polyethnic competence identified above, the authors utilized a set of psychodiagnostic assessment methodologies (Table 1).

Table 1. Psychodiagnostic Assessment Methodologies Utilized by the Authors

| Components of polyethnic competence | Methodology |
|-------------------------------------|---|
| <i>Motivational/value-based</i> | 1. Assessing the Teacher's Professional Orientations 2. One's Value-Based Orientations (VO questionnaire) |
| <i>Communicative</i> | 1. Diagnostic Assessment of One's Orientations in Communication (OC questionnaire) 2. I.M. Yusupov's Diagnostic Assessment of Empathy Levels |
| <i>Social/perceptive</i> | 1. Self-Evaluation of the Ability to Manage the Work of the Class 2. I.M. Yusupov's Diagnostic Assessment of Empathy Levels |

The above methodologies focus on the class teacher’s value-based orientations; help assess their professional and communicative orientations, empathy levels, and ability to manage the work of the class (Yusupov, 2002; Kulikova, Osipova, 2015; Fetiskin et al., 2002).

3. Results and Discussion

The authors employed the ‘Assessing the Teacher’s Professional Orientations’ questionnaire to determine the pronouncedness of the following factors: being sociable ($r=0.65$), being oriented toward the academic subject ($r=0.52$), and being cultured ($r=0.42$). This which may be interpreted as the outcome of being polyoriented and bear testimony to a pronounced norm of professional orientation.

Using the VO questionnaire the authors assessed the 3 indicators that are crucial to characterizing a class teacher’s polyethnic competence: association (communication), morality, and ethics. The statistical analysis revealed that the above values had been formed in equal measure ($r=0.72$) with the overwhelming majority of respondents.

The results obtained through on the OC questionnaire revealed that most of the respondents were characterized by an alterocentric orientation ($r=0.52$), which implies being “centered” on the collocutor and oriented toward their objectives. At the same time, teacher’s dialogical orientation was manifested insignificantly ($r=0.39$). The authors are of the opinion that, as one develops personally, a dialogical orientation in communication is no longer viewed by pedagogues as the need to adjust to the child’s level and sacrifice your interests for the sake of theirs.

The use of I.M. Yusupov’s ‘Diagnostic Assessment of Empathy Levels’ helped identify some of the dominant empathic trends for class teachers. For the purposes of this study, the more significant parameters are empathy in interacting with children and the summarized indicator of one’s empathy levels. The summarized indicator of one’s empathy levels was characterized by a very high level ($r=0.72$). Highly compassionate, these teachers tend to react subtly to the mood of their collocutors. The level of empathy with children in research subjects in all the groups was found to be OK ($r=0.52$).

The findings from the use of the ‘Self-Evaluation of the Ability to Manage the Work of the Class’ questionnaire helped establish the fundamental abilities of teachers oriented toward cooperation and fostering the ability to work independently.

The authors had assumed there is a positive (direct) correlational relationship between all of the components of polyethnic competence, as well as between these and its integral indicator, which was calculated by way of adding up all the data on the components identified: motivational/value-based, communicative, and social/perceptive.

To determine the level of development of polyethnic competence in class teachers, the authors introduced the integral indicator (II), which was calculated by way of adding up the data on the components identified: motivational/value-based (MV), communicative (C), and social/perceptive (SP). Afterwards, all the indicators of polyethnic competence were subjected to a correlation analysis (Pearson's r), which helped establish the orientation and closeness of the relationship between them (Table 2).

Table 2. Correlation Matrix Representing the Interrelationship between the Components of a Class Teacher’s Polyethnic Competence (statistical significance level $p<0.05$)

| Components of polyethnic competence | Pearson's r | | | |
|-------------------------------------|-------------|------|------|------|
| | MV | C | SP | II |
| MV | × | 0.52 | 0.45 | 0.61 |
| C | | × | 0.49 | 0.59 |
| SP | | | × | 0.52 |

Note. MV = motivational/value-based; C = communicative; SP = social/perceptive; II = integral indicator.

The findings from the statistical processing of the results of the pairwise correlation led to the general conclusion that there is a direct correlational relationship between all the components of polyethnic competence, as well as between these and the integral indicator.

Based on the findings from the authors' analysis of dependency between the components of polyethnic competence, the degree of their significance may be represented as follows: 1) motivational/value-based, 2) communicative, and 3) social/perceptive.

To establish the closeness of the relationship between a student's current sense of psychological security and a class teacher's level of polyethnic competence, as well as to determine the effect of particular components of polyethnic competence on one's sense of psychological security, the authors calculated the pairwise Pearson correlation using the Statistica analytics software package (Fig. 1).

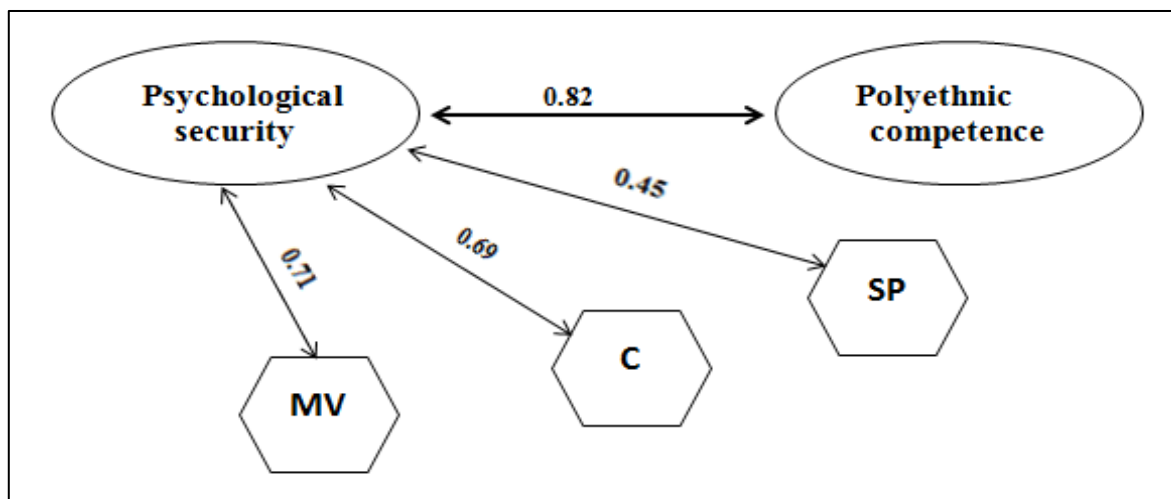


Fig. 1. Closeness of the interrelationship between a student's sense of psychological security and the level of a class teacher's polyethnic competence (statistical significance level $p < 0.05$).

Note. MV = motivational/value-based component; C = communicative component; SP = social/perceptive component.

The findings from the statistical processing of the pairwise correlation led to the following inferences:

1) there is a strong positive (direct) dependency between the student's current sense of psychological security and the class teacher's level of polyethnic competence: the correlation coefficient in this case was $r = 0.82$;

2) there is a strong positive (direct) dependency between the student's sense of psychological security and the motivational/value-based component of the class teacher's polyethnic competence: the correlation coefficient was $r = 0.71$;

3) there is a strong positive (direct) dependency between the student's sense of psychological security and the communicative component of the class teacher's polyethnic competence: the correlation coefficient was $r = 0.69$;

4) there is a strong positive (direct) dependency between the student's sense of psychological security and the social/perceptive component of the class teacher's polyethnic competence: the correlation coefficient was $r = 0.45$.

4. Conclusion

The findings from the authors' analysis and summarization of the study's results led to the conclusion that it is the teacher's personal qualities which are the components of their polyethnic competence (motivational/value-based, communicative, and social/perceptive) that determine their ability to create the psychologically safe conditions for the development of their students. These conditions form as part of the interaction between pedagogues and students and may either facilitate or impede the emergence in learners of a fear of self-expression, a sense of alarm, and a sense of being scared of the teacher and their expression of negative emotional states and worry in situations involving self-revelation and demonstration of one's potential.

The class teacher needs to possess a culture of self-acceptance and self-expression in all kinds of qualities, feelings, and deeds, which at times may be quite unexpected. A high level of self-acceptance determines a stable image of not just oneself but of other people as well (C. Rogers). A consequence of having low levels of self-acceptance, according to R. Burns, is inadequate self-appraisal and alienation of certain qualities of one's own, which may engender an inferiority complex and impede the establishment of harmonious relations with oneself and others. A dependency that is well-known in present-day psychology is the harder it is for you to accept yourself, the harder it will be to accept other people. All this perfectly applies to class teachers as well. A class teacher who is unable to accept their students as they are is denying them the right to be themselves. And that may create an insuperable psychological barrier in interacting with them.

In pedagogical activity, it is the teacher's acceptance of their own personality that facilitates their positive acceptance of their students. Teachers who accept themselves are characterized by an understanding attitude toward their students and strive to create an atmosphere of security, trust, and care, which facilitates the emergence in one of the desire to be oneself.

The study's findings have substantiated that the teacher is a key figure in fostering the student's sense of psychological security, and its key criterion is the level of the class teacher's polyethnic competence.

References

Baeva et al., 2009 – Baeva, I.A., Volkova, E.N., Laktionova, E.B. (2009). *Psikhologicheskaya bezopasnost' obrazovatel'noi sredy: Uchebnoe posobie* [Psychological security in the educational environment: A study guide]. Moscow, Russia: Ekon-Inform. [in Russian]

Bessarabova, 2007 – Bessarabova, I.S. (2007). Polikul'turnost' obrazovaniya kak filosofskaya i psikhologo-pedagogicheskaya problema [The polyculturalness of education as a philosophical and psychological/pedagogical issue]. *Sovremennye Naukoemkie Tekhnologii*, 3, 63–67. [in Russian]

Delors, 1996 – Delors, J. (1996). Learning: The treasure within – Report to UNESCO of the International Commission on Education for the Twenty-First Century. Paris, France: UNESCO Publishing.

Yusupov, 2002 – Yusupov, I.M. (2002). Diagnostika urovnya polikommunikativnoi empatii [Diagnostic assessment of polycommunicative empathy]. In I.B. Dermanova (Ed.), *Diagnostika emotsional'no-nravstvennogo razvitiya* [Diagnostic assessment of emotional/moral development] (pp. 114–118). Saint Petersburg, Russia: Rech'. [in Russian]

Kulikova, Osipova, 2015 – Kulikova, T.I., Osipova, N.V. (2015). Diagnosticheskaya programma izucheniya psikhologicheskoi bezopasnosti shkol'nika v polikul'turnoi obrazovatel'noi srede [A diagnostic program for exploring the psychological security of pupils in a polycultural educational environment]. Tula, Russia: Image Print. [in Russian]

Eliseeva, 2011 – Eliseeva, O.A. (2011). Sub'ektivnoe blagopoluchie podrostkov i psikhologicheskaya bezopasnost' obrazovatel'noi sredy [The subjective well-being of adolescents and psychological security within the educational environment]. *Psikhologicheskaya Nauka i Obrazovanie*, 3. [in Russian]

Kulikova, 2008 – Kulikova, T.I. (2008). O soderzhanii psikhologo-pedagogicheskogo soprovozhdeniya deyatelnosti klassnogo rukovoditelya [On the content of psychological/pedagogical support for the activity of a class teacher]. In V.V. Kozlov (Ed.), *Psikhologiya XXI stoletiya. V 2-kh t.* [The psychology of the 21st century. In 2 volumes] (pp. 20–23). Yaroslavl, Russia: MAPN. [in Russian]

Makaev et al., 1999 – Makaev, V.V., Mal'kova, Z.A., Suprunova, L.L. (1999). Polikul'turnoe obrazovanie: Aktual'naya problema sovremennoi shkoly [Polycultural education: A topical issue facing present-day schools]. *Pedagogika*, 4, 3. [in Russian]

Manoilova, 2009 – Manoilova, M.A. (2009). Psikhologicheskie osobennosti sovremennoi polikul'turnoi obrazovatel'noi sredy [Psychological characteristics of present-day polycultural educational environments]. *Vestnik Pskovskogo Gosudarstvennogo Universiteta. Seriya: Sotsial'no-Gumanitarnye i Psikhologo-Pedagogicheskie Nauki*, 9, 118–123. [in Russian]

Kulikova, 2015 – Kulikova, T.I. (Ed.). (2015). *Psikhologicheskaya bezopasnost' shkol'nika v polikul'turnoi obrazovatel'noi srede: Monografiya* [The psychological security of pupils in a polycultural educational environment: A monograph]. Tula, Russia: Image Print. [in Russian]

[Kulikova, 2015a](#) – *Kulikova, T.I.* (Ed.). (2015). *Polietnicheskaya kompetentnost' klassnogo rukovoditelya: Teoriya i praktika: Monografiya* [The polyethnic competence of a class teacher: Theory and practice: A monograph]. Tula, Russia: Image Print. [in Russian]

[Poshtareva, 2009](#) – *Poshtareva, T.V.* (2009). *Formirovanie etnokul'turnoi kompetentnosti uchashchikhsya v polietnicheskoi obrazovatel'noi srede* [Fostering ethnocultural competence in learners in a polyethnic educational environment] (Extended abstract of unpublished doctoral dissertation). North Ossetian State University, Vladikavkaz, Russia. [in Russian]

[Fetiskin et al., 2002](#) – *Fetiskin, N.P., Kozlov, V.V., Manuilov, G.M.* (2002). *Sotsial'no-psikhologicheskaya diagnostika razvitiya lichnosti i malykh grupp: Uchebnoe posobie* [Social/psychological diagnostic assessment of the development of a person and persons within small groups: A study guide] (pp. 153–156). Moscow, Russia: Izdatel'stvo Instituta Psikhoterapii. [in Russian]

[Khazova, Khatit, 2015](#) – *Khazova, S.A., Khatit, F.R.* (2015). *Polikul'turnaya kompetentnost' pedagoga: Nauchnoe elektronnoe izdanie (monografiya)* [The polycultural competence of pedagogues: A scholarly electronic publication (monograph)]. Maykop, Russia: OOO Elektronnye Izdatel'skie Tekhnologii. [in Russian]

[Khupsarokova, Khakunova, 2011](#) – *Khupsarokova, A.M., Khakunova, F.P.* (2011). *Predmetno-soderzhatel'nye komponenty polikul'turnoi kompetentnosti pedagoga* [Substantive components of the polycultural competence of pedagogues]. *Vestnik Adygeiskogo Gosudarstvennogo Universiteta. Seriya 3: Pedagogika i Psikhologiya, 1*, 50–55. [in Russian]



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.

All rights reserved.

Published in the Slovak Republic

European Journal of Contemporary Education

ISSN 2304-9650

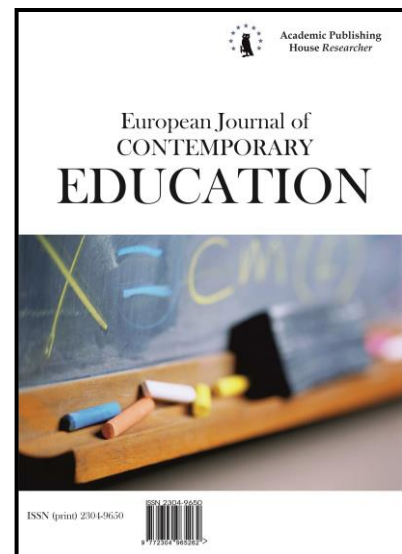
E-ISSN 2305-6746

2017, 6(3): 565-573

DOI: 10.13187/ejced.2017.3.565

www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



Model of Distant Learning Educational Methods for the Students with Disabilities

Tatyana A. Naumova ^{a,*}, Nadezhda I. Vytovtova ^a, Nicholas W. Mitiukov ^b, Teymur E. Zulfugarzade ^c

^a Udmurt State University, Russian Federation

^b International Network Center for Fundamental and Applied Research, Russian Federation

^c Plekhanov Russian University of Economics, Russian Federation

Abstract

The present paper represents the results of the studies done at the Udmurt State University with assistance of the Russian Humanitarian Scientific Fund (project 14-16-18004). In the course of studies e-learning educational methods for the students with special educational needs were developed, approved and implemented in educational process. Features of training and educational activity motivation, as well as attention span, time history of working efficiency and interpersonal relations, peculiar properties of logical thinking and coping behavior of the group of the students of "Law" department were revealed in the process of stating experiment. On the basis of psychology and educational features of the group under study, we developed the integrated educational methods of training matching the features of disabled students. The technology includes both traditional and innovative methods of training. During the pedagogical experiment it was proved that application of active methods of training in educational process increases educational motivation makes active informative activity and improves the interpersonal relations that positively influences the process of professional adaptation in modern society. The results received during the experiment can be used by the teachers realizing e-learning of disabled students, managers of educational sphere organizing e-learning of students.

Keywords: e-learning, special educational needs, disabled student, educational methods, active methods of training, mode of study, teaching method.

1. Introduction

In our modern age knowledge is the necessary tool of tasks solution both in professional and personal spheres.

* Corresponding author

E-mail addresses: nta64@yandex.ru (T.A. Naumova), nadivit@rambler.ru (N.I. Vytovtova), nicoo2@mail.ru (N.W. Mitiukov), teymurz@yandex.ru (T.E. Zulfugarzade)

At the same time it is necessary to consider that demand for education arise for representatives of various sections of society. It inevitably results in stiffening of requirements to training organizations and enabling of self-education.

The satisfaction of educational requirements demands consideration not only specifics of the studied discipline, but also specific features of students. Students show interest in different spheres of professional activity, have various level of basic preparation, feature of the organization of the informative sphere of the personality. Each of them has specific picture of the future profession and possibilities to use the gained knowledge. One educational group can unite persons with the high level of educational background, and those who meet the minimum volume of qualifying standards. This is especially the case of disabled people having difficulties in getting the high-level education.

One of the ways to solve this problem is development of training courses, creation of textbooks and study guides in the form of the electronic educational resources (EER) taking into account the principle of training individualization.

Free access to information educational resources of all population of Russia including persons with special pedagogical needs led to change of educational paradigm of the information society. Development of information and communication technologies created essentially new conditions of educational evolution.

However there is a set of problems connected with the organization of educational process of disabled students. These are psychological, physical and system-base barriers. Because of the existing physical violations students cannot regularly attend classes in higher education institutions. The traditional forms and methods of training in higher education institutions are often unacceptable for the students claiming ad hoc approach. Features of a disease also hinder full integration into educational process of ordinary student's group. Modern information technologies allow getting online education in institutions of different levels. Such educational form allows creating significant opportunity for disabled students to acquire knowledge taking into account their personal features.

Need of e-learning implementation, or, at least, online courses, is understood in all higher education institutions of Russia and other countries. Every institution develops technology of training and mentoring of students in its own way. Unfortunately, lack of a uniform paradigm of distance learning will not allow creation of uniform educational virtual space of e-learning with a possibility of remote courses exchange, creation of uniform global audience for collaboration over practical tasks, projects, joint speakers' branch, etc.

However, proceeding from the principles of training individualization, it is necessary to investigate psychology and educational features of the group of students with special pedagogical needs.

One of current problems of the present is improvement of quality of higher education. It is multipurpose problem directly connected with change of functioning of the higher education, transformation of all educational process in general and change of education purpose. At implementation of training the real purpose of education is not just obtaining of ready professional knowledge and skills, but acquisition in the course of training of core competency, such as readiness for decision-making, readiness for use of information and communication technologies, readiness for social interaction, communicative competence, etc., that is provided by educational standards of new generation. In Russia it is caused by transition to the European system of education providing competence-based approach to training (Khutorsky, 2005). Change of the purposes and problems of education demands change of technology of the organization of the whole educational process. It is necessary to realize transition from the centralized model of knowledge transfer in which a teacher telling knowledge to a student is a center to the model in which center is a student supported by a teacher in definition of the training purposes and reaching them (Yakimanskaya, 1996). Reconsideration by the teacher of own role in educational process and mastering the new pedagogical technologies based on learner-centered approach to training is urgent task in Russia today.

2. Purpose

Purpose of the present study is design of educational technology of distance learning of students with special educational needs. According to the document "Methodological

recommendations about Management of Educational Process for Training of Disabled People and Individuals with Disabilities in the Higher Educational Institutions including Equipment of Educational Process" of April 08, 2014 AK-44/05vn. The present document recommends adapting of educational programs and educational methodological support of educational process to the needs of disabled people and individuals with disabilities. Information technologies allow access to information in available forms depending on nosology. Web content has to be available for a wide range of users with health limitations (disorder of hearing, sight, musculoskeletal system, speech, mental sphere, and also combined disabilities). The teaching material has to be available to all the categories of students. The special efficiency is gained by a combination of individual and group methods of training with the use of modern distant technologies and innovative methods of training.

3. Materials and methods

The Purpose of the present study is examination of process of distance learning of the students having disability. An object of research is the model of teaching methods with the use of distant technologies and e-learning. The authors used the following methods: carrying out the theoretical analysis of the approaches to training of the students with disabilities as at inclusive, so at e-learning in references; modeling of the process of distance learning in the conditions of the university. The training process was simulated according to the approaches developed for teaching of students in stationary and virtual realities (D.B. Elkonin, V.P. Ovechkin, A.G. Rivin, T.V. Kudryavtsev); the system approach providing the analysis of an object of research; the competence-based approach allowing to correlate the virtual environment of education to the needs of students with disabilities and the social service procurement through the Available Environment program. The logic of the research was constructed in such a way that, proceeding from psychology, educational and physiological features of disabled students and the developed technology of training in the conditions of e-learning, there were created conditions making education to be accessible for the students with disabilities.

Tactics of the study was intra group experiment.

4. Discussion

We investigated such educational and psychological features of students as motivation of learning in higher education institution, motivation of educational activity, attention span and performance distribution, and also features of coping behavior of students. The group of six students studying at the educational department "Law" participated in the study in the distant form. The purpose of the "Stating Experiment" was identification of psychology and educational features of the students with disabilities of various etiologies and learning in one group. The research of motivation was conducted by the means of several techniques: motivation of training in higher education institution (technique of T.I. Ilyin) (Mironov, 2005), and technique of research of educational activity (variant II) modified by A.A. Rean (Rean, 1990) and V.A. Yakunin (Yakunin, 1994). The research of attention span and performance distribution was conducted by means of the Schulte tables. Test of Ravena was the tool for logical thinking research.

The study gave the following indices. At the high level of motivation to training knowledge acquisition is students' number one concern, then obtaining the diploma follows and only on the third place there is learning of trade. Another, not unimportant factors of successful educational activity are attention, working capacity and operational efficiency. The intensity of these factors is considered at the choice of a technique and didactics of training. Performance distribution had linear character with slight increase of time. The overall performance, expectedly, is individual within average values with a decrease tendency to the end of a task, and depends on a student disease.

In order to improve effectiveness of performance of educational tasks at the beginning of the lessons it is expedient to offer the tasks demanding the maximum concentration of the student's attention. The attention also tends to decrease in the course of tasks fulfillment. That is the number of the tasks of the middle difficulty level solved during one in-class lesson should not be very big. Or solutions of tasks have to alternate with other types of activity. Degree of getting into the swing of work demonstrates that examinees need more time for preparation for the main work. The indicator of mental stability (according to Ravenna) corresponds to good mental resistance to

those types of educational activity where students are to perform tasks attentively. The level of development of intelligence showed average value for this age group.

At the second investigation phase we conducted a group research on coping behavior which consists in the most effective adaptation of a person to requirements of a difficult or even extreme situation.

The results were yielded by mean values of reaction to a stressful situation. The concept of "coping behavior" is used for the characteristic of ways of behavior of a person in various difficult situations. For the students having problems with health and studying, actually individually with limited level of communication at tasks fulfillment, communication can be considered "a difficult life situation". The technique of research of resistance to stress and social adaptation (Holm, Rage) revealed the average level of resilience to a stress. Having analyzed an average picture of emergence of a stressful situation, it is possible to note the following stress-producing situations: all the situations concerning own health and health of relatives (that is, actually, natural for the people having disabilities), changes in the modes of training work, rest and social activity. However the integrated indicator of psychological tension gave mean indices. It indicates presence of deadaptation and psychological discomfort in the period of the experiment fulfillment. It is possible to explain such a discomfort with the beginning of a new semester, with the advent of new school subjects and new teachers. Requirements of the teachers who for the first time started training of students in the remote mode in general and disabled students in particular is the reason of the increased tension to a students, cautious attitude, fear to do something wrong or to lag. That is why it is necessary to develop standard requirements for provision and realization of teaching situation. Of course, it is very difficult to make everybody to work to pattern, but these efforts will return to a teacher in the form of effective work of the educational group (Baranov et al., 2014; Neskorumnykh et al., 2017; Naumova, Vytovtova, 2014). For estimation and analysis of amplitude attributes with the use of basic indices there were chosen the following indicators (see Fig. 2). That is why selection of definitive educational methods taking into account individual features of the students with special needs is our next task.

At the third stage of our research, after approbation of the training courses developed by us, we started design of educational technology taking into account the data obtained when carrying out the stating experiment. At the stage of selection we considered the following educational technologies:

- Traditional (reproductive) technology of training (the technology is focused on transfer of knowledge and skills);
- Technology of evaluative training (D.B. Elkonin, V.V. Davydov and their numerous pupils) which cornerstone is training on special level; the technology of stage-by-stage formation of intellectual actions (the theory of P.Y. Galperin, D.B. Elkonina, N.F. Talyzina, etc.) based on pragmatist approach to assimilation of knowledge and skills; technology of collective interaction (developed by A.G. Rivin with assistance of his pupils and followers V.V. Arkhipova, V.K. Dyachenko, A.S. Sokolov and and others);
- Technology of full assimilation (authors of the technology of full assimilation are the American scientists J. Carroll and B. Blum and M.V. Klarin). Basic aspects of this technology the planned results of training which have to be reached;
- Technology of split-level training which assumes creation of educational conditions for inclusion of each trainee in the activity corresponding to a zone of his next development;
- Technology of split-level training assuming flexible system of studies management taking into account specific features of students;
- Technology of the programmed training (N. Krauder, B. Skinner, S. Pressi, P.Ya. Galperin, L.N. Landa, A.M. Matyushkin, N.F. Talyzina and others). This is technology of independent individual training according to the training program developed in advance with the use of special means (the automated training environment, the special training machines, etc.);
- Technology of computer training, which represents is the technology of program training changed during scientific and technical progress including interrelation of computers and specialized tutorials;
- Technology of problem training (T.V. Kudryavtsev, A.M. Matyushkin, M.I. Makhmudov, V. Okon and others) – independent search activities of studentss for the solution of educational

tasks during which the students get new knowledge and skills, develop their abilities, informative activity, inquisitiveness, erudition, creative thinking, etc.;

- Technology of the concentrated training or otherwise the method of immersion in a subject (P. Blonsky, V.F. Shatalov, M.P. Shchetinin, A. Tubelsky, G. Ibragimov and others);

- Technology of design training (D. Dewey) which cornerstone is the solution of practical tasks of everyday life;

- Technology of the guaranteed training (V.M. Monakhov) is a model of interaction of the teacher and trainee in design and realization of educational process;

- Technology of distance learning is receiving of educational services without visit of educational institution, by means of the modern systems of telecommunication and Internet resources.

At such variety of educational technologies all of them come down to two ways of their origin, i.e. practical and theoretical: in some cases the technology arises from the theory (V.P. Bepalko, V.V. Davydov, V.K. Dyachenko, L.V. Zankov, P.Y. Galperin, N.V. Kuzmina and others), in other cases the technology results from practice (E.N. Ilyin, S.N. Lysenkova, V.F. Shatalov, V.V. Sheiman, etc.). The cornerstone of the educational technology offered by the authors is the technology of distance learning in combination with the technologies of stage-by-stage formation of intellectual actions, full assimilation, split-level training and problem training. The experiment was carried out in the conditions of the prevailing use of remote educational technologies, so students did not attend class in higher educational institution; the State Educational Standard allows it. The technology of training assumes design of content of each discipline, forms of the organization of educational process, choice of methods and tutorials. When developing our educational technology we took into account not only psychology and educational features of this student group, but also the requirements of modern educational standards, namely application of interactive and active methods of training (Mariko, 2004). Therefore forms and methods of training listed below contain references to the used by us the equipment and strategies. Some of them are applied at the organization of the distant learning for the first time.

Fig. 1 represents the model of educational technology of distant learning with health limitation.

Forms of organization or distant learning for students with health limitation:

- **Frontal.** This form is chosen as far as with its help the basic theoretical provisions of a subject before fulfillment of practical works will be stated. The form underwent approbation and implemented in the teaching situation "The active lecture" with the use of the strategies "Logbook" and "Interactive lecture".

- **Individual.** Students perform work independently – the Portfolio method.

- **Group.** This form and method of a discussion will supplement each other and at joint use the discussion method will be even more effective. We chose the following strategies "Training together", "Zigzag", "Mosaic of problems", and also the strategy of problems solution "IDEAL".

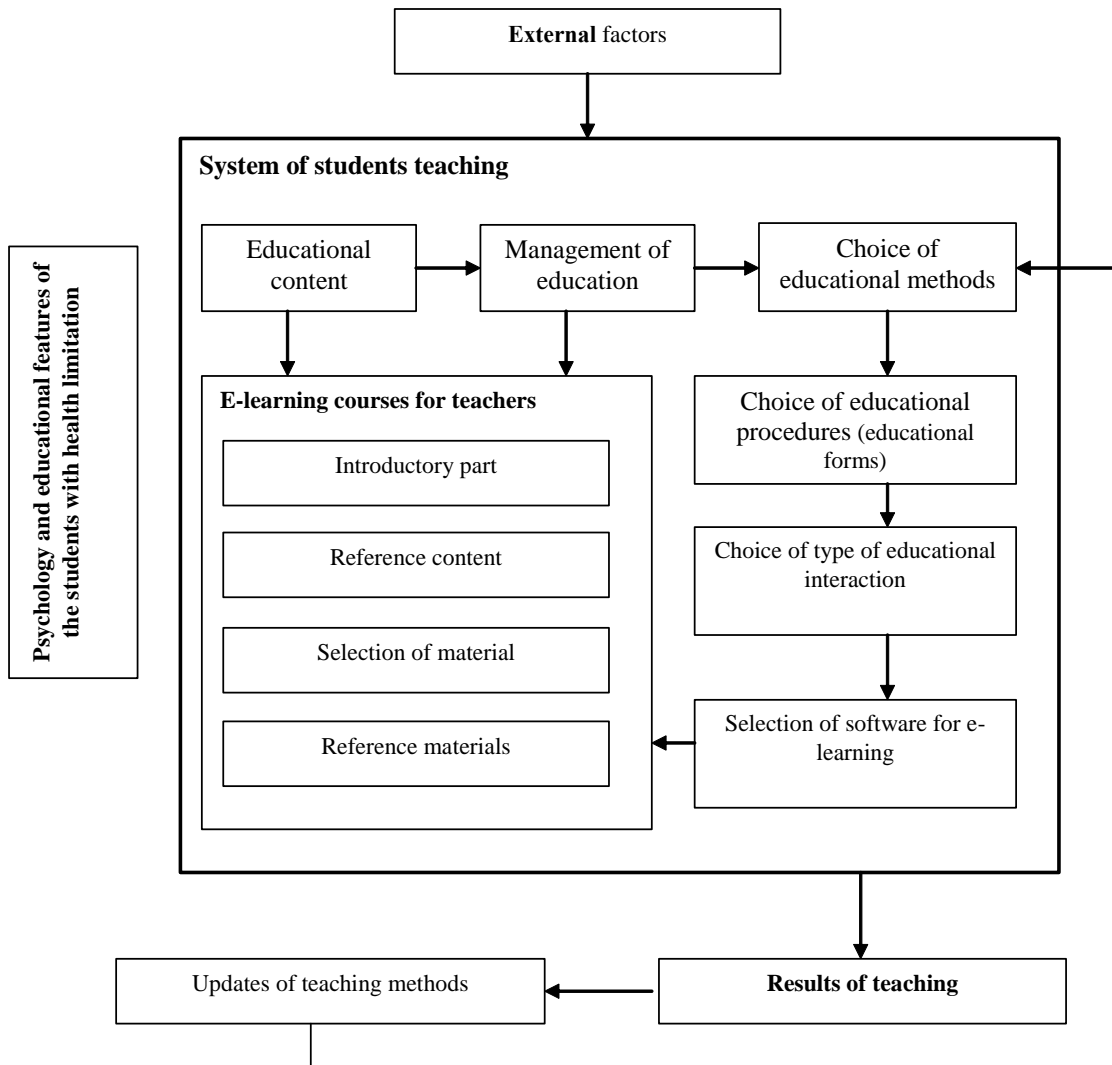


Fig. 1. Model of educational technology of distance learning

And – and now try one of the decisions; L – let’s think together how to realize it), etc.

2. Descriptive method

* The illustrative and demonstrational method represent use of descriptive educational methods which in the present technique are directed to a lecture method reinforcement by means of use of an electronic board and other modern technical means. Well proved at distance learning are educational presentations and educational websites.

3. Practical method

* Making use of practical method the students will work with the modern programs and educational means for solution of educational tasks. The method is aimed at the development of liability for the work done.

4. Problem-oriented training

* The method of problem-oriented training will help the students to study consider and solve specific problems. Herewith using new ways and approaches, the students develop their personality and promote innovative activity namely development of initiative. Within the methods of problem-oriented training there are used such techniques as problem-oriented issue, problem-oriented situation, problem-oriented lesson and problem-oriented task.

5. The analysis of concrete situations (case study)

The analysis of concrete situations (case study) is one of the most effective and widespread methods of the organization of vigorous cognitive activity of students. Coming up against a

concrete situation, the trainee has to define: whether there is a problem in it, what is it consists in and define own position on the situation.

6. Active methods of training

Active methods of training as the methods directed to stimulation of cognitive activity of students is facilitated discussion (strategy "Reading with stops"), strategy of development of the reflexive attitude to information ("I know" – "I want to learn" – "I learned"), the strategy of RAFT (Role-Auditorium-Form-Topic).

7. The method of design training

The method of design training is focused on independent activity of students – Individual, pair or group, which students carry out during a certain interval of time at solution of any research task

For discussion of the results of the design group work Edward de Bono's method "Six Thinking Hats" is very effective for discussion of the results of design group work.

Tutorials:

- Electronic educational resources (the training courses developed by teachers for work on the Adobe Connect platform, the system of electronic training at the LMS Moodle platform, etc.)
- Audiovisual educational resources (educational videos, presentation)

5. Results

Upon termination of the study we repassed inquiry of students, having used the questionnaire on training results after the active methods of training (AMT). The questionnaire represents 22 polar statements, each of which was estimated on-scale from 0 to 6 points. The received results are interpreted by three categories: the educational motivation (EM), the informative activity (IA) and the interpersonal relations (IR). In the table the corresponding points of the scale are marked with the corresponding letters. Taking into account that according to each statement the maximum number of points is "6" and minimum is "0", there was calculated the total amount of points by each criterion. On the basis of the received values there were distinguished the levels stated in [Table 1](#):

Table 1. Level of educational motivation, informative activity and interpersonal relations after the experiment

| | Levels in points | | |
|-----------------------------|------------------|---------|--------|
| | High | Middle | Low |
| Educational motivation (EM) | 25-36 | 13-24,9 | 0-12-9 |
| Informative activity (IA) | 35-57 | 19-36,9 | 0-18,9 |
| Interpersonal relations(IR) | 29-42 | 15-28,9 | 0-14,9 |
| Total | 89-132 | 45-88,9 | 0-44,9 |

[Table 2](#) presents the comparative data obtained before and after the experiment.

Table 2. The summary table of the results on AMT technique before and after the experiment

| | Before experiment | After the experiment |
|------------------------------|-------------------|----------------------|
| Educational motivation (EM) | 26 | 29 |
| Informative activity (IA) | 23 | 37 |
| Interpersonal relations (IR) | 22 | 29 |

Prior to the experiment the educational motivation was estimated as high (that is confirmed by the results received by the Ilyina's technique.), informative activity was at average level, the interpersonal relations also were at the average level. After the experiment the results changed as

follows: the educational motivation was high, but changed towards increase in result, level of the informative activity became high, the interpersonal relations also moved to the high level.

Visually the results of the time history of indices obtained before and after the experiment are presented in the Fig. 2.

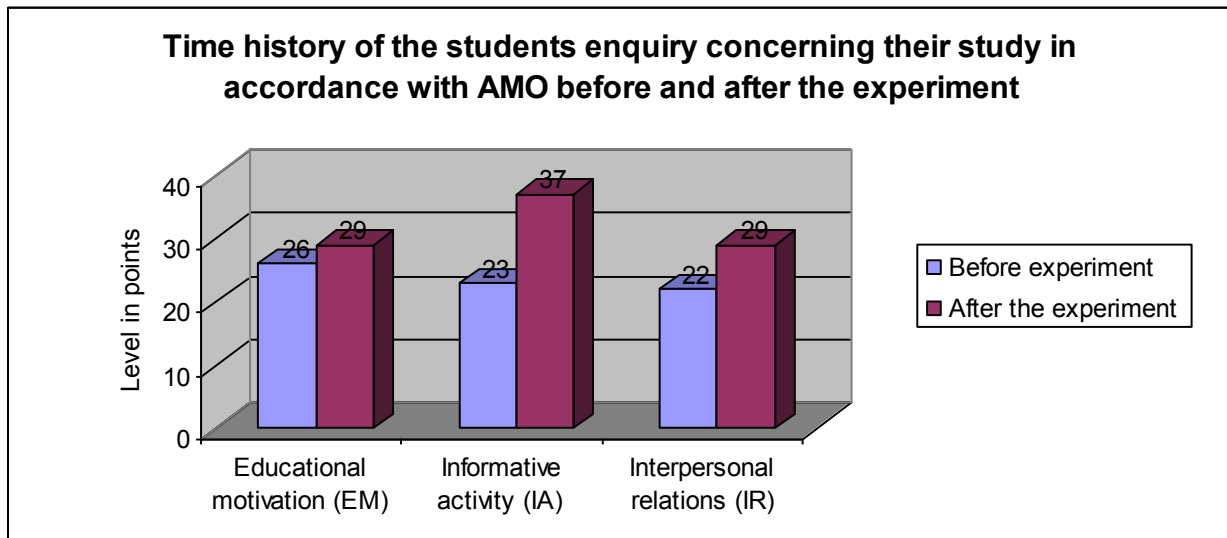


Fig. 2. Time history of indices before and after the experiment

At initially high level of motivation of the students to training there is observed weak tendency of the indicator to growth after carrying out the experiment (3 %). Growth of the informative activity (48 %) and the interpersonal relations (10 %) is considerable. If before use of the experimental technology of training only the motivation, as it was already noted, had a high rate, then after the experiment both the informative activity and the interpersonal relations received high indices, that is very important for training in the conditions of distance learning.

For confirmation of efficiency of the technology of training offered by the authors there were applied methods of mathematical statistics, i.e. T-criterion by Vilkokson, for identification of orientation and expressiveness of shifts in the same group of examinees in two different conditions - before and after use of our technology. For motivation $T_{emp} = 9.5$ at $T_{crit} = 2$ at 5 % level of the statistical importance that lies in a zone of unimportance of an indicator. Informative activity $T_{emp} = 2.1$ that is a significant indicator. Interpersonal relations constitutes $T_{emp} = 1.95$. The given indicator is in the area of uncertainty, but close to $T_{crit} = 2$ for 5 % level of the statistical importance that grants to us the right to consider it to be a significant indicator. Thus, it is possible to claim that the intensity of shifts in the typical direction does not surpass intensity of shifts in the atypical direction.

6. Conclusion

Therefore the offered educational methods of distant learning for the students with special educational needs based on the advances in information technology in combination with active methods of training is optimum for this educational group. It can be successfully used by teachers in educational groups with such students. Besides in the course of studies there is proved improvement of such factors as informative activity and interpersonal relations. It is very important for the distant-learning students training without direct communication with teachers and other students. Rise of informative activity bears testament that students with special educational needs (who sometimes are isolated from the whole world) are able to produce socially important transformation of material and mental spheres.

7. Acknowledgement

The present research was conducted within the project of the Russian Humanitarian Scientific fund and (p) 14-16-18004 “Development of educational methods for distance learning of disabled people”.

8. Recommendation

The educational technology developed by the authors is option of the distance learning management for the students with disabilities of various etiologies learning in one group.

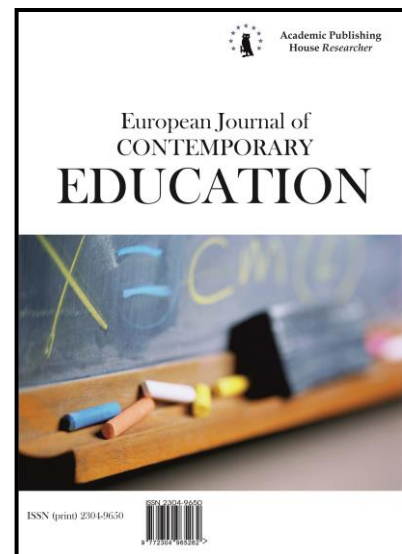
References

- [Baranov et al., 2014](#) – Baranov, A.A., Vytovtova, N.I., Naumova, T.A. (2014). Features of the development of distance learning courses for students with specific educational needs // Innovations in science, technology and the integration of knowledge: International scientific-practical conference (27-28 February 2014, London). London. pp. 129-136.
- [Dahl, 1991](#) – Dahl, V. (1991). *Tolkovy slovar' zhivogo velikoruskogo yazyka* [The Explanatory Dictionary of the Living Great Russian Language]. Vol. 4. Moscow: Russian Language.
- [Khutorsky, 2005](#) – Khutorsky, A.V. (2005). Tekhnologiya proektirovaniya klyuchevykh i predmetnykh kompetentsii [The technology of design of key and subject competences] // Online magazine "Eidos". <http://www.eidos.ru/journal/2005/1212.htm>. Patent data: Distant learning center "Eidos".
- [Mariko, 2004](#) – Mariko, V.V. (2004). Tekhnologiya razvitiya kriticheskogo myshleniya: opyt deyatel'nosti v ramkakh novoi obrazovatel'noi paradigmy [The methods of development of critical thinking development: experience of activity within new educational paradigm] / The social and cultural environment and uniform educational space of the Volga Federal District: regional policy and development strategies: Materials of the scientific and practical conference devoted to the 65 anniversary of Nizhny Novgorod Institute of development of education (October 28-29, 2003). N. Novgorod: Humanitarian Center of Nizhny Novgorod. pp. 148-150.
- [Mironov, 2005](#) – Mironov, E.E. (2005). Collection of psychological tests. Minsk: Women's Institute ENVILA. 155 p.
- [Monakhov, 2006](#) – Monakhov, V.M. (2006). Vvedenie v teoriyu pedagogicheskikh tekhnologii [Introduction to the theory of educational technologies]. Monograph. Volgograd: Peremena.
- [Monakhov, 1995](#) – Monakhov, V.M. (1995). Tekhnologicheskie osnovy proektirovaniya uchebnogo protsessa [Technological bases of the educational process design]. Monograph. Volgograd: Peremena.
- [Naumova, Vytovtova, 2014](#) – Naumova, T.A., Vytovtova, N.I. (2014). *Canadian Journal of Science, Education and Culture*. Vol. 2, № 1. January-June. pp. 347-351.
- [Neskoromnykh et al., 2017](#) – Neskoromnykh, N.I., Chernenko, N.V., Mamadaliev, A.M., Vorozhbitova, A.A. (2017). Educational-Cognitive Barriers in the Preparation of Future Social Pedagogues for the Prevention of Social Dependencies. *European Journal of Contemporary Education*, 6(1): 57-63.
- [Ojegov, 1982](#) – Ojegov, S.I. (1982). *Slovar' russkogo yazyka* [Dictionary of the Russian Language]. Moscow: Russian Language.
- [Pedagogy, 2000](#) – Pedagogika. Pedagogicheskie teorii, sistemy, tekhnologii [Pedagogy. Educational theories, systems and technologies]. Editorship of S.A. Smirnov. Moscow, 2000.
- [Rean, 1990](#) – Rean, A.A. (1990). Reflexive and perceptive analysis in teacher's activity. *Questions of psychology*. № 2.
- [Yakimanskaya, 1996](#) – Yakimanskaya, I.S. (1996). Lichnostno-orientirovannaya sistema obucheniya: printsipy ee postroeniya [Personality focused system of teaching: principles of its construction]. Moscow: September.
- [Yakunin, 1994](#) – Yakunin, V.A. (1994). Psychology of learning activities of students. Moscow.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.
All rights reserved.
Published in the Slovak Republic
European Journal of Contemporary Education
ISSN 2304-9650
E-ISSN 2305-6746
2017, 6(3): 574-585
DOI: 10.13187/ejced.2017.3.574
www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



Incorporating Beliefs, Values and Local Wisdom of Betawi Culture in a Character-Based Education through a Design-Based Research

Suswandari ^{a,*}

^a University of Muhammadiyah Prof Dr HAMKA, Jakarta, Indonesia

Abstract

This design-based research is part of three-year national projects examining the incorporation of local wisdom in a character-based education in primary school contexts. Specifically, the present study addresses two research questions: 1) what are local wisdoms of Betawi ethnic feasible to be incorporated in character based curriculum in primary school contexts, 2) what are potential classroom instruction methods for such a local wisdom integrated curriculum. To this end, I worked with historian, educational experts and practitioners. Multiple data collection methods were employed, including documents study, interview, survey, focus group discussion and observation. The collected data were analysed both qualitatively and quantitatively. This study has highlighted several beliefs, values and local wisdom from Betawi culture feasible for integration within classroom instruction. More importantly, the study has discussed an alternative instructional method that facilitated the incorporation of the beliefs, values and local wisdom from Betawi culture in classroom context.

Keywords: design based research, character education, moral value, local wisdom.

1. Introduction

Character education which is viewed as an attempt to promote positive characters (Berkowitz, Bier, 2005) has recently gained much attention in Indonesian classrooms. In the country, character education is seen as a potential solution of the increasing crime rate by school age children (see for example Sutrisno, 2015). Specifically, in the capital city of Jakarta, the statistic of crime rates shows that in 2009, 8 % of the crimes are conducted by school age children (Unayah, Sabarisman, 2015). This means 1.318 out of 1.647.835 primary and secondary school children are

* Corresponding author
E-mail addresses: suswandari@uhamka.ac.id (Suswandari)

committed to crime, and this number is growing each year (p. 122). Issues of morality have been considered as contributing factors for the increase of crimes among the students (ITS, 2016).

Early in his government, the new elect Indonesian president 2014-2019, Joko Widodo has proposed what he called “Revolusi Mental (Mental Revolution) as one of his urgent political agenda. This agenda has given more support to the Indonesian character education in the country. Unfortunately, although CBE has been put as the main country’ agenda in education, its implementation in the school classrooms has caused wide disputes among the government itself, education practitioners and experts in the field. Three questions of disputes include 1) whether the policy on CBE would imply directly on an establishment of a new subject within the school curriculum or not, 2) what kind instructional approach and 3) what kind of instructional materials would fit the classroom practices.

One of alternatives taken by the local government of Jakarta to address the above disputes above is by integrating the beliefs, values and wisdom from the Jakartan’s native culture; that is Betawi culture, into the school curriculum. This was done by promoting a new subject called as “The education of environment and culture of Jakarta” (Pendidikan Lingkungan Budaya Jakarta or PLBJ) in primary education levels.

For years, public perceived that PLBJ was as a solution for the practice of CBE at schools across Jakarta. Yet, on the other side, many education experts as well as practitioners has risen their concerns that such practice did not fundamentally address the main issues of CBE. They perceived that PLBJ was local and cognitive-oriented course. In the classroom practice, for example, teachers were observed to teach about the Betawi arts and artefacts rather than its belief, values and wisdom that students could learn and exercise in their daily life. In other words, the practice of CBE through PLBJ mainly relied on the development of students’ knowledge about Betawi culture rather than instilling good characters of Betawi culture to the students.

Moreover, the implementation of PLBJ as a media to promote CBE was challenged by teachers’ lack knowledge about Betawi culture and its beliefs, values and wisdom in addition to their ability to teach and instil these cultural aspects to their students. These two issues are critical and apparently have constrained the success of the practice of CBE in school classroom, particularly in context of primary education. It is thus the aim of this present study to address the two challenges as discussed above. Using a design based research design, the study attempted to explore the process of the incorporation of local wisdom in a character-based education in primary schools in Jakarta, Indonesia. Specifically, two research questions were addressed as follow:

- 1) What are the local wisdom from the Betawi ethnic feasible to incorporate in a character-based education in public primary schools in Jakarta, Indonesia?
- 2) What is a potential classroom instruction method that can accommodate the incorporation of the Betawi local wisdom in a character-based education?

2. Method

2.1. Design-based research

Design-based research (henceforth DBR) is viewed as a research design that allows educational researcher to design and test certain innovations within classroom contexts or other learning environments (Fishman et al., 2013). In the fields of educational research, the main objective of DBR is particularly to enhance “the impact of educational research, and generate generalizable design principles” (Anderson, Shattuck, 2012: 16). Zheng (2015) highlights several characteristics that define DBR; including 1) the research is situated in a real context, 2) it focuses on the examination of certain intervention, 3) it involves continuous iteration of design, implementation, analysis and redesign. In addition to Zheng (2015), Anderson and Shattuck (2012) suggest two prominent aspects that characterise DBR, namely collaboration and mixed research design. According to Anderson and Shattuck (2012), in doing DBR, researchers should develop a mutual collaboration between themselves and practitioners, besides the use of mixed methods in collecting and analysing the data to address the established research questions.

To achieve such objectives above, by adapting Wang, Hsu, Reeves, and Coster’s (2014) procedure, the present study carried out several stages: first, the researcher worked together with historian, local Betawi community, and education practitioners in the context of the study. Second, together with education practitioners, the researcher developed a potential classroom instruction

method which promote the integration of Betawi local wisdom in a character-based education. This was done by first the researcher evaluated curriculum documents at schools, including teaching and learning curriculum, syllabus, teaching plans and teaching reports. Third, with collaboration with the school teachers, the researcher applied and monitored the teaching and learning activities to which local wisdom was incorporated in the syllabus. Finally, the researcher developed an instruction method for classroom application. Reeves' (2006) framework for conducting DBR was also employed to guide the present study as presented in figure below:

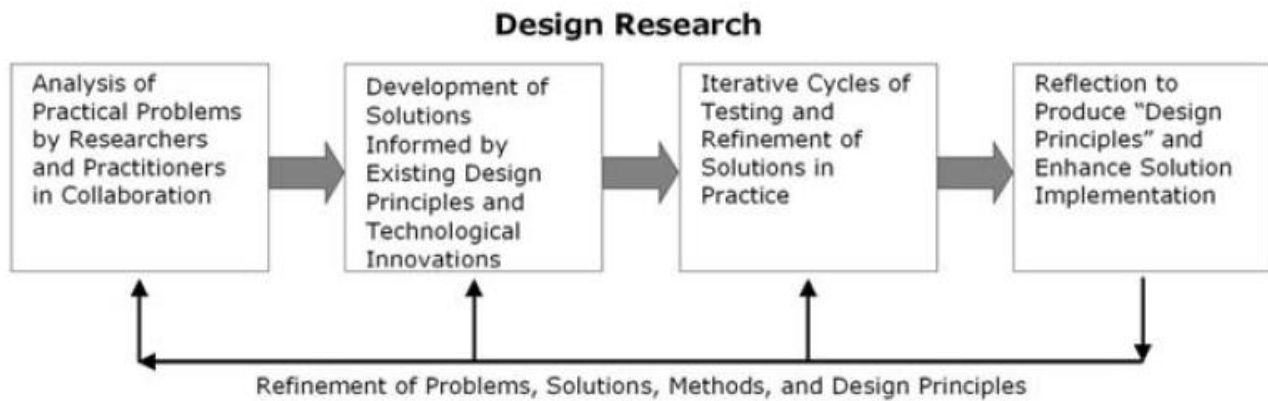


Fig. 1. Reeves' (2006) DBR cycle

2.2. Description of context

2.2.1. Jakarta

The present study was conducted in Jakarta, the capital of Republic Indonesia. As a special capital city district, Jakarta is divided into six administrative cities, such as Central Jakarta (with population 913,870 people, total area 48.13 km²), South Jakarta (with population 2,183,900, total area 141.27 km²), East Jakarta (with population 2,826,66 people, total area 188.03 km²), West Jakarta (with population 2,460,780 people, total area 129.54 km²), North Jakarta (with population 1,745,820 people, total area 146.66 km²), and Kepulauan Seribu (Thousands Islands) (with population 23,310 people, total area 8.7 km²) (Badan Pusat Statistik, 2015). Jakarta is described as of multicultural city across Indonesia. Hendor and Suparman (2006) writes that there are more than ten ethnicities in Jakarta, among of which are Betawi, Sunda, Jawa, Malay, North Sulawesi, Minang, Maluku, Batak, Depok, South Sumatera, Madura, Chinese, Europe, and Arabs. For education practitioners, promoting multiculturalism in classroom practices at schools in Jakarta is of main challenges.

2.2.2. Betawi ethnicity

Betawi ethnic is the native of Jakartans. Although the use of such a term of "native of Jakartans" to present the Betawi ethnic has been a long debate among historians. It is because Betawi ethnicity is fundamentally a result of cultural assimilation among various ethnic groups in Batavia around 18 century such as China, Europe Arabs and the local people of Batavia at the time (Alfian, 2013). Recently, Betawi ethnic makes up about 28.02 % of the entire population in Jakarta (Badan Pusat Statistik, 2010). In the school curriculum, the history, life, arts and values of Betawi ethnic is taught as a part of character education in Jakarta (Alfian, 2013; Kementerian Pendidikan Nasional, 2010b, 2011; Purbasari, 2010). Such a culture of Betawi ethnic is taught in primary school levels (grade one to six) under the Environment education and the culture of Jakarta (Pendidikan Lingkungan dan Budaya Jakarta) subject. For example, the folk story, arts, drama, performance, games, and daily ceremony of Betawi people are taught to fifth graders (Setiawan et al., 2002).

2.3. Participants

116 primary school teachers participated in the present study. They were 96 female and 20 male teachers aged between 28 and 55 years old. The teachers' teaching experience ranged from three to thirty-three years. As suggested by Wang et al (2014), the profile data from each schools were collected to help the researcher understand the character-based classroom teaching practices

at schools. It included the school performance the last three years, the school progress report of the implementation of the new curriculum 2013 and character-based education at schools.

2.4. Data collection and analysis

Data needed for the present study were gathered through multiple data collecting methods. The following subsections provide the detail of each of the method.

2.4.1. Document study

To address the first research question, I conducted a review of literature on Betawi ethnic and its culture. Many of their artefacts were also studied, particularly those are still being used by Betawi People in Setu Babakan Betawi village. In addition, to address the second research question, I conducted document study. The study included the review of national education curriculum, government policy on education and character education, and teaching documents (e.g. teachers' lesson plans, instructional materials etc.)

2.4.2. Interview

Interview with historian was carried out to explore the history of Betawi ethnic in Jakarta, Indonesia. In addition, people from Betawi ethnic particularly those living in Setu Babakan Betawi village was also interviewed to explore their daily social life, particularly the belief, value and local wisdom they practiced during their interaction and communication among them.

2.4.3. Survey

Survey was distributed to 116 teacher participants to examine their awareness and knowledge about beliefs, values and local wisdom of Betawi ethnic.

2.4.4. Focus group discussion

Four series of focus group discussions (FGD) were conducted and participated by thirty teachers of 116 teacher participants. Teachers' participation in FGD was on voluntarily basis and each of FGD was video-recorded. The first series of focus group discussions were aimed to explore the values which were promoted in the character education in primary schools in Jakarta. The series lasted for two months covering five meeting with 60 minutes each. The second FGD series were aimed to examine the feasibility for the incorporation of the beliefs, values and local wisdom of Betawi ethnic into school learning curriculum. The series lasted for one month and covered three meetings. In the series, the discussions were focused on values which were promoted in the character education in primary schools in Jakarta, the beliefs, values and local wisdoms of Betawi ethnic which can fit the values as promoted in the character education curriculum and the discussion about teachers' knowledge and awareness of the Betawi values.

In the third FGD series, I and the groups of teachers discussed about short and long terms of the development plan of education in Jakarta and the local government's policy on education, the character education documents, the documents about the implementation of character education in primary school classrooms (e.g. syllabus, teaching plan and reports). It is important to mention that teachers were provided with documents such as education regulations, education policy, and school curriculum. In final discussion series were employed to explore teachers' perception about a classroom instruction method for classroom activity within which local wisdom was incorporated in character based education in primary school context. The series lasted only two weeks with coverage of two meetings.

2.4.5. Observation

Two observations were conducted in the present study. The first observation was conducted to address the research question 1. To this end, I visited Betwai community in Jakarta, particularly Kampung Budaya Betawi (Betawi culture village). Each time of the visit, I observed how Betawi people interacted each other. I frequently involved in their interaction to enable me to understand the beliefs, values and local wisdom of Betawi ethnic and how these beliefs, values and local wisdom were practised in the community. Talks and chats with the Betawi people were audio-recorded. Second, I conducted classroom observation to address the research question 3. In this observation, I evaluated teachers' classroom instruction of which local wisdom of Betawi ethnic

was incorporated in character based education in primary school context. During the classroom observation, I recorded teachers' instructional activity and wrote notes about it.

2.4.6. Data analysis

The data collected were analysed within three ways. First, the data collected from survey was evaluated quantitatively to reveal the percentage of teachers' responses. Second, the data from focus group discussion were analysed using thematic analysis. The data from interview and FGD first were transcribed verbatim then they were colour coded (Solihati, Mulyono, 2017). The codes obtained then were analysed and extracted into themes. Third, the collected data were triangulated to promote the validity of the findings (Cohen et al., 2011; Denzin, 2012).

3. The study narratives and the discussions

3.1. Phase one: Analysis of beliefs, values and local wisdoms of Betawi ethnic and the feasibility of curriculum integration

The procedure and framework of DBR as suggested by Reeves (2006) and Wang, Hsu, Reeves, and Coster's (2014) present several research stages. In the first stage I worked together with historian, local Betawi community, and education practitioners in the context of the study. I interviewed Betawi historian, reviewed literature about Betawi ethnic and study their artefacts. In addition, I observed Betawi people in their community and interacted with them. From these data collection methods, I highlighted five aspects that represented the belief, values and local wisdom of Betawi ethnic and interestingly, these five aspects were similar to those described in Chaer (2012) and Kementerian Pendidikan Nasional (2010a). They include as in Table 1 below:

Table 1. Belief, values and local wisdom of Betawi ethnic

| No | Aspects | Belief, values and local wisdom |
|----|--------------------|---|
| 1 | Religious value | Religious, religion is embedded in social life, faithful |
| 2 | Language | <i>Cablak</i> (honest in speaking, direct communicators) |
| 3 | Social interaction | Tolerant, friendly and plural (admit difference in race, religion), open-minded, democratic, cooperative, humorous, loyal to the people in the community, empathy, forgiving, social awareness, dynamic, adaptable, egalitarian |
| 4 | Arts | Creative and innovative, prose, songs and humour are used to promote beliefs and values of Betawi ethnic |
| 5 | Self-performance | High confidence, tough, peace, critical, positive thinker, divergent thinker, high motivated people |

In the second stage, together with education practitioners and teachers, we developed a potential classroom instruction method which promote the integration of Betawi local wisdom in a character-based education. I evaluated several documents related to the character-based education such as government policy, curriculum documents at schools, including teaching and learning curriculum, syllabus, teaching plans and teaching reports. Result from the document study showed that character education plays as a key role within the overall education activity in Jakarta and the belief, values and local wisdom from Betawi culture were placed in the central of such a character based education.

I then examined the potential integration of five aspects of Betawi culture into the school curriculum. To this end, I surveyed the teachers to explore their knowledge and awareness of the beliefs, values and local wisdom of Betawi ethnic. Result from the survey showed that more than 50 % of the participants had known about the values and local wisdom of Betawi ethnic. In more detail, participants had knowledge about existence of Betawi people and their ethnicity (68 %), the theological and social aspects of Betawi ethnic (54 %) and characteristics of Betawi people (56 %). These positive responses were seemed as a result of intense exposure of information about Betawi ethnic which was done by the local government. 51 % teacher participants mentioned that they obtained much information about Betawi people and its ethnicity from the local government.

While exploration of teachers' ideas, thoughts, and perceptions about the incorporation of Betawi culture into classroom practices were regarded necessary, I conducted three series of focus group discussion (FGD) with the teacher participants (see section 2.4 for the detail). The series of FGD highlighted several key findings as follow:

a. Teachers had proper knowledge about Betawi culture, particularly about people of Betawi's belief, values and local wisdom. When teachers were asked to name some of the belief, values and wisdom from Betawi culture, they mentioned some aspects similar as described in [Table 1](#). Most cultural aspects cited by teachers included their perception that Betawi people were so religious, *Cablak* (honest in speaking, direct communicators), friendly and humorous. Most teachers also mentioned about Ondel-ondel (traditional art from Betawi culture) and *Lenong* (traditional drama) as the most remarkable arts in Betawi culture.

b. Teachers possessed appropriate level of knowledge about the character education as proposed in the school curriculum. When asked to define what was meant by character education and the basic principles of character education as in the school curriculum, teachers could answer very well. More importantly, teachers viewed that the belief, values and local wisdom from Betawi culture fitted the characters as proposed in the school curriculum. Teachers also mentioned that character based education could be facilitated through the teaching of the belief, values and local wisdom from Betawi culture.

c. It was also found, however, teachers possessed little knowledge on how to incorporate the belief, values and local wisdom from Betawi culture into classroom practices. Teachers were observed to be confused on develop lessons plan in which the belief, values and local wisdom from Betawi culture were integrated in the classroom learning activity. More specifically, teachers had no clear instructional method as well as classroom activity that could guide them incorporate the belief, values and local wisdom from Betawi culture in classroom setting.

3.2. Phase two: The development of classroom activity model that incorporated the belief, values and local wisdom from Betawi culture.

The findings of FGD as presented in earlier section has drawn critical issues that teachers encountered when carrying out character-based education in classroom contexts. In particular, teachers had no knowledge about what they should incorporate and lack of method on how the the belief, values and local wisdom from Betawi culture should be incorporated in classroom learning activity. To help teachers with guidelines for the incorporation of the belief, values and local wisdom from Betawi culture into the classroom setting, I collaborated with education practitioners and teachers to develop a model of classroom activity. Through several FGD series, we have created classroom activities that might represent the five aspects of the belief, values and local wisdom from Betawi culture and it is described in [Table 2](#) below:

Table 2. Belief, values and local wisdom of Betawi ethnic which were practiced in the classroom activity

| No | Aspects | Belief, values and local wisdom | Classroom activities |
|----|-----------------|--|--|
| 1 | Religious value | Religious, religion is embedded in social life, faithful | <ul style="list-style-type: none"> • Students respect and give an opportunity for other peers to practice their belief and religion • Students pray before and after learning |
| 2 | Language | <i>Cablak</i> (honest in speaking, direct communicators) | <ul style="list-style-type: none"> • Students maintain honesty in classroom interaction and communication • Students are able to express their opinion freely • Students gives their critics straightforward without necessarily hurting other people |

| | | | |
|---|--------------------|---|---|
| 3 | Social interaction | Tolerant, friendly and plural (admit difference in race, religion), open-minded, democratic, cooperative, humorous, loyal to the people in the community, empathy, forgiving, social awareness, dynamic, adaptable, egalitarian | <ul style="list-style-type: none"> • Students are taught to accept and respect peers who have different faiths, religion and come from different ethnicity • Students are taught to be open for critics given by peers who have different faiths, religion and come from different ethnicity • Students are encouraged to interact and communicate with peers regardless their religion and ethnicity • Students are able to help each other and cooperate with peers beyond their their religion and ethnicity • Students are able to work together to solve particular issues during their interaction and communication |
| 4 | Arts | Creative and innovative, prose, songs and humour are used to promote beliefs and values of Betawi ethnic | <ul style="list-style-type: none"> • Students can create enjoyable classroom environment • Students are given wide opportunity to express their creativity and innovation |
| 5 | Self-performance | High confidence, tough, peace, critical, positive thinker, divergent thinker, high motivated people | <ul style="list-style-type: none"> • Students are encouraged to make decision with confidence • Students can take lessons from classroom activities • Students are taught to think positively and use positive language • Students are taught to be optimistic and to work hard |

3.3. Phase three: The development of instructional method for the incorporation of the belief, values and local wisdom from Betawi culture in classroom practices.

The practice of character-based education in school classrooms is highly dependent on “more active and engaging pedagogies” (Berkowitz, Hoppe, 2009: 139). To address this issue, and particularly to help teachers carrying out the classroom model that had been produced in the phase two, I attempted to develop an integrated method. This was done by first studying the curriculum documents and teachers’ teaching documents. From the document study, I understood that the curriculum 2013 (henceforth C13), which is recently practiced by the schools across Jakarta, had placed the constructivism approach as its fundamental philosophical foundation. C13 requires students to actively participate in the classroom learning activity. Teachers’ role, on the other hand, is not mainly to deliver considerable amounts of instructional materials to the students. Rather, they are required to provide students with opportunities to develop their knowledge through series of learning experience. While C13 proposed the scientific approach to help teachers and students achieve the learning objectives through direct learning experiences, inquiry method was shown to facilitate the classroom learning activities. This inquiry method enables the students construct knowledge as it encourages students’ critical thinking and their scientific reasoning (Banerjee, 2010).

In this study, I was aware that C13 has clearly promoted the use of scientific approach which might be appropriate only for the teaching of science subjects. While the aim of the this present study was to facilitate teachers with instructional method for the incorporation of the belief, values and local wisdom from Betawi culture into classroom activities, the application of scientific approach, or specifically inquiry method in classroom therefore was modified in line with the

learning objectives. Although, some basic principles in the inquiry method as suggested by the National Science Education Standard (2000, as cited in [Banerjee, 2010](#)) should remain as follow:

- a. Students' learning activity are guided by scientific questions
- b. Students are given opportunities to evidence which enables them construct and evaluate arguments to respond the questions
- c. Students are required to construct arguments from the results of their experiments in order to answer the questions
- d. Students are given opportunity to examine the arguments they have created in order to produce alternative arguments
- e. Students are encouraged to communicate and to make justification of the arguments they propose.

The modification of scientific approach, or inquiry method in particular was done by integrating the belief, values and local wisdom from Betawi culture. The approach modification, which later was called integrated inquiry-local value method (IILV) was practiced through three basic stages as presented in the following figure:

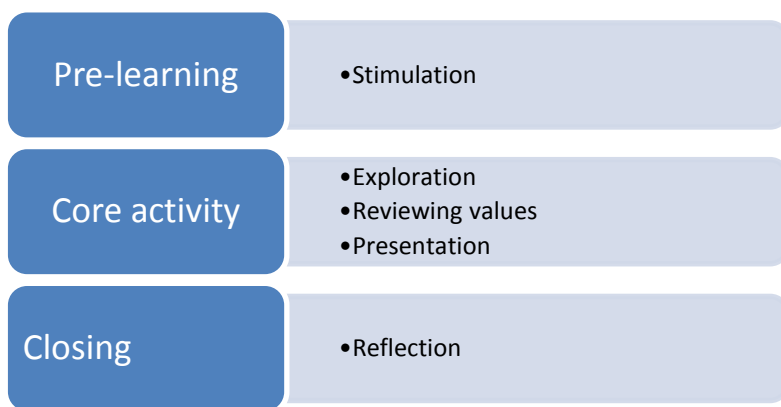


Fig. 2. IILV basic stages

a. Stimulation

In this stage, students were stimulated to the learning and this was done by providing them with the instructional materials and with learning motivation. During the stage, students were exposed with the belief, values and local wisdom from Betawi culture. This could be done by presenting students with video, images or telling stories to students.

b. Exploration

The exploration stage was aimed to build students' ability to examine and highlight values in Betawi cultures from the subjects they were learning. While IILV still maintained the basic principles of inquiry method, in the exploration stage, students were given chances to employ their existing knowledge and ability to address the questions scientifically developed by the teachers. The employment of knowledge during series of experiments would help the students construct not only knowledge related to the area they were learning and but also values for social interaction and communication. The construction of social value happened as a result of students' interpretation of knowledge by employing the belief, values and local wisdom from Betawi culture they obtained.

c. Reviewing

The review stage was the core of IILV in that students Students were asked to explore the local value from the learning experience they already had. This activity was particularly aimed to enable students to practice their sensivity and their analysis from what they had seen, heard and done. Berkowitz (1985 as cited in [Berkowitz, Hoppe, 2009: 139](#)) argue discussions on moral are prominently "stimulating of the development of such reasoning capabilities". At this reviewing stage, teachers gave the students with worksheets of questions related to students' experiments. Using this worksheet, teachers asked the students to work together evaluating the values from the knowledge they had obtained.

d. Presentation

When students had identified certain local values from their learning experiences, then students were asked to share them with peers. Within this presentation stage, teachers helped the students on how to structure their presentation. It was also significant that the teachers had taught the students to be open for critics that might be given by their peers during the presentation

e. Reflection

The activity in IILV ended with a reflection activity. Reflection in IILV plays significant role. According to Kish as cited in Komalasari (2016), through a reflection, students are able to understand why they are successful or failed. Students are also informed by contributing factors to their success and failure which accordingly influences their personality development. In IILV, students were asked to evaluate their presentation. More importantly, teachers also asked peers to give comments related to strengths and weaknesses of the student presenters. In this stage, teachers were also encouraged to give feedback as well as rewards for students' achievements.

3.4. Phase four: Applying the IILV instructional method in classroom practices

To see the potential use of IILV as a classroom instructional method, I piloted its use at a primary school in East Jakarta, Indonesia. To this end, I worked with two classroom teachers teaching year 2 and year 4 at the school. In this paper, their names are pseudonyms as Teacher A and Teacher B. Consents from school headteacher, teachers and the students were obtained prior to our classroom practice. The pilot was done through the following procedure:

a. I had a meeting with both the headteacher and teachers about modification of lessons and classroom activities. During the meeting, I informed to them about IILV and taught them about the method. At first, the teachers were a bit worried as I used a new term called inquiry-local value method (IILV). However, after my explanation, teachers could understand that IILV was just a modification from instructional methods they had already known. As teacher A for example said:

“At first, I was thinking that IILV was a new method. I said to myself I would be hard for me to learn something totally new. But then, I learned from Prof Sus’ explanation about IILV, it was actually part of the school curriculum. The stages in IILV were quite familiar for me. I have learned them in C13.”

b. I worked together with year 2 (Teacher A) and year 4 classroom teachers (Teacher B) to modify the lessons and classroom activities. We plans instructional materials as well as classroom activities that accommodated classroom model that we had already developed in phase two and IILV. In particular, we developed teaching and learning module for classroom activities and instructional media. I was happy to see teachers' motivation in the planning stage. During the planning process, both teacher A and B shared their ideas for classroom activity.

c. Teachers employed IILV in their classroom instruction practices and I observed their teaching. The narratives were described below:

- At the simulation stage, teacher played a video about Setu Babakan Betawi village. The video presented the life of Betawi people with their houses and daily activities. Students were observed to be very enthusiast and this were shown from their faces and gestures.

- Then, in exploration stage, teachers gave several questions to the students about the film they had seen. The questions were mostly asking about the conditions of Setu Babakan Betawi village, e.g. was it clean? Was the environment managed well? Many of the students responded to the questions. They opined that the village was clean with trees, although the mentioned that the river was quite dirty.

- In reviewing stage, teacher grouped the students into four and discussed a topic “Clean and Healthy Environment”. Each of the group was given pictures of houses and their environment. Working in the groups, students were asked to compare what they saw in the pictures and from the

video. This activity was particularly aimed to enable the students understand the concept of clean and healthy environment and accordingly keep their environment clean and healthy.

- When they students had known the concept of clean and healthy environment, they were asked to present their understanding to their peers. From the presentation, teacher led classroom discussion to give opportunities for the students to practice their criticality. Teacher also taught the students to respect critics and other people's view.

- After student presentation, students were required to write a summary of what they knew about cleanliness. More importantly, they were assigned to keep cleanliness of their environment

The application of IILV to facilitate the integration of the belief, value and local wisdom of Betawi culture in subject teaching in classroom showed positive result. From FGD with the two teachers, it was found that IILV increased students' motivation to learn the subject materials. Teacher A for example mentioned that her students were really enthusiastic during the learning activity. Mainly, when she used game method to present artefacts of Betawi culture, students were observed to actively participate in the game. Similar account was also recounted by Teacher B. During our discussion, Teacher B expressed her happiness to see how some of their students joined a singing session of Betawi song. *"It was really a great activity, I used songs to talk about Betawi people and the values inside,"* said Teacher B. She added, *"I think it was the students were already familiar with the songs so that when I asked them to sing together, they agree."*

More essentially, IILV raised students' awareness of their local culture and the values of it to their social life. The application of IILV was also found to fit the fundamental philosophy of C13 in that students were able to construct knowledge and take valuable lessons from their learning experiences. Teacher B affirmed, *"my singing activity at the beginning of the session was not about how to motivate the students to learn about Betawi culture. But, it was aimed to help me introduce moral value of the songs to the students in the next stage."* In addition, IILV also helped teachers in carrying out contextual learning as required by the school curriculum. Teacher A said, *"I felt like the method really present the procedure of contextual learning. I mean, teaching the students in the real contexts."*

However, from my retrospective analysis, I highlighted three issues regarding the application of IILV in classroom practice. First, IILV may fit students from year 3 primary school. It was because IILV required higher skill to examine the belief, values and local wisdom from Betawi culture from the the materials students had learned. While IILV may still be possible for students in the lower level, it required teachers' participation to help and work together with the students to reveal the belief, values and local wisdom from Betawi culture. Second, the IILV application in classroom took longer time than usual. It was because, IILV required students to use their skills in exploring the belief, values and local wisdom from Betawi culture from the subjects they were learning. More importantly, students were required to apply the the belief, values and local wisdom from Betawi culture they obtained from the classroom learning in daily life. Finally, the practice of IILV in classroom demands skilful teachers. Particularly, teachers were required to have considerable knowledge about the belief, values and local wisdom from Betawi culture, possessed analytical skills, and to have ability to transfer the belief, values and local wisdom from Betawi culture using their students' language. Moreover, teachers were required to be creative and able to use any resources and media available around them to support their classroom instructions.

4. Conclusions and limitations

This study has highlighted several beliefs, values and local wisdom from Betawi culture feasible for integration within classroom instruction. More importantly, the study has discussed an alternative instructional method that facilitated the incorporation of the beliefs, values and local wisdom from Betawi culture in classroom context. Despite of these benefits, the study had two limitations. First, the pilot study as presented in phase four only included only one primary school with two classroom cases. It is thus, the findings obtained from the pilot study could be generalised or transferred into wider classroom contexts. Second, the effectiveness of IILV as an instructional method for the integration of beliefs, values and local wisdom from Betawi culture in classroom context has not been evidenced empirically by students' improvement on their learning achievement. It is therefore, further study examined if students' learning achievement was

improved by exercising IILV method is required to provide empirical evidence of the method effectiveness.

5. Acknowledgement

The design-based research project reported in this article was funded by Directorate of Research and Public Service, Ministry of Research, Technology and Higher Education, Republic of Indonesia. Some parts of this article have been presented in conferences.

References

- Alfian, 2013 – Alfian, M. (2013). *Potensi kearifan lokal dalam pembentukan jati diri dan karakter bangsa. Paper presented at the 5th International Conference on Indonesian studies: Ethnicity and Globalization*. Jogjakarta.
- Anderson, Shattuck, 2012 – Anderson, T., Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher*, 41(1), 16–25.
- Badan Pusat Statistik, 2010 – Badan Pusat Statistik. (2010). *Data penduduk jumlah suku Betawi di DKI Jakarta*. Jakarta: Badan Pusat Statistik Provinsi DKI Jakarta.
- Badan Pusat Statistik, 2015 – Badan Pusat Statistik. (2015). *Profile kependudukan hasil SUPAS 2015 Provinsi DKI Jakarta*. Jakarta: Badan Pusat Statistik Provinsi DKI Jakarta.
- Banerjee, 2010 – Banerjee, A. (2010). Teaching science using guided inquiry as the central theme: A professional development model for high school science teachers. *Science Educator*, 19(2), 1–9.
- Berkowitz, Bier, 2005 – Berkowitz, M.W., Bier, M.C. (2005). *What works in character education: A research-driven guide for educators*. Washington DC: Character Education Partnership.
- Berkowitz, Hoppe, 2009 – Berkowitz, M.W., Hoppe, M.A. (2009). Character education and gifted children. *High Ability Studies*, 20(2), 131–142.
- Chaer, 2012 – Chaer, A. (2012). *Foklor Betawi, kebudayaan dan kehidupan orang Betawi (Betawi Folklor, culture and the life of Betawi ethnic)*. Jakarta: Masup.
- Cohen et al., 2011 – Cohen, L., Manion, L., Morrison, K., Bell, R. (2011). *Research methods in education*. London: Routledge.
- Denzin, 2012 – Denzin, N.K. (2012). Triangulation 2.0. *Journal of Mixed Methods Research*, 6(2), 80–88. Retrieved from <http://mmr.sagepub.com/content/6/2/80.abstract>
- Fishman et al., 2013 – Fishman, B.J., Penuel, W.R., Allen, A.-R., Cheng, B.H., Sabelli, N. (2013). Design-based implementation research: An emerging model for transforming the relationship of research and practice. *National Society for the Study of Education*, 112(2), 136–156.
- Hendro, Suparman, 2006 – Hendro, P., Suparman, A. (2006). *Masalah etnisitas dan tata ruang di Indonesia. Paper presented at Seminar Fakultas Teknik dan Perencanaan*. Jakarta: Universitas Gunadarma.
- ITS, 2016 – ITS. (2016). Moral kaum pelajar rusak, kriminalitas membabi buta. Retrieved 21 June 2017, from <https://www.its.ac.id/berita/100269/en>
- Kementerian Pendidikan Nasional, 2010a – Kementerian Pendidikan Nasional. (2010). *Bahan pelatihan: Penguatan metodologi pembelajaran berdasarkan nilai-nilai budaya untuk membentuk daya saing dan karakter bangsa*. Jakarta: Badan Penelitian dan Pengembangan Pusat Kurikulum, Kementerian Pendidikan Nasional.
- Kementerian Pendidikan Nasional, 2010b – Kementerian Pendidikan Nasional. (2010b). *Kerangka acuan pendidikan karakter*. Jakarta: Direktorat Ketenagaan Direktorat Jendral Pendidikan Tinggi, Kementerian Pendidikan Nasional.
- Kementerian Pendidikan Nasional, 2011 – Kementerian Pendidikan Nasional. (2011). *Panduan pelaksanaan pendidikan karakter*. Jakarta: Badan Penelitian dan Pengembangan Pusat Kurikulum dan Perbukuan, Kementerian Pendidikan Nasional.
- Komalasari, 2016 – Komalasari, S.K. (2016). Living values education in teaching materials to develop students' civic disposition. *The New Educational Review*, 44(2), 107–121.
- Purbasari, 2010 – Purbasari, M. (2010). Indahnya Betawi. *Humaniora*, 1(1), 1–10.
- Reeves, 2006 – Reeves, T.C. (2006). Design research from a technology perspective. In J. van den Akker, K. Gravemeijer, S. McKenney, N. Nieveen (Eds.), *Educational Design Research*

(pp. 52–66). Routledge.

Setiawan et al., 2002 – Setiawan, H., Sartono, E., Kaluge, A., Wahyu, R. (2002). *Pendidikan lingkungan budaya Jakarta 5*. (E. Nurlaeli, Ed.). Jakarta: Yudistira.

Solihati, Mulyono, 2017 – Solihati, N., Mulyono, H. (2017). A Hybrid classroom instruction in second language teacher education (SLTE): A critical reflection of teacher educators. *International Journal of Emerging Technologies in Learning*. 12(5), 169–180.

Sutrisno, 2015 – Sutrisno, O.D. (2015, November 6). Tingkat kriminalitas remaja meningkat di Kota Bandung. *Metro TV News*. Jakarta. Retrieved from <http://jabar.metrotvnews.com/read/2015/11/06/448399/tingkat-kriminalitas-remaja-meningkat-di-kota-bandung>

Unayah, Sabarisman, 2015 – Unayah, N., Sabarisman, M. (2015). Fenomena kenakalan remaja dan kriminalitas. *Sosio Informa*, 1(2), 121–140.

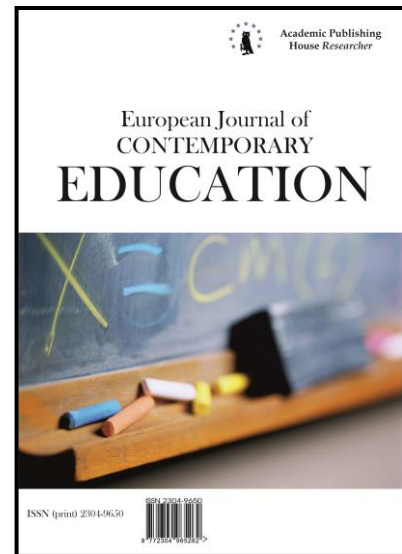
Wang et al., 2014 – Wang, S.-K., Hsu, H.-Y., Reeves, T.C., Coster, D.C. (2014). Professional development to enhance teachers' practices in using information and communication technologies (ICTs) as cognitive tools: Lessons learned from a design-based research study. *Computers & Education*, 79, 101–115.

Zheng, 2015 – Zheng, L. (2015). A systematic literature review of design-based research from 2004 to 2013. *Journal of Computers in Education*, 2(4), 399–420.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.
All rights reserved.
Published in the Slovak Republic
European Journal of Contemporary Education
ISSN 2304-9650
E-ISSN 2305-6746
2017, 6(3): 586-592
DOI: 10.13187/ejced.2017.3.586
www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



The Development of Informal Learning and Museum Pedagogy in Museums

Pavol Tišliar ^{a, *}

^a Comenius University in Bratislava, Slovakia

Abstract

This paper presents an outline of the history and the current orientation of informal learning in museums, museum pedagogy. This is the result of a lengthy process over the last two centuries, which became particularly intensive from the 1960s, in which museums looked for deeper ways to communicate with visitors, starting from basic presentation activity with occasional spoken commentaries. From this, modern museums have developed specialised ways of working with different age groups of visitors, which can be referred to collectively as museum pedagogy and museum education. These activities not only strengthen the experience of museum exhibits and exhibitions but also allow information to be communicated using collection items in a playful way, through informal learning. Museums' current focus on communication and working with visitors owes much to the long development of heritage institutions, the stabilisation of their position in cultural and social systems, in cultural policy and strategy and the overall significance of the collections of museums and galleries for our modern knowledge societies. The aim of this paper is to outline the historical development and direction of museums' educational activities to the present.

Keywords: museum, informal learning, museum pedagogy, history of museum communication.

1. Introduction

1.1 *The museum as an institution for research and education*

The collection and preservation of naturfacts – the products of natural processes – and artefacts – the products of human society – are amongst the most important functions of a museum. Alongside the professional performance of these functions, which now have methodological support from theoretical museology, practical museography and the applied forms

* Corresponding author
E-mail addresses: pavol.tisliar@uniba.sk (P. Tišliar)

of the natural sciences, technical disciplines, the social sciences and the humanities, museums also have the function of making collection items accessible for purposes of study, education or pleasure (Desvallées, Mairesse, 2010).

There are many ways in which collections can be made accessible. Alongside the research and publication activities of museums, whose main topic and resource are the items in the museum's depositories, the most common way in which museums make their collections accessible is through museal presentation (Beneš, 1980; Gregorová, 1984; Stránský, 1979). Whether in a permanent exhibition reflecting a museum's collection activities or temporary thematic exhibitions, items are installed in an appropriate manner for the defined purpose with at least basic accompanying labels and explanatory text (Dolák, 2015; Šobáňová, 2014). Exhibits and exhibitions usually also include verbal commentary by a tutor or guide, a person who accompanies visitors to the museum and draws their attention to the most important exhibits using appropriate commentary. These basic forms of museal presentation – exhibition and guided commentary – are amongst the oldest ways of making a museum's collection accessible. New ways of working have gradually been added to these basic methods in accordance with museums' overall mission to provide visitors with informal instruction and explanation of the development of society (nature), the expressions, relationships and contexts of this development and so on, while at the same time generating interest (the sense of an experience) and providing entertainment. These forms of communication with the public are referred to as accompanying programmes. They work mainly by providing additional interpretation of collections through various events (Waidacher, 1999; Beneš, 1981; Beneš, 1997; Gregorová, 1984, Kačárek et al., 2013).

While the priority mission of a museum was once characterised as researching collections and making their museal value available to researchers, the main function of a modern museum is now perceived to be on the educational level (Pavlikánová, 2015; Brabcová et al., 2003; Mruškovíč et al., 1993). The specific educational function of museums needs to be understood in a specific and narrower sense as an extension of their function for scholarship (Rohmeder, 1977). The educational function of a museum is informal and often takes the form of a game or entertainment. It is linked to lifelong learning and develops a relationship between visitors and collections (Waidacher, 1999). The educational function of a museum involves activities through which visitors learn, either directly or indirectly from the activity of a tutor or instructor. Museums' educational processes are mainly functional (in contrast to the intentional processes in schools), reflecting the aesthetic environment, the value of the museum exhibits or the museal-didactic concept of the exhibition. (Jůva, 2004; Šobáňová, 2012a).

2. Materials and methods

Museums' educational activities are nowadays amongst their most important functions. Scientific procedures and the management of collections are oriented towards the museum's pedagogical activities and museum staff's educative communication with the public. Museum pedagogy is no longer seen as a mere side activity for a museum's visitor education and it has been defined as a separate scientific discipline applied to the museum environment or social science concerned with museum education (Jagošová et al., 2010). The functions, mission and status of museums have changed throughout history. The museal phenomenon has evolved, and with it the relationship between the museum as an institution and society, which has then provided feedback affecting the understanding of the function and objectives of museums' activities. It is therefore important to understand the evolution of museums' educational activity and the genesis and elaboration of the concept of informal education in the theory and practice of museums. Tracing the historical development of views on the educational mission of museums and their benefit for the education of society is one of the fundamental areas of study in the history of museums and it significantly reflects cultural and social relations in the studied regions.

The main materials used in this paper are theoretical publications on the phenomenon of museum education, didactics and museum pedagogy itself which show the most important milestones in the development of European and world museums and their interpretation in the context of the work of museums. The paper has a strong historical orientation and therefore the methods used are mainly those of history (heuristics, criticism, interpretation and synthesis).

3. Discussion

3.1 Brief history of museums as institutions and the perception of their objectives and mission to the end of the 20th century

The oldest collections, which became basis for museums, were connected with the development of science and research. This was the motivation for the first “Mouseions” in ancient Greece and Egypt, which included collections of items (artefacts and naturfacts) for use in research in the natural sciences, astronomy, medicine, botany, zoology and art (Waidacher, 1999; Brožek, 2002; Štěpánek, 2002; Lalkovič, 2005). The collections were used not only as objects for scientific research but also as teaching aids. This form of education and collection did not survive the end of the ancient world, however.

Significant new collections began to be appear in the middle ages in church treasuries and the castles of rulers and the nobility (Mruškovič et al., 2005). Their meaning and use had little to do with science or education though. They were used only for their owners’ prestige, to show their status, wealth and power. As universities developed, they began to create their own collections (often referred to as cabinets of curiosities or chambers of wonders) (Lalkovič, 2005; Gregorová, 1984), which were used as teaching aids, and this practice was taken up by the scientific and learned societies that began to be appear in the second half of the seventeenth century as a way to spread scientific knowledge and appreciation of art in accordance with the emerging values of the Enlightenment. Collections were often founded together with libraries to provide a suitable base for complex academic research. Although the first museums as independent institutions appeared in the seventeenth century (e.g. the Ashmolean Museum in Oxford), it was only in the eighteenth century that museums began to open for the general public rather than a limited circle of researchers and scholars. The British Museum in London is usually recognised as the first modern museum (1753) (Stránský, 2005), but many other important world museums were founded in the same period, including the Hermitage in St Petersburg (1764), the Museo del Prado in Madrid, Spain (1785) and the Louvre in Paris (1773).

Major influences on the establishment of public museums included the spread of enlightenment thought and, from the beginning of the nineteenth century, the idea of the French Revolution, which inspired national movements and patriotic feeling in many European countries. These forces prompted the creation of regional and national museums in Europe in the early nineteenth century (e.g. Budapest 1802, Copenhagen 1807, Graz 1811, Opava 1814) (Waidacher, 1999) and the gradual emergence of other types of museums (municipal, homeland, historical and fine art museums, later applied arts, archaeological, ethnographic, technical and other museums) usually supported by an association. These reasons for the establishment and development of public museums were reflected in the early stages of museums’ pedagogical activity (Jagošová, Jůva, Mrázová, 2010; Waidacher, 1999). Early in the nineteenth century, exhibits were seen as a source of learning and the potential advancement of society. In this period museums played an important role in the cultivation of patriotism (Šobánková, 2012b). The natural models for the new museums were the oldest and largest museums, such as the previously mentioned British Museum and the Louvre, which had become a symbol of national pride for French society.

The new types of museums had an important influence on educational activities. Museums of fine art and the applied arts with collections of craft products began to focus on documenting the technological procedures used in production and the products that resulted from these procedures. Their exhibitions presented procedures and products side by side. Visitors to such museums could thus familiarise themselves with the whole production process as a guide for recreating it and producing new works (Lalkovič, 2005).

As Vladimír Jůva has noted, public museums developed from a social need to develop a new and dynamic relationship between learning and culture (Jůva, 2004). The motivation for establishing museums included the needs of society and the idea to preserve and care for evidence of the development of society and nature for future generations so that they will know their ancestors, their nation, their region etc. As collection activities became more institutionalised, the opinion grew stronger that collection items could contribute to society’s knowledge.

A milestone in the development of museums and society’s concept of cultural heritage was the organisation of highly popular global exhibitions in the second half of the nineteenth century. These attracted many visitors and became the basis for several important museums, such as the Victoria and Albert Museum in London, initially founded as the South Kensington Museum in 1857

(Waidacher, 1999). Several governments gradually became aware of museums' potential for educating society, in Great Britain, Germany, France, Austria-Hungary amongst others, and in the late nineteenth and early twentieth centuries they began to provide financial support for the development of museums. Ideas broadened during this period and new concepts were developed for linking museums and schools (Jagošová et al., 2010) but the promising ideas that were being kindled in Europe were snuffed out by the military conflicts of the second decade of the twentieth century. During the First world War some British museums took over some functions in schools when school buildings were taken over for other purposes and many teachers were recruited into the army (Šobáňová, 2012b).

After the war, there were extensive political changes, especially in central Europe. Several new states were established and developed cultural policies and museums reflecting the needs of their societies. In some countries, the standing and function of museums began to fall under the spell of ideology during the interwar period (Stránský, 2005). During this period, museums in Italy, Germany and elsewhere came under the totalitarian influence of their new regimes, especially in the second half of the 1930s and the 1940s (Fascism, Nazism and certain forms of racism and extremism) and after the Second World War and the division of Europe, the eastern European countries were influenced by the Communist regimes. Ideology had a strong effect not only on collection activities but also on museal presentation. Under totalitarian regimes museums were required to use cultural and educational activities to support pro-regime objectives, and they stagnated (Kačárek, Tišliar, 2015; Gregorová, 1985; Jagošová et al., 2016). The democratic societies of western Europe followed a different path and museum culture was able to develop without major political interference.

During the twentieth century a modern concept of the museum developed, effectively culminating in the last decades of the twentieth century with the conception of the museum as a public institute for general education. Another trend that came to prominence in the 1960s was towards elaborating didactic accompanying programmes and encouraging museum workers with pedagogical training to establish deeper contact with visitors through active presentations. The basic definition of the museum thus began to emphasise museal pedagogical work as a way to overcome the crisis of the modern museum (Jůva, 2004).

3.2 Educational function of museums

Reflections on the museum as an institution and a place offering resources for scientific research date from the earliest times. The oldest surviving deeper reflections that we possess on the form of the ideal museum date from the sixteenth century (Waidacher, 1999). Samuel von Quiccheberg (1529–1567), whose work was published at Munich in 1565, saw the meaning of the museum in mainly scientific terms. He also considered the museum on the educational level, referring to it as an educational centre open to study (Jagošová et al., 2010). A similar view of the function of museums (school collections) is found in the work of the Moravian pedagogue, Ján Ámos Komenský (1592–1670), whose pedagogical activities emphasised the importance of illustrations and practical examples (Dravecký, 2006; Šobáňová, 2012b), especially examples from life. Accordingly, his advice and guidance on teachings recommended practical cooperation between schools and “educational” collections (a school museum). His ideas became the foundation not only for modern pedagogy in the general sense of the word but also the later formation of museal pedagogy.

More detail was added to the relationship between museums and education in the eighteenth and nineteenth centuries. As mentioned previously, the establishment of public museums was largely driven by Enlightenment ideas. However, some Enlightenment writers, such as Denis Diderot (1713–1784), emphasises the educational importance of certain types of cabinets and the functions that they could perform in education.

When public museums open to a wide audience were established, several authors reflected on their educational potential (e.g. Emil A. Rosmäsler, Alfred Lichtwark, Georg Hager, Hugo von Tschudi) (Jagošová et al., 2010; Šobáňová, 2012b). Amongst the leading topics of discussion were how museums could inspire children and young people (school pupils) and what was the best relationship between museums and schools.

The development of museums' educational function was not confined to Europe. The museum as an institution and relationships with museums began to develop in North America

from the mid-eighteenth century (Waidacher, 1999). Eventually the United States of America would begin addressing questions of museums' educational function more intensively than the European countries. This was a result of the closer connections between museums and universities and schools in the USA, whereas European museums were initially dominated by science and research interests (the classical view of the museum as a scientific institution) with a focus on collecting and on collection items. At the end of the nineteenth and the beginning of the twentieth century, a close connection between museums and schools was supported, for example, by John Dewey (1859–1952) (Jagošová et al., 2010). He saw the museum as a part of everyday school life and an aid for illustrating lesson on the development of human experience through support for activities and initiatives – learning from experience with an object (learning by doing) (Dewey, 1904; Dostál, 2008; van Mensch, van Mensch, 2011).

US museum pedagogy's approach of learning by doing and by experience led to the creation of a special type of museum, the children's museum. The oldest children's museum was the Brooklyn Children's Museum, which opened in New York at the end of the nineteenth century. (Jůva, 2004). The museum's primary mission was to teach children in Brooklyn and Queens and develop their interests. After the Brooklyn museum, others opened in Boston, Detroit and Indianapolis. In the middle of the twentieth century there were nearly 40 children's museums in the USA but still none in Europe. The first, isolated European children's museum was opened in 1970, at the Ethnological Museum of Berlin. Real development of children's museums in Europe began only at the end of the twentieth century and the beginning of the twenty-first. They are thus a relatively recent phenomenon which, unlike traditional museums, tell visitors "Please do touch" (a "hands-on" approach) in order to make it easier to understand the function and context of the material evidence of cultural and natural heritage (Kucharík, 2016).

Since the start of the twentieth century, there has been a reform movement in pedagogy that criticises and seeks to modify traditional school education. The pedagogy reform movement and its two wings, "the movement for artistic education" and the "movement for working schools", have made major contributions to museum pedagogy, because they have, amongst other things, encouraged the direct involvement of museums and other cultural institutions in systematic cooperation with schools (Jagošová et al., 2010).

From the mid-1930s onwards, museums in many European countries were infiltrated by the aforementioned political propaganda of totalitarian regimes. Although the Second World War put an end to fascism and Nazism, in eastern Europe socialism and communism succeeded them and continued to use museums' presentation activity for propaganda. This caused a significant retardation in their development which became apparent in many areas of museum work from the 1960s. Cultural and educational activities in these countries were concentrated on a limited range of ideologically defined issues, such as the history of the workers' movement while other areas were considered undesirable. The free development of museums in western Europe, on the other hand, allowed them to respond flexibly to the needs of all sections of society and from the 1960s onwards the term museum pedagogy came to apply to all the educational activities of museums. Museums in West Germany were amongst the leaders in this development and began to publish papers on museum pedagogy covering both theory (museum didactics) and, more especially, practice.

4. Results

Current developments in museum pedagogy have their institutional roots in the 1960s. In western Europe this development has been continuous while in the east it only took off after the great social and cultural transformation at the end of the twentieth century. The gradual elimination of pro-regime propaganda made possible more intensive work with the public which was not just promotion but which adapted freely to visitors' areas of interest above all.

Thanks to the work of many specialists in the theory of museum pedagogy in the second half of the twentieth century and the first decades of the twenty-first century (Jürgen Rohmader, Samy Bill, Georg Hein, Wolfgang Zacharias, Vladimír Jůva, Hildegard Vieregg, Petra Šobáňová and many others), we now have a system for a professional approach to visitors involving primarily their self-development through informal learning in the museum environment. For this purpose it uses not only traditional and well-established forms of presentation activity, tours, tours with commentaries and additional activities, lectures and seminars (Šobáňová, 2012a; Kirsch, 2014) involving primarily looking and listening, but frequently also education by touching, smelling and tasting.

Common forms of contemporary museum pedagogical work include workshops and courses involving drawing, modelling and other activities related to a specific item or group of items in a museum's collection. One of the special aspects of museum pedagogy is organising activities that link intellectual concepts with practical applications. Museum education thus involves both the development of visitors' perceptual abilities and their capability to think, compare, analyse, experiment and evaluate.

Museum pedagogy is a specialised, scientific approach to a museum's communication with visitors and the museum educator is an important factor for activities in this area. These specialised workers prepare and conduct the museum's educational and accompanying programme for various groups of visitors. They also prepare accompanying museum didactic materials for exhibitions and educational programmes (e.g. an exhibition guidebook, worksheets). They coordinate and supervise the communication of scientific and other knowledge to target groups of visitors and coordinate the activity of tutors and guides.

5. Conclusion

The results of the historic development of the ideas of museum pedagogy followed from both the development of museums as institutions and the development of general pedagogy. The result is that museum pedagogy has become an important part of museums' activities that has flourished in recent years. Museum pedagogy has become part of the university system. It has been taught in several countries since the 1970s and 1980s. It can be a subject in its own right, in the German-speaking countries for example, or it can be incorporated into other subjects such as museology (museum studies), history of art or free-time pedagogy (Jagošová et al., 2010). There is no doubt that the educational activities of museums are an important step towards the popularisation of the cultural heritage preserved in our museums. They have opened up communication with many age groups of visitors, although children and young people remain the most common target group, and also the possibility of special work with handicapped visitors. Museum education also has an important part to play in lifelong learning in contemporary societies. Learning through play is increasingly popular with visitors and there is no doubt that museums attract a new audience through such activities, which become a repeated and effective use of free time if their educational objectives are achieved.

6. Acknowledgements

This work has been partially funded by the MŠSR VEGA grant No. 2/0057/17 "Najvyššie dosiahnuté vzdelanie a jeho vplyv na transformujúce sa rodinné a reprodukčné správanie žien na Slovensku" // "The relationship between attained education and the transforming family and reproductive behavior of women in Slovakia".

References

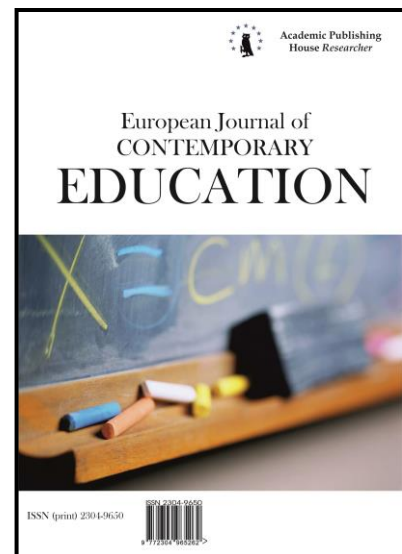
- Beneš, 1980 – Beneš, J. (1980). Muzeum a výchova. Praha: Ústav pro informace a řízení v kultuře, 309 p.
- Beneš, 1981 – Beneš, J. (1981). Kulturně výchovná činnost muzeí. 1. díl. Praha: SPN, 153 p.
- Beneš, 1997 – Beneš, J. (1997). Základy muzeologie. Opava: Slezská univerzita, 179 p.
- Brabcová et al., 2003 – Brabcová, A. et al. (2003). Brána muzea otevřená : průvodce na cestě muzea k lidem a lidí do muzea. Náchod: Nakl. Juko, 583 p.
- Brožek, 2002 – Brožek, A. (2002). Alexandrijská knihovna. Národní knihovna : knihovnická revue, vol. 13, No 2: 122-124.
- Dewey, 1904 – Dewey, J. (1904). Škola a společnost. Praha: Jan Laichter, 100 p.
- Desvallées, Mairesse, 2010 – Desvallées, A., Mairesse, F. (2010). Základní muzeologické pojmy. Brno: Technické muzeum, 64 p.
- Dolák, 2015 – Dolák, J. (2015). Muzeum a prezentace. Bratislava : Muzeológia a kultúrne dedičstvo, 116 p.
- Dostál, 2008 – Dostál, J. (2008). Elektrotechnické stavebnice : teorie a výsledky výzkumu. Olomouc: Votobia, 98 p.
- Dravecký, 2006 – Dravecký, J. (2006). Dejiny pedagogiky. Poprad: KU Ružomberok, 118 p.
- Gregorová, 1984 – Gregorová, A. (1984). Múzeá a múzejníctvo. Bratislava: Matica slovenská, 308 p.

- Gregorová, 1986 – Gregorová, A. (1986) (ed.). Múzeum a škola. Bratislava: Ústredná správa múzeí a galérií, 163 p.
- Jagošová et al., 2010 – Jagošová, L., Jůva, V., Mrázová, L. (2010). Muzejní pedagogika : Metodologické a didaktické aspekty muzejní edukace. Brno: Paido, 298 p.
- Jagošová et al., 2016 – Jagošová, L., Kirsch, O. et al. (2016). Muzejní profese a veřejnost I. : Nástin historie a současnosti vzájemných vztahů muzeí a jejich publika. Brno: MU, 114 p.
- Jůva, 2004 – Jůva, V. (2004). Dětské muzeum : Edukační fenomén pro 21. století. Brno : Paido, 264 p.
- Kačírek et al., 2013 – Kačírek, L., Ragač, R., Tišliar, P. (2013). Múzeum a historické vedy. Krakov: SSVP, 285 p.
- Kačírek, Tišliar, 2015 – Kačírek, L., Tišliar, P. (2015). Múzejné exkurzie vo vyučovaní : minulosť a súčasný stav na Slovensku. *Museologica Brunensia*, No 3 (2): 10-15.
- Kirsch, 2014 – Kirsch, O. (2014). (Po)Zapomenutí nositelé paměti : Německé muzejnictví na Moravě. Brno: Paido, 281 p.
- Kucharík, 2016 – Kucharík, J. (2016). Dětské muzeum SNM v Bratislave v rokoch 2010–2015. *Muzeológia a kultúrne dedičstvo*. No 1 (4): 109-116.
- Lalkovič, 2005 – Lalkovič, M. (2005). Typológia múzeí. Banská Bystrica: UMB, 143 p.
- Mruškovič et al., 1993 – Mruškovič, Š. et al. (1993). Etnomuzeológia : Teória, metodológia, prax. Martin: SNM, 128 p.
- Mruškovič et al., 2005 – Mruškovič, Š., Darulová, J., Kollár, Š. (2005). Múzejníctvo, muzeológia a kultúrne dedičstvo. Banská Bystrica: UMB, 254 p.
- Pavlikánová, 2015 – Pavlikánová, M. (2015). Vzdelávanie v múzeách a galériách na Slovensku. *Muzeológia a kultúrne dedičstvo*. No 2 (3): 29-38.
- Rohmeder, 1977 – Rohmeder, J. (1977). Methoden und Medien der Museumsarbeit : Pädagogische Betreuung der Einzelbesucher im Museum. Köln: DuMont Buchverlag, 159 p.
- Stránský, 1979 – Stránský, Z.Z. (1979). Úvod do studia muzeologie. Brno: UJEP, 167 p.
- Stránský 2005 – Stránský, Z.Z. (2005). Archeologie a muzeologie. Brno : Masarykova univerzita, 315 p.
- Šobáňová, 2012a – Šobáňová, P. (2012). Muzejní edukace. Olomouc: Univerzita Palackého, 142 p.
- Šobáňová, 2012b – Šobáňová, P. (2012). Edukační potenciál muzea. Olomouc: Univerzita Palackého, 396 p.
- Šobáňová, 2014 – Šobáňová, P. (2014). Muzejní expozice jako edukační medium. 1. díl : Přístupy k tvorbě expozic a jejich inovace. Olomouc: Univerzita Palackého, 364 p.
- Štěpánek, 2002 – Štěpánek, P. (2012). Obrisy muzeologie. pro historiky umění. Olomouc: Univerzita Palackého, 252 p.
- van Mensch, van Mensch, 2011 – van Mensch, P., van Mensch, L. M. (2011). New Trends in Museology. Celje: Muzej novejšje zgodovine, 119 p.
- Waidacher, 1999 – Waidacher, F. (1999). Příručka všeobecnej muzeológie. Bratislava: SNM, 477 p.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.
All rights reserved.
Published in the Slovak Republic
European Journal of Contemporary Education
ISSN 2304-9650
E-ISSN 2305-6746
2017, 6(3): 593-603
DOI: 10.13187/ejced.2017.3.593
www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



The Speed Reading is in Disrepute: Advantages of Slow Reading for the Information Equilibrium

Milena I. Tsvetkova ^{a,*}

^a Sofia University St. Kliment Ohridski, Bulgaria

Abstract

The study is dedicated to the impact of the speed and the acceleration on the preservation of the information equilibrium and the ability for critical thinking in the active person. The methods about the fast reading training are subjected to a critical analysis. On the grounds of the theory for the information equilibrium and the philosophy of the slow media, is derived the relation “slow reading – information equilibrium”. “Information equilibrium” is defined as “imposed by the information environment for natural and sufficient satisfaction of the individual needs, in the conditions of relative freedom.” It is supported the thesis about the rethinking of the positives of the fast reading and the rehabilitation and active promotion of the universal literacy in slow reading. The need of promoting the slow reading in the context of the requirements for urgent mass training on information literacy and for critical thinking at times of misinformation, fake news and post-truth has been empirically drawn and grounded. The author's suggestion is to move to a stratified and subordinate redefinition of the goals of the information and the media literacy. The idea is to develop a standard for “profiled” or “niche” information literacy – for each category of person (age, professional) to be written the relevant “maximum program” that does not exceed the rational and the advisable towards their potential.

Keywords: information equilibrium, information literacy, misinformation, fast reading, psychology of reading, sociology of reading, librarian as filter.

1. Introduction

In 2001 in his work “Tyranny of the Moment” the professor of Social Anthropology at the Oslo University Thomas H. Eriksen summarized: “In the age of the information, it is practically impossible to think over even on a single thought. The profound reasonings are constantly interrupted by the new fragmentary information” (Eriksen 2001: 5). Right at this time the

* Corresponding author
E-mail addresses: milenaic@uni-sofia.bg (M.I. Tsvetkova)

requirements for the reader, acquaintance, rationalizing and constructing the social reality has grown immeasurable: the speed of his reactions shouldn't be at the expense of the economics of thought and superficial judgments.

It seems paradoxical but still at the end of the 20th century it became clear that the information could "involve" the individual in two absolute extremes – to ignorance and superinformation, to restriction of the freedom and to overspending with the claims of freedom, to enslavement and to anarchy. Somewhere between these theoretically cleaned situations is found every particular case of individual choice. From information decay can be protected only this one who finds the balance between the placed on the scales fanaticism and skepticism, "pilgrimage" and "tourism", cosmopolitanism and egocentrism can be protected.

2. Materials and Methods

The main problem that provokes the present research are the strong fluctuations in the equilibrium "information environment – information comfort of the man". We will seek an answer to the question *whether the reading capabilities as a guarantee of the intellectual survival and as a basic technology of the information "self-defense" have been exhausted*. A particular subject of the presentation is the rediscovery of the old art of reading "Festina Lente".

The focus of the research is directed to the "slow culture" as a challenge to the culture of the speed and the effectivity and its impact not only on the mental and the physical health, the work and the relationships, but above all on the information, the learning and the accompanying reading process. The purpose is to find arguments for the positives of the "slow reading" towards the maintaining of the general information equilibrium of every citizen of the digital era.

Definition of Information Equilibrium

Can the direct linking between the reading and the information balance be grounded? The theory of the information equilibrium is as necessary as the theory of the ecological equilibrium and the equilibrium in the society. Over the centuries, the failure of the human race regarding the attempts to produce such kind of theory in the field of the mass communications has been full. On 17th of February 1950 Pope Pius XII envisages the threat of the information and of the communication abundance that has occurred at the end of the 20th century: "It is not exaggerated if we say that the future of the modern society and the stability of its inner life depends to a great extent on the maintaining of an equilibrium between the power of the communication techniques and the bound of the reactions of the individual himself." (McLuhan, 1990). But what has actually been achieved? The information environment turned into a "prison without walls" for obedient, non resisting users.

Under the notion "information equilibrium" we will understand "*imposed by the information environment for natural and sufficient satisfaction of the individual needs, in the conditions of relative freedom*" (Tsvetkova, 2009: 155). The maintaining of an information equilibrium means that man can normally perform his role of a source or of a recipient in the information systems and of a relaxed user in constantly changing information situations. Equibalance behavior means not a closure in the shell, but an active resistance to the destructive barriers, to the objective circumstances striving to disturb it. To find the balance means to be discovered subjectively the necessary boundaries beyond which the person loses his integrity.

They form an alternative security field those low borderline can be called a "critical point of equilibrium" and the ceiling – the highest level of information stability. Every step upwards the ladder is taking away the subject from the critical point and increases the security field. The "survival" process is due to this mechanism.

The disturbance of the information equilibrium "recipient – environment" can generally occur in two ways – by increase of the speed of the information flow directed to a particular recipient and by supersaturation of the the information environment (or *infoglut*) with an unbearable amount of information. The experienced reader who is self-learning but besides this he is also a self-regulating system, will hardly permit an informational stressful situation; he even finds time for rest under the information "scope of fire". In the full sense of the word, he is able to keep his psychic and informational equilibrium even in contacts with aggressive media.

In one perspective of concern about the ergonomics of the training in the new literacies in the digital epoch, the equilibrium “recipient – environment” and the speed of the information could be regulated by the philosophy of “slowness”.

Definition of Slow Culture

The culture of the slow reading or “Slow reading” is a derivative of the world movements “slow” that were born in 1986 as a counter-advertisement of slow-food – “Slow Food”, counterpoint of the a fast food chains “Fast Food” and grew up as communities resisting the fast city life, the fast technologies and the fast culture. The idea of slowness and the perspectives of the delay are supported by the directions of “slow upbringing”, “slow education”, “slow art” (“slow trends” in the art, supporting works that have been created for years), “slow horticulture”, “slow tourism”, “slow fashion” “slow money” (that calls for investment in provincial and organic farms), “slow software development” (slow software development for carefully written programs and exceptional design), “slow design” (dedicated to the development of an ergonomic for the reader page, of information architecture of the page, that reflects the point of view of the readers). As a whole the “slow movement” has the mission to regain a meaningful connection in the global state of coherence. It is a reaction against those aspects of the modern life in which the quality and the humanity are sacrificed on the altar of the convenience and the efficiency. It is justifiable for the movement to gain speed, because the more and more people recognize their discomfort from the fast tempo and the “excluded” character of their natural life.

In 2010 was proclaimed the concept of “Slow Media”, documented in the “Slow Media Manifesto”, widely discussed also outside Germany (Blumtritt, 2010). “Slow Media” have declared new competencies and a two-way commitment – on the one hand to increase the quality of the media content and on the other – for detoxication and ecology of the perception. In this context two phenomena are interesting. The more and more actual trend in the digital competencies among the journalists is the “Slow Journalism”. Slow Journalism is for focused minds that want more quality - more retelling, more story analysis and hard reading until they make sure that no stone was left unturned. Units of measure for Slow Journalists are months or years, not hour and day. Slow Journalism pleads for the freedom to lean on back in order to analyze the flood of news to reflect on them and to receive a sense of perspective. It is intended for journalists and readers who want to stay longer at one place. In 2015 in Norway was also launched the “Slow TV” project, overturning the ideas of watching at the screen in contemplation. As a whole the slow media propagandize the concentration on one task (monotasking). They do not stimulate the interactivity and sociability, but the informing in solitude and calmness and the reading in non-technological format. In other words, slow media are those media that are offering “*dietary reading and information*”.

It is important that the marketing also is accepting very well the slow media philosophy. This support has been successfully concentrated in the conception of the world-famous marketer Seth Godin: “Now it is a golden time for slow media. And today the problem is to be thoughtful enough and patient enough to waste (unlimited) time to create slow texts for slow reading. These can be media difficult to understand, difficult to use. But this is normal because the slow media is not a mass media. The slow media represent patience. There is no deadline, their text is not measured in characters or kilobytes. These are media that can afford peace instead of sensationalism, depth instead of superficiality. The slow media are not for amusing masses, but for the focused minority” (Godin, 2013).

The reading from the paper is a cure against the crisis. That's what declared the futurist Richard Watson at the end of 2009, when the world was going towards the economic crisis and the people were afraid of news for bankruptcies, inflation and uncertainty (Watson, 2010). Namely the content on paper (the heavy texts, the analyzes, the novels) and the print media first accepted to advertise with the new brand – as “slow media”. In this context was born the tendency of returning to the printed books. A significant action was accomplished by the Australian airline Quantas when it began publishing a series of short printed books by bestseller authors to distribute them to their elite passengers (Nawotka, 2013). The volume of these books is such that they can be read in one flight. With this move, the readers on board the plane were encouraged to change their readers and tablets with the more relaxed media – the paper book. People who realize that when they are reading from paper are more relaxed and they understand the majority of the content, who are

seeing the whole picture and have the patience to bring it into its context, are really multiplying. It would be fair the affirmation that the slow media are *a cure for readers "sick of hurry"*.

3. Results

3.1. Speed is in collision with the nature of the reading

In the 21th century, the rapidity became a major indicator of efficiency and the speed – the most fashionable fetish. In all the everyday activities related to service and communication, are expected speed and timeliness. The today's mobile *Homo Informaticus* prefers everything that happens around him to be as proportional as possible to his tempo of life. And this tempo is getting faster, with which is minimized the people's ability to think.

It is known that the admission physiological capabilities of the man are too limited. The human brain perceives almost all of the signals, but it processes only the stronger signals received from the outside. However during an increased intensity of the information flow, the recipient's sensitivity to the weak signals is reduced, and his brain receives a limited information variety of limited perceived messages. There are created conditions for limited knowledge, based only on factual and often on contradictory information. When the events, the changes in the environment occur faster than the normal, man is able to react only selectively to the individual phenomena while in normal dynamics, the selective reaction is saving him from mistakes and failures.

What is the experimentally established data?

a) The amount of data that enters in the human brain today is minimum 100,000 bits per second and it can be perceived and used in fact between 25 and 100 bits per second (Semenjuk, 1988).

b) The biggest amount of data that reader can perceive is calculated in units per second: when reading in the mind – 45 units per second, when reading aloud – 30 units per second, when it is about correction reading – 18 units per second (Eljakov, 2005: 114-121).

c) The human brain is able to absorb (perceive and process) information with a maximum speed of 25 bits per second. At such a limited capacity and provided that every day we spare time for 50 pages of text, in our entire life we can read up to 3,000 books (Eljakov, 2005: 114-121).

d) The speed of transmission of the human nerve signal is up to 30,000 characters per second, while the signals in the computer move and process millions of times faster. Only in 2016 were recorded several new world records in the speed of data transmission though the Internet – firstly college scientists from the London University achieved a speed of 1,125 terabytes per second, and later on at the International Economic Forum in St. Petersburg was demonstrated a speed of mobile Internet of 1,24 gigabits per second. In other words all the episodes of the HD Series "Game of Thrones" can be downloaded "all in a breath" – in less than 1 second (Maher, 2016; MegaFon, 2016).

e) Besides the unbelievable speed with which the changes in the present are happening, called Big Data, is standing a huge data growth – over 90 % of the created digital content is unstructured information (Schubmehl, 2014).

We can also try to formulate the effects on the intellectual abilities of the reader from the non-ergonomic speed of the communications and the information. (There are used observations on the information overload and the information stress by Prof. Thomas Eriksen, by Prof. Anatolij Eljakov and by Prof. Daniel Levitin (Eriksen, 2001: 59-60; Eljakov, 2005: 120; Levitin, 2017):

1) The person automatically "deletes" from his operative memory the previous data from the current information flow in order to liberate space for the newer, abundant and multiple messages.

2) The person remembers too little of the perceived current information, because the messages are generally submitted chaotically, fragmentary, out of any logical order and structure.

3) The person doesn't perceive the whole amount of information (he misses part of the information) because he doesn't have time to see it (to hear it).

4) The person increases his mistakes; he loses precision in his results because he doesn't have time to check and to discuss his actions.

5) The person perceives and processes precisely and accordingly to his task all the information, but later than the deadline.

6) The person perceives the information in a distorted light because he receives it in an unstructured shape that becomes a source of an incorrect concept of the facts and of wrong decisions.

7) The person refuses to perceive the information because he fails to follow it.

8) The person gets irritated and even in panic when he realizes that he didn't perceive or he didn't remember the full information on the topic he is interested in.

9) The person loses self-confidence from the accelerated tempos of his work activity, from the blurred borderline between free and working time, from the frequent reproaches "There is no time", and as a result of this, he resorts to pharmacological methods (antidepressants) to solve his problems. The acceleration and the uncertainty are right proportional, affirms Paul Virilio in his book „La machine de vision“ (Virilio, 1988).

10) The person willingly becomes hostage to the simplification of the intellectual operations, advertised as a liberation from the human suffering, deliverance from the mental tortures in time of super-speeds. Such is the propaganda style of Prof. Michael Dertouzos of MIT, one of the web's ideologists. When in 1997 he predicts the simplification of mental work through "electronic bulldozers", he defends himself with impeccable human arguments: "More contacts than we can remember, more complexity than we can cope with, higher speed than we can master – if we let these things overload us, we will suffer from stress and we will be ineffective." (Dertouzos, 2001). However, along with that, the simplifications suggest to the consumer a false sense of authority over the nature of things, even over the construction of the world.

11) The person easily amputates his sense of responsibility as the speed creates the "conveyor effect" and the "relay race effect" – you give the signal to the next on the route and you exclude yourself from the engagement with relief.

12) The person deforms his writing habits as speed influences on the syntax and on the style. A typical example is the phenomenon of "texting", the written slang of the SMS, criticized in 2002 by Howard Rheingold in his book „Smart Mobs“ (Rheingold, 2002).

13) The person destroys his abilities to think, to study and to create because of a sharp time deficit.

Especially adequate for the described situation is the episode of Winnie the Pooh, whom Christopher Robin pulls down the stairs, his head is striking the stairs and he is saying to himself – well, only if I had time to stop, to think. (Remembering the popular English play "Stop the World, I Want to Get Off"). The acceleration is not the most comfortable state of the human race. Because of the physics we know that the excessive speed deforms. But the contemporary active person has no choice: if he doesn't join this race, he just stays "on the platform".

3.2. Healthy skepticism towards the fast reading

The speed with which our eyes are travelling along the route of the written page has serious and even surprising consequences about the way the words are giving meaning.

At a normal for the readers average speed of 150-250 words per minute, the champion achievements of the practice polygons of fast reading are truly enticing. The latest "revolutionary application" for fast reading in online environment "Spritz", created in 2014 by the based in Boston start-up, promises to its customers that with its help, they will read from the screen with an average speed of up to 1000 words per minute. We can add also the attempt of the average reader to be complexed with speed reading records. The fastest reader in the world – Howard Berg, popular with the inhuman reading speed of 25-30,000 words per minute (4 seconds per page), can read "War and Peace" (where there is around 560,000 words) approximately in 15 minutes. Another so-called world record belongs to Ann Jones, who reads 4700 words per minute, therefore she can read "War and Peace" for about 11,866 minutes.

The mentioned revolutionary method "Spritz" doesn't answer the question of whether the fast reading really contributes to the fast perception. In an advertisement, the entrepreneurs are saying that "the reader will be able to master a big part of the information", but they do not specify what they mean by "a big part" or how they will measure its "mastery". Another problem of Spritz is that it is helpless to the ability of a person to understand what they are reading and in this direction they do not give any hope to their users.

Each advertisement of fast reading methods is based on scientific evidences for minimizing of the eye fixations by the letter page at the expense of enlargement of the field of vision (peripheral

vision) of the reader with exercises. The physiological truth is that the visual analyzer perceives the letter / the word only when it stops, when the eye is fixed. And during the saccades (word-to-word jumps) we find ourselves in the so-called visual blindness – we don't perceive nothing. In this case, the flying by a standard 30-line typewritten page (30 rows) only with 30 "stops" (1 fixation per row), instead with 60 or 90 "stops" (2-3 fixations per line for the normal reader), there is no way to perceive the text on the entire rows, no matter how developed his peripheral vision is. Until today there is no evidence of a natural intelligence that is able to overjump the natural admission capabilities of its nervous system.

It can be found that the most propaganda illustration of the fast reading methods is also the most compromising these methods (see [Figure 1](#)).

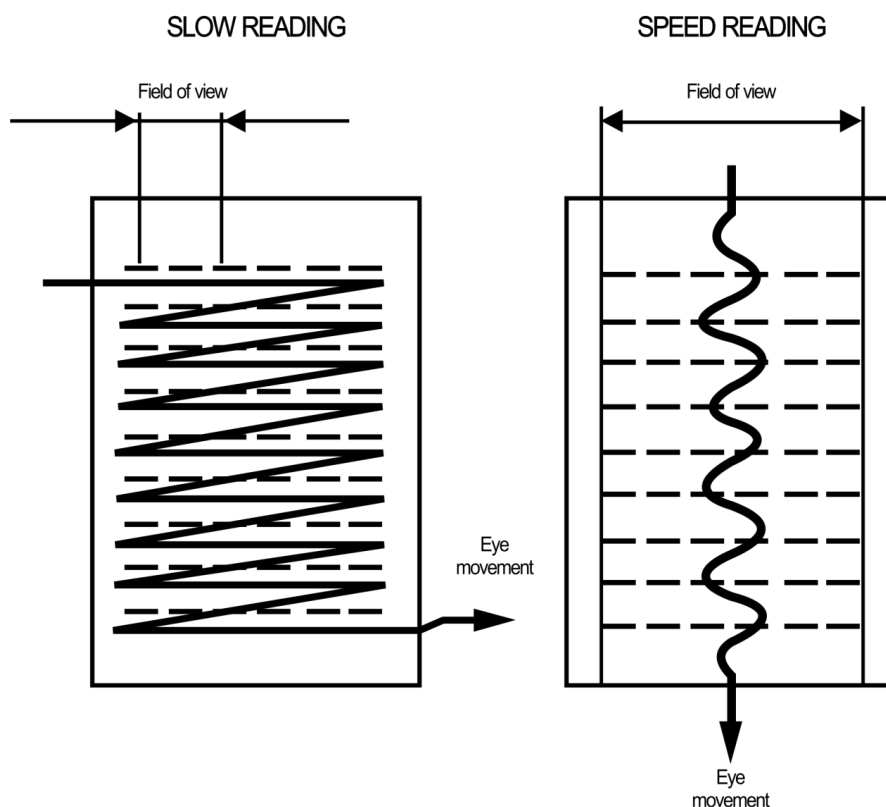


Fig. 1. “The Eye Path“ in slow and fast reading (transl. from: [Andreev, Hromov, 1991](#))

The fast reading instead of overcoming, it increases the errors while reading. The most fatal and the most difficult to overcome even for the most attentive reader are the risks from the so-called *errors of the visual perceptions*. These are errors of cultivated automatism in reading and are due to at least five natural laws of the eye. These are errors of the cultivated automatism in reading and they are due to at least five natural regularities of the eye. The first regularity of the visual perception is anticipation – a person automatically recognizes (identifies) the words through his past experience by comparing them with these ones kept in his memory. The second regularity is the contextual dependence – the visual perception of the word is under the influence of the context where it is found. The third regularity is filtering – the reader disregards the superfluous, the unnecessary according to him. The fourth regularity is a subjective blindness – the perception is a choice for each individual reader (“We see what we want”). The fifth regularity of the visual perception is integrity (holisticity) – the brain reads the objects in a “package”, i.e. not each letter individually, but the whole word. This regularity of the reading eye is also called “beginning-end”, because for the discerning of the word it is important only the first and the last letter to be at their right place.

The problems with the lapses of the reader's eye, with the optic frauds in the perceptual field, with the unread word, with the unseen letter, with the skipped conjunction or the preposition in

the sentence are familiar to every active reader, but the richest experience in this respect have the proof-readers. Examples from the bulgarian practice in cyrillic transliteration:

- “klasifikaciya – kvalifikaciya” (english: „classification – qualification”)
- “knigoznanie – knigoizdavane” (english: „book science – book publishing”)
- “predpolozheniya – predlozheniya” (english: „suggestions – proposals”)
- “diplomat – diplomant” (english: „diplomat – graduate”)
- “predgovor – pregovor” (english: „foreword – revision”)
- “udvoeno – usvoeno” (english: „doubled – mastered”)
- “osobeno – osoleno” (english: „particular – salted”)
- “otbori – otvori” (english: „teams – vents”)
- “tekst za izpit – test za izpit” (english: „exam text – exam test”)
- “Anastas – Atanas” – in the dozens of publications of the news on the election of a new rector of the Sofia University at 17.11.2015 his name – Anastas Gerdjikov – appeared as “Anastas” or “Atanas” in approximately equal proportion.

Even the most vigilant and experienced proof-reader (the typical slow reader with an “eagle eye”) is not insured by fatal (printed) errors that can overturn the meaning of the word or the meaning of the sentence. In this respect, the speed reading can't exceed the slow reading, the only able to minimize the treachery of the visual regularities.

Maybe the most worrying in the speed reading programs is that in their control studies there is never any question towards the participants regarding the meaningful information that is contained in the read texts. The mechanics of the fast reading is generally recognition of the word or of the group of words. And the control tests of the trainings don't include check-up of the *understanding* beyond the word identification. Perhaps the most authoritative expert on the subject of the eyes during reading, the psychologist Keith Rayner, after decades of systematic researches of the reading speed, is convinced that the fast readers are able to read so quickly just because they are trained to do less fixations (“stops of the eye”) at the rows: instead of reading each word, they are taking “tests” from the text, they are fixing at some words from here and there. When they examined them on the reading, they found out that they cope relatively well with some general questions related with the text, that they grasped from the passed on the run fragments and they supplemented on the basis of their pre-existing knowledges of the subject. But when they examined them on details of the text, they failed. The leading thesis of Keith Rayner and his colleagues today is that only at the level of mechanics (identifying words and phrases) can be achieved a reading speed, but not a success in the understanding. People do not read at a constant speed. Everyone uses different rates, which always depend on the difficulty and the purpose of the reading task. People don't read at a constant speed. Every person uses different rates, which always depend on the difficulty and on the purpose of the reading task (Rayner, 2016).

The speed, with which we read something, must serve our ability to *remember* it more permanently. Logically, it is a priority in the advertisements of the fast reading, to be the affirmation that at high speed the text is memorized with 70 % better. But the recent studies made by the specialists in neurolinguistics and by the cognitive psychologists have shown that the better (which means the more durable) remembering in reading is achieved in slow reading, limited by difficult to spell out font. As a rule these are the serif fonts. The more complex, rich and filigree is the font of the text, the more time it takes to recognize the individual word, that however is leading to a stronger memory of the message, reads the conclusion on of the study by Connor Diemand-Yauman and Daniel Oppenheimer (Diemand-Yauman et al., 2010). I will allow myself to add that this study is strongly quoted in modern studies on reader literacy as it proves experimentally that the non-serif fonts, loudly propagated by Microsoft, even though having the advantage of easy decoding, they don't help the remembering. From the point of view of the psychology of the communication design, when the reader has more knowledge of the wealth of the glyph configurations, it will extract more content in their recognition and decoding (in unison with the sentence “The more you know, the more you see”). Previous and subsequent studies continue to reinforce one more thesis - that the increased unreadability of the printed text forces the reader to examine the words more carefully that is leading to a richer, deeper memory of them and to a better meta-understanding.

Maybe the fast reading achieves a fast perception and remembering, but the complex cognitive operations such as *the comprehension*, even more *the rationalization* of the text, are

achievable at a pace in the range „largo – lento – adagio” (the slowest paces according to the music terminology). On top of that, the experts on fast reading methodologies mix the reading phases in an inadmissible way, that are moving in an algorithm as a rule – perception, remembering, understanding, rationalization.

The listed considerations make impossible the determination of the real benefit of the speed achievements of the fast readers and may serve as sufficient reasons for distrust towards similar, the more actively advertising services for reinforcing of the information (media and digital) literacy. It seems that the schools, the training courses, the fast reading simulators and the technology companies with analogic software for mass use succeed only in their public reflexions towards the skeptical aphorism of Anatole France: “Life is too short, Proust is too long.”

4. Discussion

4.1. Fairplay with slow reading

A new trend in the digital era, such as “literacy for slow reading”, emerges just as tempting as the mainstream mania of fast reading. De facto, in parallel with the aggressive popularization of the techniques of “speed reading” (“fast reading” or “rapid reading”), is activated the voice of the slow reading fans. And if we use the marketing brands, we can say that “slow reading” imposed as a counterpoint to the “fast reading”, as Gourmet is a counterpoint of McDonald's.

Organized advocates of slow reading today are Slow books movement, Slow library movement, and from 2012 is released “Slow reading manifesto”. Very often actions for delayed rhythm of life include the slow reading as part of their program.

The scientific interest towards the slow reading is also growing. In the literary theory, it is associated with “close reading”, “intimately reading” or “unmediated reading”. It is activated the use of the terms “deep reading” and “immersive reading”. There are studies that are interested in the differences between the depth reading and the mainstream fashion of “super reading” – the “diagonal reading”, the photo reading, the skimming and scanning reading. A good source to explore the positives of the slow reading is the book of John Miedema “Slow reading” (Miedema, 2009). The author's thesis is that slow reading means exercising the right of choice for your own pace of reading and resistance of the compulsion of all the people to read everything and as quickly as possible.

The expression “slow reading” has been used by Friedrich Nietzsche: “I am a TEACHER OF SLOW READING” (the capital letters are by the original: Nietzsche, 1982). But the principle of “slow reading” itself draws inspiration from the old Jewish practice for studying of sacred texts, to which are specific the analytical reading, the team reading and the reading as comment. In fact there are interesting educational initiatives, ambitious to revive this forgotten art. The principle of the slow reading, based on the particular 2000-year-old Jewish reading technique for reading–consultation to sacred texts “Midrash”, is leading for the educational project “Eshkalot” (Moscow), dedicated to the traditional and contemporary Jewish culture. The organizers combine in an original way the ancient form of Beit-Midrash with the practice of “slow reading” in the sense of an anti-modernist gesture towards the unsatisfied with the too fast reading and the loss of a taste for reading. The method of the slow reading is applied in a group and consists in the fact that not the text is supporting someone's theses but on the contrary: the logic of opening of the discourse is determined by the process of reading the text. The task is to be offered volumetric and multi-layered to a highest degree reading of a book from which later every individual reader can take advantage. “Beit-Midrash” encourages the further independent deep and slow reading of the learners by giving them the tools about this – bibliography, approaches, teachers (Eshkolot, 2016).

The slow reading is directed traditionally to the literary reader. This heaviest category of readers who derive the biggest pleasure in the contact with the text may also have to be the most active lawyers of the slow reading. They affirm that during the fast reading, it is dangerously avoided the phase responsible for rationalization of the books. In the fiction the “talking” in mind is what makes the reader feel implicated in the story. To mark the characters and the objects by his own model. In the fast reading these mini-pauses and delays are missing and this limits the imagination. The advocates of the slow reading explain that it only in slow reading is reinforced the effect of re-reading, and only with slow pace is given the greater delight to the reader. In order to be fascinated by the mastery of the writer and to relax his imagination, it is necessary to make pauses

and to not miss any part of the text. And the maximum that can be achieved by the fast reading is to give possibility for fast processing of data in a large volume of text (Carbonell, 2012).

However reading is a cultural practice, and not only a technical method. Reading is embedded in the rituals, in the cultures, in the institutions, in the history – all that provides to the next generations one “genetically” important kind of knowledge that derives only from patience, calmness and static. The person learns to read in order to enter into cultures and communities to enter into the secrets of the religious experience, in order to share the messages of the literature and to enter in partnership with the authors, in order to compete with the others, in order to be recognizable and loyal towards the institutions. As a counterpoint of these values are the modern “hurried curriculum” and tyranny of the “teacher’s clock”, explains Thomas Newkirk, author of the book “The Art of Slow Reading”. The examination tests suggest a dangerous point of view about the reading and learning in children: that the speed has a key significance, that reading is a race, that rules are determined by the stop-watch. Exactly the opposite claims the author of this book: the excellent command of the learning material means a delay. The excellent proficiency is a harmony with the text, a voluntary act of attention, of vigilance to the mood, to the voice and to the sensitivity of the written language. You won’t become a freer reader if you read faster, ends Newkirk (Newkirk, 2012).

As a foundation of the information culture, the reading is the most effective and efficient method of filling in of the a priori knowledge and, accordingly, of achieving an adequate cultural level. The slow reading has a special role in the filling of the thesaurus of lasting knowledge and not for receiving of a quick information, because for its systematization and its permanent fixation in the memory, are needed pauses on each key word, on every information saturated paragraph, on every strophe in the poetic work. It is fact that a poetic text can’t be read quickly and just a professional reader of poetry can illustrate how the slow reading is called upon to discover what is kept in silence one “letter” image, what is over the time, the unnoticeable, the unpretentious.

Additional positives of the slow, the secluded and the silent reading can be found in his genesis. In the 13th-14th century in the European monastery and university reading-rooms, the reading ability in mind and an own pace generates key to the development of the civilization abilities: it puts the bases of the peculiar cluster reading with references and comparison, it emancipates the private intellectual curiosity, it cultivates the reading-reflection, the reading-contemplation and the reading-creature, it encourages the individual critical thinking, it commits conditions for expressing subversive ideas, it frees the personal opinions on the problems of the conscience, it increases the depth of the secular religious experience, it contributes to the development of the skepticism and of the “intellectual heterodoxy” and it gives an stimulus to the rush for reforms (Saenger, 1982). We can express the fear that in eventual escalation of the euphoria in the fast reading, the energetics of these qualities will be exhausted unnoticeably.

4.2. Slow reading for information equilibrium

The real and the objective view towards the over-saturated information environment, towards the intensive information flows, towards the jump in the quantitative increase of the information can’t be a cause for alarm of the modern paradox: simultaneously with the increase in the information growth, it can be felt strongly the need to speed up the paces of information extraction, i.e. the user not by will, but under the compulsion of the environment, he is encouraged to master fast reading methods, which in its turn is accompanied by the harm of these methods.

In order to keep his information equilibrium during his life, the individual has to read at least 20,000 books, however at a speed of three words per second. The quick reader experts affirm that this is not difficult, especially for readers of the visual type (80 % of all the people) whose capabilities allow them a run on the lines of the page and fixing of the eyes only on the most informative fields in the text. There are even recommendations for reading of newspapers by the methods the “beginning and end of the publication”, “paragraph by paragraph” or “just the title is enough” and the rest is implied.

The fast (speed) reading also can ensure an informational equilibrium for the user, but it brings a danger from information over-saturation and from here – from loss of his inner, mental and intellectual equilibrium. Only slow information behavior has the potential to revise and to balance quite a lot of objective and subjective states that already disbalance the information equilibrium and threaten the information health of the individual (see Table 1). The generalized name of the subjective states is explored interdisciplinary in the studies in medicine,

neuropsychology and cognitive psychology as “information diseases”. (For the factors of the era of Web 1.0 that violate the human information equilibrium, see more in: [Tsvetkova, 2009: 138-145](#)).

Table 1. Factors of information disbalance

| Objective information states | Subjective information states |
|---|---|
| <input checked="" type="checkbox"/> Information entropy | <input checked="" type="checkbox"/> Information frustration |
| <input checked="" type="checkbox"/> Information chaos | <input checked="" type="checkbox"/> Information deprivation |
| <input checked="" type="checkbox"/> Information mess | <input checked="" type="checkbox"/> Information anxiety |
| <input checked="" type="checkbox"/> Information saturation (infoglut) | <input checked="" type="checkbox"/> Information neuroticism |
| <input checked="" type="checkbox"/> Information noise | <input checked="" type="checkbox"/> Information hunger (info-famine) |
| <input checked="" type="checkbox"/> Information attacks | <input checked="" type="checkbox"/> Information overeating (info-gorge) |
| <input checked="" type="checkbox"/> Canalization of the interest and the search | <input checked="" type="checkbox"/> Information burnout |
| <input checked="" type="checkbox"/> Misinformation | <input checked="" type="checkbox"/> Digital Alzheimer |
| <input checked="" type="checkbox"/> Information indoctrination | <input checked="" type="checkbox"/> Apathy to the information order |
| <input checked="" type="checkbox"/> Information manipulation | <input checked="" type="checkbox"/> Phubbing |

There is a parable that can be an excellent illustration of the final result of the superhuman acceleration. An European adventurer was leading an expedition to Africa. For the long and difficult passage through the dangerous jungles he hired carriers from the local tribes. Enthusiastic on the fast reaching of the target, at the first day of the trip he didn't give a moment for a rest. In the morning, however, the carriers refused to move. Their argument was irrefutable: as the previous day they had to move too fast, now they had to wait for the souls to reach their bodies.

5. Conclusions

The outlined tense atmosphere of the actual information line, defined by the pressure of the time and the speed, provokes the experts to seek more individual approaches to solve the problems of the active person in the digital era.

Expecting revival is the described more than 80 years ago by José Ortega y Gasset role of the librarian as a “filter” ([Ortega y Gasset, 1935](#)). Here is possible an objection that in the epoch of internet the filters became too many and lead to fragmentary knowledge. But the philosophy of the filter's function of the librarian today won't be focused on the effect of the PR (a publicity of every appearing source of information), nor on the effect of the iceberg (service only with metadata), and on the reference filter serving with distilled and compressed information (secondarily processed resources) in a sequential order, on the librarian as a “virtual assistant”, on the librarian as an “intellectual interface” between the speed of the information flows and the limited time of the user.

It is possible a stratified and subordinate redefinition of the objectives of the information, the digital and the media literacy – for each category of person (age, professional), to be written the relevant “maximum program”, that doesn't exceed the rational and the advisable compared to their potential. A standard for profiled or “niche” information literacy center would free us from the overexpectation toward all the social and age groups and would outline for the citizen his fitting digital literacy and relevant to his capacity tools to manage the affecting him information.

An advisable universal tool is slow reading literacy, focusing on those sources that the virtual assistants – masters of the technology, will filter on a personal request. There is enough common sense in the thesis of the Professor in Medieval History Lynn White Jr. that “the technology opens doors, but no one is forced to pass through them”.

As it became clear, this new trend of “slow reading” is not a partisan march against the speed, but a chance for information survival and information freedom: everyone at his own pace and when the text requires this, to read not with a care for the clock but only with a care for the self. The philosophy of slow reading offers also a chance for happiness of the disorientated by the fierce speed of the multitasking and of the depressed, the desperate, the unhappy by lack of time people.

6. Acknowledgements

The author are thankful to the Sofia University Science Fund for the support under the Grant for the project “Scientific publications management” (contract No80-10-223/24.04.2017).

References

- Andreev et al., 1991 – Andreev, O., Hromov, L. (1991). Uchites bystro chitat. Moskva: Prosveshhenie. 160 p.
- Blumtritt et al., 2010 – Blumtritt, J., David, S., Köhler, B. (2010). Das Slow Media Manifest. In: Slow Media, 02.01.2010. URL: <http://www.slow-media.net/manifest> (accessed 31.06.2017)
- Carbonell, 2012 – Carbonell, D. (2012). Speed reading vs. slow reading. In: Voxxi, 08.05.2012. URL: <http://voxxi.com/2012/05/08/speed-reading-vs-slow-reading> (accessed 31.06.2017)
- Dertouzos, 1997 – Dertouzos, M. (1997). What Will Be: How the New World of Information Will Change Our Lives. New York: HarperEdge. 440 p.
- Diemand-Yauman et al., 2010 – Diemand-Yauman, C., Daniel, M. (2010). Oppenheimer and Erikka B. Vaughanet. Fortune favors the BOLD (and the ITALICIZED): Effects of disfluency on educational outcomes. In: Cognition, vol. 118, №1, pp. 111–115. DOI: 10.1016/j.cognition.2010.09.012
- Eljakov, 2005 – Eljakov, A. (2005). Informacionnaja peregruzka ljudej. In: Sociologicheskie issledovanija, №5, pp. 114–121.
- Eriksen, 2001 – Eriksen, T.H. (2001). Tyranny of the Moment: Fast and Slow Time in the Information Age. London: Pluto Press. 208 p.
- Eshkolot, 2016 – Eshkolot. (2016) Evrejskaja kultura v formate edutainment. URL: <http://eshkolot.ru/about> (accessed 31.06.2017)
- Godin, 2013 – Godin, S. (2013). Slow media. – In: Seth's blog, 25.01.2013. URL: http://sethgodin.typepad.com/seths_blog/2013/01/slow-media.html (accessed 31.06.2017)
- Levitin, 2017 – Levitin, D.J. (2017). Weaponized Lies: How to Think Critically in the Post-Truth Era. New York: Dutton. xxii, 294 p.
- Maher et al., 2016 – Maher, R., Alvarado, A., Lavery, D., Bayvel, P. (2016). Increasing the information rates of optical communications via coded modulation: a study of transceiver performance. *Scientific Reports*, Reports 6, №21278. DOI: 10.1038/srep21278
- McLuhan, 1990 – McLuhan, M. (1990). The Medium is the Message. In: Savremenna zhurnalistika (Bulgaria), №3, p. 167.
- MegaFon, 2016 – MegaFon. (2016). 5G, 16.06.2016. URL: http://corp.megafon.ru/press/news/federalnye_novosti/20160616-1106.html (accessed 31.06.2017)
- Miedema, 2009 – Miedema, J. (2009). Slow Reading. Sacramento: Litwin Books. 92 p.
- Nawotka, 2013 – Nawotka, E. (2013). Qantas Airline Publishes Short Books Tailored for a Flight. In: Publishing Perspectives, 17.05.2013. URL: <http://publishingperspectives.com/2013/05/cool-idea-quantas-airline-publishes-short-books-tailored-for-a-flight> (accessed 31.06.2017)
- Newkirk, 2012 – Newkirk, T. (2012). The Art of Slow Reading: Six Time-Honored Practices for Engagement. Portsmouth: Heinemann. 216 p.
- Nietzsche, 1982 – Nietzsche, F. (1982). Daybreak, 1881. Transl. by R. J. Hollingdale. Cambridge University Press. (Preface, paragraph 5).
- Ortega y Gasset, 1935 – Ortega y Gasset, J. (1935). Misión del bibliotecario. In: Revista de Occidente, T. 48, №143, pp. 121-162. (English ed.: The Mission of the Librarian. Transl. by James Lewis and Ray Carpenter. Boston: G. K. Hall, 1961. 22 p.)
- Rayner et al., 2016 – Rayner, K., Schotter, E.R., Masson, M.E.J., Potter, M.C., Treiman, R. (2016). So Much to Read, So Little Time: How Do We Read, and Can Speed Reading Help? *Psychological Science in the Public Interest*, vol. 17, №1, pp. 4-34. DOI: 10.1177/1529100615623267
- Rheingold, 2002 – Rheingold, H. (2002). Smart Mobs: The Next Social Revolution. Cambridge, MA: Perseus Publishing. xxii, 266 p.
- Saenger, 1982 – Saenger, P. (1982). Silent Reading: Its Impact on Late Medieval Script and Society. *Viator*, №13, pp. 366–414.
- Schubmehl et al., 2014 – Schubmehl, D., Vesset, D. (2014). The Knowledge Quotient: Unlocking the Hidden Value of Information Using Search and Content Analytics: White Paper. International Data Corporation (IDC), June 2014. 22 p. URL: http://www.coveo.com/~media/Files/WhitePapers/Coveo_IDC_Knowledge_Quotient_June2014.ashx (accessed 31.06.2017)
- Semenjuk, 1988 – Semenjuk, E.P. (1988). Informacionnyj podhod k poznaniju dejstvitel'nosti. Kiev: Naukova dumka. 240 p.
- Tsvetkova, 2009 – Tsvetkova, M. (2009). Information culture: the name of reading. [in Bulgarian]. Sofia: Universitetsko izdatelstvo Sv. Kliment Ohridski. 356 p.
- Virilio, 1988 – Virilio, P. (1988). La machine de vision. Paris: Editions Galilée. 158 p.
- Watson, 2010 – Watson, R. (2010). Vestnikat e vechen: Cheteneto e lek v krizata. Standard (Sofia), №6096, 5.01.2010.



Copyright © 2017 by Academic Publishing
House Researcher s.r.o.

All rights reserved.

Published in the Slovak Republic

European Journal of Contemporary Education

ISSN 2304-9650

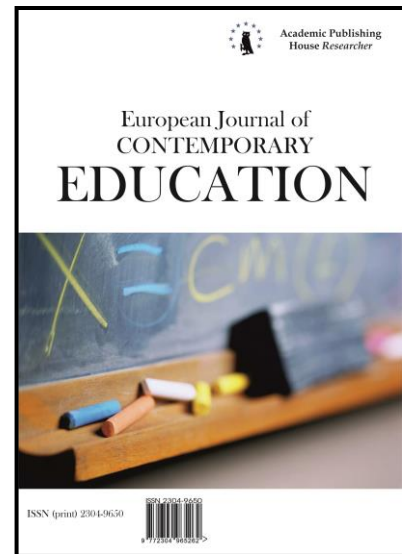
E-ISSN 2305-6746

2017, 6(3): 604-611

DOI: 10.13187/ejced.2017.3.604

www.ejournal1.com

WARNING! Article copyright. Copying, reproduction, distribution, republication (in whole or in part), or otherwise commercial use of the violation of the author(s) rights will be pursued on the basis of international legislation. Using the hyperlinks to the article is not considered a violation of copyright.



Education Faculty Students' Levels of Satisfaction with E-Learning Process

Murat Yalman ^{a,*}, Bulent Basaran ^a, Selahattin Gonen ^b

^a Computer Education and Instructional Technology, Dicle University, Turkey

^b Department of Physics Education, Dicle University, Turkey

Abstract

Also, e-learning environments, which integrate technology into education, have now become widespread and popular. Examining how students use this education management system is fairly important for the success of this system, and any possible results to be obtained are significant. For this purpose, the present study was conducted with 348 students attending an education faculty. In the study, the courses of 'Introduction to Computer' found in their curriculum were taught to the students for two academic terms with the e-learning management system. At the end of the academic year, a questionnaire was applied to the future pre-service teachers to determine their levels of satisfaction with e-learning. The results revealed no significant difference in the preservice teachers' levels of satisfaction with e-learning in terms of their gender, their education program and their department. In addition, it was revealed out that there was a significant difference at the significance level of $p < .05$ between their levels of satisfaction with e-learning and their levels of knowledge of Internet technologies. It was found out that the students' mean score regarding their satisfaction with e-learning was calculated as $\bar{X} = 3.80$, which referred to "I don't agree". The students thought that teaching a course with this method is important for learning new education management systems, and the students who were introduced to technology during their university education, reported that this education should be given following their university education.

Keywords: e-Learning, Web-Based Systems, Education.

1. Introduction

Education has been one of the most important elements for people throughout the history. The basic purpose of education, which has gone through a number of phases up until today, is the

* Corresponding author

E-mail addresses: mumanenator@gmail.com (M. Yalman)

train individuals. Thanks to rapid spread of the Internet and use of technology to read books regarded as source of information for all people around the world, information is now easily accessible in all parts of the world (Yalman et al., 2013). With recent developments in technology, every person can use the Internet and computer. The potential of the Internet to reach millions of people encourages many business firms to invest on this platform. Therefore, the Internet now has a structure that allows people to search for and reach information, to communicate with friends and relatives, to play games and to read newspapers (Aggarwal, 2000).

Positive results obtained via experiments conducted by researchers made it possible to use the Internet for educational activities as well as in many other areas made. Use of educational platforms for instructional activities helps determine not only the positive but also the negative sides of this learning management system. These structures designed in electronic environments and used for educational activities are called e-learning platforms. In other words, e-learning can be defined as “use of Internet technologies that provides solutions necessary to increase information and performance” (Ünsal, 2004). The success of this management to be conducted via Web depends on what type instruction is planned and for whom as well as on how to transfer these arguments to the web environment in the best way (Eşgi, 2006). The success of education given via the e-learning management system by any institution can be said to change in line with individual differences of students (motivation, learning styles, attitudes, self-efficacy and so on) (Güngör, Aşkar, 2004, Shraim, Khlaif, 2010).

Today, e-learning applications used for education are provided as two different models: synchronous and asynchronous. Many e-learning platforms found on the Internet generally give education with asynchronous model. Asynchronous model can be defined as a system in which individuals who give education and those who take that education do not necessarily exist in the same place at the same time and in which students feel free to complete their education at the time they want (Driscoll, 2002). In synchronous model, instructors and students who are both found in different places can do their educational activities by communicating simultaneously with each other via the website used as the education platform (Güngör, Aşkar, 2004). Based on the characteristics of the education to be given, one of the models (synchronous or asynchronous) can be selected during the preparation of the e-learning system. In this way, the model to be selected could increase the quality of the education (Watkins et al., 2004).

E-learning is still used as a distant education management system in higher education institutions. In Turkey, the number of universities using the distant education system to give their associate-degree education and other certificate programs is gradually increasing. In addition, the fact that universities lack the technical sub-structure necessary to give such education and that there are no standards set for students and teachers regarding technical efficacies and skills hampers studies conducted on e-learning (Gülbahar, 2012). Determining the satisfaction levels of students with the platform they use to take their education could help identify the pros and cons of the system.

It is important to determine the views of users of such a system about the related processes. As the participants of the present study were selected among education faculty students who are prospective teachers, it is important to know about their levels of satisfaction with this model so that their levels of satisfaction can be reflected upon future generations. It is only possible to train future teachers who prefer to use technological tools while giving education if they are conscious of the subject.

2. Method

Purpose and Research Model

The purpose of the study was to examine education faculty students' levels of satisfaction with e-learning with respect to certain variables. What are education faculty students' levels of satisfaction with e-learning? The present study tried to find answers to the question of whether their levels of satisfaction with e-learning differ significantly with respect to their characteristics, their gender, their type of education (daytime education or evening education), In order to determine the relationships between two or more variables, the descriptive survey method was used. Survey method aims at describing a past or present situation (Karasar, 2005: 77).

Data Collection

The questionnaire method was used as the data collection tool in the study. The study was carried out with education faculty students who took the course of Computer-I and Computer-II via the e-learning method in the Fall and Spring Terms of the academic year of 2012-2013. The questionnaire form developed was put in the e-learning platform prepared, and the students were asked to fill in the questionnaire form. Of the 615 students registered to the system, 266 of them participated in the study filling in the questionnaire form. One of the most important limitations of questionnaires conducted via the Internet is that they do not have consistent return-rates (İnan, 2002). The questionnaire forms were delivered to the departments that were not accessible via the Internet. As a result, a total of 82 questionnaires were included in the study.

Universe and Sample

The universe of the present study carried out to determine the participants’ levels of satisfaction with e-learning included 615 students attending an Education Faculty in the Fall and Spring Terms of the academic year of 2012–2013. In the study, the questionnaire form was either sent via the Internet or delivered in paper-form to a total of 348 students were selected from this universe with the method of simple random sampling method. Table 1 below presents information about the participants in the present study.

Table 1. Demographic Backgrounds of the students in relation to e-learning

| Variable | Demographic Feature | N | % |
|--------------------------|------------------------------|-----|-------|
| Gender | Female | 216 | 62.07 |
| | Male | 132 | 37.93 |
| Type of Education | Daytime Education | 226 | 64.94 |
| | Evening Education | 122 | 35.06 |
| Departments | Elementary School Teaching | 211 | 60.63 |
| | Preschool Teaching | 66 | 18.97 |
| | Math Teaching | 41 | 11.78 |
| | Religion and Ethics Teaching | 30 | 8.62 |
| Total | | 348 | 100.0 |

Of all the students responding to the questionnaire, 62.07 % of them were female, and 37.93 % of them were male students. Among the participants, 64.94 % of them (226 students) were taking daytime education in their faculty, while 35.06 % of them (122 students) were taking evening education. As for the departments of the students who responded to the questionnaire, 60.94 % of them were from the department of Elementary School Teaching, 18.97 % of them from Preschool Teaching, 11.78 % of them from Math Teaching and 8.62 % of them from Religion and Ethics Teaching.

Data Collection Tools

In the study, the e-learning satisfaction scale developed by Gülbahar (2012) was used. The original scale was made up of seven parts with 55 items. These seven parts were personal characteristics, access to technology, technical skills, motivation and attitude, factors influencing success, transmission and practicality instructional process, instructional content, interaction and assessment. As for the items in the scale, they were 5-point Likert-type items. The Cronbach alpha reliability coefficient of the scale was calculated by Gülbahar (2012) as 0.93.

Data Analysis

For the analysis of the data collected via the questionnaire, SPSS 18.0 package software was used. In the questionnaire, “I completely disagree” was scored as “1”; “I disagree” as “2”; “I partly agree” as “3”; “I agree” as “4”; and “I completely agree” as “5”. While interpreting the mean scores regarding the students’ attitudes towards e-learning, the mean scores ranging between 1.00 and 1.80 were regarded as “I completely disagree”; those between 1.81 and 2.60 as “I disagree”; those between 2.61 and 3.40 as “I partly agree”; those between 3.41 and 4.20 as “I agree”; and those

between 4.21 and 5.00 as “I completely agree”. These ranges were obtained dividing them by the number of values between 1 and 5, the former being the lowest value assigned to the choices and the latter being the highest. For the analysis of the data, first, mean scores, frequencies and percentages were used. As for the application of parametric and nonparametric tests for the analyses of the data to explain the sub-problems regarding the dependent and independent variables of the study, normal distribution and group variances were examined. For the purpose of testing the hypotheses regarding the sub-problems in the study, independent samples t-test, one of parametric tests, was used, and for the dependent groups, one-way ANOVA was applied. In variance analysis, in order to determine the groups the significant difference was in favor of, Tukey HSD test was used. As a result of the analysis of the data collected, the Cronbach alpha reliability coefficient was calculated as 0.93.

Findings

The results obtained from the questionnaire applied to determine the students’ levels of satisfaction with the e-learning management system are presented in Tables below.

Table 2. Students’ levels of satisfaction with e-learning

| | n | \bar{X} | Ss |
|------|----------|-----------|-----------|
| Mean | 348 | 3.80 | 0.46 |

The mean score of the education faculty students’ levels of satisfaction with e-learning was $\bar{X} = 3.80$. It was seen that the students’ levels of satisfaction with e-learning were in the range of 3.41 and 4.20 which referred to the level of “I agree” in the measurement tool.

Table 3. t-test results regarding the students’ levels of satisfaction with e-learning with respect to their gender

| Gender | n | \bar{X} | Ss | Sd | t | p |
|---------------|----------|-----------|-----------|-----------|----------|----------|
| Female | 216 | 3.81 | 0.37 | 346 | -.782 | .43 |
| Male | 132 | 3.77 | 0.58 | | | |

According to the findings obtained in the study, the female students’ mean score was $M_f=3.81$ ($S_d=0.37$), while the male students’ mean score was $M_m=3.77$ ($S_d=0.58$). The statistical analysis conducted regarding the mean scores revealed no significant difference between the students’ mean scores with respect to their gender ($t_{(346)} = -.782$; $p > .05$).

Table 4. t-test results regarding the students’ levels of satisfaction with e-learning with respect to their type of education (daytime education or evening education)

| Type of Education | n | \bar{X} | Ss | Sd | t | p |
|--------------------------|----------|-----------|-----------|-----------|----------|----------|
| Daytime education | 226 | 3.82 | 0.44 | 346 | 1.398 | .16 |
| Evening education | 122 | 3.75 | 0.47 | | | |

According to the research findings, the mean score of the students taking daytime education was $M_{de}=3.82$ ($S_d=0.44$), while the mean score of the students taking evening education was $M_{ee}=3.75$ ($S_d=0.47$). The results of the statistical analysis regarding the related mean scores did not reveal any significant difference between the students’ mean scores with respect to the type of their education (daytime education or evening education ($t_{(346)} = 1.398$; $p > .05$)).

In the study, ANOVA was conducted to determine the satisfaction levels of the participants taking the courses taught with e-learning management system during the two academic terms. The results obtained are presented in [Table 5](#).

Table 5. Results of ANOVA regarding the students' levels of satisfaction with e-learning with respect to their departments

| | KT | df | KO | F | Level of Significance |
|----------------|--------|-----|------|------|-----------------------|
| Between Groups | .158 | 3 | .053 | .249 | .862 |
| Within Groups | 72.496 | 344 | .211 | | |
| Total | 72.653 | 347 | | | |

No statistically significant difference was found between the students' levels of satisfaction with e-learning with respect to their departments ($F_{3-344}=.249$; $p=.010$).

Table 6. Mean scores, frequencies and percentages regarding the students' levels of satisfaction with e-learning

| Students' knowledge about Internet technology use | \bar{X} | <i>f</i> | % |
|---|-----------|----------|-------|
| No | - | 4 | 1.15 |
| Little | 3.61 | 38 | 10.92 |
| Average | 3.78 | 164 | 47.13 |
| Good | 3.87 | 121 | 34.77 |
| Very Good | 3.91 | 21 | 6.03 |
| Total | | 348 | 100 |

Regarding the students' general knowledge about Internet technologies necessary to use the e-learning environment, 1.15 % of the students said they had "No" knowledge about these technologies; 10.92 % of them said "Little"; 47.13 % of them said "Average"; 34.77 % of them said "Good"; and 6.03 % of them said they had "Very Good" knowledge about Internet technologies they needed to use the e-learning system. As for the related mean scores of the students with respect to their levels of knowledge about Internet technologies necessary to use the e-learning system, they were $\bar{X}=3.61$ for those with little knowledge, $\bar{X}=3.78$, for those with average knowledge, $\bar{X}=3.87$ for those with good knowledge and $\bar{X}=3.91$ for those with very good knowledge.

Table 7. Results of ANOVA regarding the students' satisfaction with e-learning management system with respect to their Internet use knowledge

| | KT | df | KO | F | Level of Significance |
|----------------|--------|-----|------|-------|-----------------------|
| Between Groups | 2.332 | 3 | .777 | 3.852 | .010 |
| Within Groups | 68.609 | 340 | .202 | | |
| Total | 70.940 | 343 | | | |

The study investigated whether there was a significant difference between the groups with respect to the students' levels of knowledge about Internet use. The number of those with "No" knowledge about Internet use was not enough for analysis, these participants were not included in the analysis. The results revealed a significant difference between the groups ($F_{3-340}=3.852$; $p=.010$). [Table 8](#) presents the results of Tukey HSD test conducted to determine the difference.

Table 8. Tukey HSD Significance Test Results Regarding the Students’ Knowledge of Internet Use

| Knowledge of Internet Technology Use | | Mean Difference | Mean Difference |
|--------------------------------------|------|-----------------|-----------------|
| Little | Good | -.26204 | .010 |

The results of Tukey HSD Test conducted to determine the difference revealed that there was a significant difference between the groups with “Little” and “Good” levels of knowledge about Internet Technology Use in favor of the group of students who had good levels of knowledge about Internet technologies.

Table 9 presents the students’ views about the e-learning management system.

Table 9. Students’ mean scores regarding their views about the e-learning platform

| E-learning Environment | \bar{X} |
|-------------------------------|-----------|
| Its Use | 3.63 |
| Design | 3.81 |
| Introduction | 3.89 |
| Syllabus | 4.09 |
| Content | 3.93 |
| Communication and Interaction | 3.69 |
| Assessment | 3.72 |

The students’ mean scores regarding the e-learning environment were at the level of “I agree” as follows: \bar{X} =3.63 for usability, \bar{X} =3.81 for its design, \bar{X} =3.89 for its introduction, \bar{X} 4.09 for the syllabus, \bar{X} =3.93 for the content found in the platform, \bar{X} =3.69 for the students’ communication and interaction with each other and with the trainers in the web environment and \bar{X} =3.72 for the overall evaluation of the platform used.

3. Discussion and Conclusion

The present study aimed at determining the education faculty students’ levels of satisfaction with e-learning. Of all the students responding to the questionnaire, 37.93 % of them were male, and 62.07 % of them were female students. The satisfaction levels of the students who took their courses with the e-learning management system were found to be at the level of “I Agree” with \bar{X} =3.80. The t-test results conducted revealed that there was a significant difference between the students’ satisfaction levels with respect to their gender. In addition, it is reported in related literature that faculty members find use of e-learning management system more demanding and time-consuming when compared to regular education (Karaman, 2007). Introducing students to such learning management systems during their undergraduate education could have positive influence on the use of these learning management systems in future (Yalman et al., 2013, Hye-Jung, Rha, 2009; Ilgaz 2008).

Preservice teachers’ levels of Internet technology use is considered to be among the most important factors influential on their levels of satisfaction with e-learning (Yalman, 2013). In the study, a significant difference was found between the students’ levels of knowledge about the Internet and about the use of Internet technologies and their levels of satisfaction with e-learning ($p < .01$). The results of ANOVA conducted revealed a significant difference between the groups with “Little” and “Good” levels of knowledge about Internet use in favor of the students who good levels of knowledge about the Internet and Internet technologies. The fact that the students were knowledgeable about the use of education platforms created in the Internet environment will increase their success in their courses and contribute to their understanding of the education platform (Palmer, Holt, 2009; Bray et al., 2008; Machado, 2007; Alper et al., 2006).

The fact that the participants in the study were education faculty students increases the importance of the related trainings to be given to them. Adaptation of education faculty students to the e-learning system, who regard education as their professional life, will help introduce them to the technologies and e-learning environments in their future institutions where they will be appointed. In addition, students' conscious and appropriate use of the Internet and computer will facilitate the process of accessing information throughout their education lives (Yalman, 2013).

In the study, it was seen that the students' satisfaction were at the level of "I Agree" regarding the usability of the e-learning platform they used, the design of the activities found in the platform, the introduction of the elements used, the methods applied to follow the lessons, the course contents prepared, students' communication and interaction with each other and with the teachers, tests given at the end of lessons, assessments of the learning gains. In studies conducted, teachers reported positive views about the use of e-learning management systems although they feel themselves inefficient in the use of technological tools (Gözütok et al., 2007).

References

Aggarwal, 2000 – Aggarwal, A. (2000). *Web-Based Learning and Teaching Technologies: Opportunities and Challenges*. Hershey-USA: Idea Group Publishing.

Alper, Çakır Balta, 2006 – Alper, A., Çakır Balta, Ö. (2006). The Effects of Distance Learning on Motivation. 2nd International Open and Distance Learning (IODL) Symposium. Eskişehir, Türkiye.

Bray et al., 2008 – Bray, E., Aoki, K. ve Dlugosh, L. (2008). Predictors of Learning Satisfaction in Japanese Online Distance Learners. *International Review of Research in Open and Distance Learning*, 9(3), 1-24.

Eşgi, 2006 – Eşgi, N. (2006). Web Temeli Öğretimde Basılı Materyal ve Yüz Yüze Öğretimin Öğrenci Başarısına Etkisi. *Türk Eğitim Bilimleri Dergisi*, 4(4), 459-473.

Driscoll, 2002 – Driscoll, M. (2002). *Web-based training: Creating e-learning experiences*. San Francisco: Jossey-Bass/Pfeiffer.

Gözütok et al., 2007 – Gözütok, D., F., Gülbahar, Y. ve Köse, F. (2007). E-Öğrenme Yönetimi ile Öğretmenlerin İnsan Hakları Eğitimi. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi*, 40(1), 135-156.

Gülbahar, 2012 – Gülbahar, Y. (2012). E-Öğrenme Ortamlarında Katılımcıların Hazır Bulunuşluk ve Memnuniyet Düzeylerinin Ölçülmesi için Ölçek Geliştirme Çalışması. *Ankara Üniversitesi Eğitim Bilimleri Fakültesi Dergisi*, 45(2), 119-137.

Güngör, ve Aşkar, 2004 – Güngör, C ve Aşkar, P. (2004). E-Öğrenmenin ve Bilişsel Stilin Başarı ve İnternet Öz Yeterlik Algısı Üzerine Etkisi. *H.Ü. Eğitim Fakültesi Dergisi*, 27, 116-125.

Hye-Jung, ve Rha, 2009 – Hye-Jung, L. ve Rha, I. (2009). Influence of Structure and Interaction on Student Achievement and Satisfaction in Web-Based Distance Learning. *Journal of Educational Technology & Society*, 12(4), 372-382.

İnan, 2002 – İnan, H. (2002). Firmalar Arası Pazarlama Faaliyetlerinin Yürütülmesinde İnternet Kullanımının Etkisi: Türkiye Uygulaması". *Çukurova Üniversitesi Sosyal Bilimler Enstitüsü İşletme Anabilim Dalı*, 96.

İlgaz, 2008 – İlgaz, H. (2008). Uzaktan Eğitimde Teknoloji Kabulunun ve Topluluk Hissinin Öğrenen Memnuniyetine Katkısı. Yayımlanmamış Yüksek Lisans Tezi. Hacettepe Üniversitesi, Fen Bilimleri Enstitüsü, Ankara.

Karaman, 2007 – Karaman, S. (2007). Ders Web Sayfaları: Özellikleri, Hazırlanması, Kullanılması ve Öğretim Elemanlarının Tutumu, *İnönü Üniversitesi Eğitim Fakültesi Dergisi*, 7, 13, 47-68.

Karasar, 2005 – Karasar, N. (2005). *Bilimsel Araştırma Yöntemi*. Ankara: Nobel Yayın ve Dağıtım.

Machado, 2007 – Machado, C. (2007). Developing an e-readiness model for higher education institutions: results of a focus group study. *British Journal of Educational Technology*, 38(1), 72-82.

Palmer, ve Holt, 2010 – Palmer, S. ve Holt, D. (2010). Students' perceptions of the value of the elements of an online learning environment: looking back in moving forward. *Interactive Learning Environments*, 18(2), 135-151.

[Shraim, Khlaif, 2010](#) – *Shraim, K., Khlaif, Z.* (2010). Students' Readiness Towards E-learning. A case study of Virtual Classrooms for secondary education in Palestine. The 3rd Annual Forum on e-learning Excellence in the Middle East. Dubai. 1-4 Feb. 2010.

[Ünsal, 2004](#) – *Ünsal, H.* (2004). Web destekli eğitim, elektronik öğrenme ve web destekli öğretim programlarındaki çeşitli ders modelleri. *Türk Eğitim Bilimleri Dergisi*, 2, 375-388.

[Watkins et al., 2004](#) – *Watkins, R., Leigh, D. ve Triner, D.* (2004). Assessing Readiness for E-Learning. *Performance Improvement Quarterly*, 17(4), 66-79.

[Yalman, 2013](#) – *Yalman, M.* (2013). Eğitim Fakültesi Öğrencilerinin Bilgisayar Destekli Uzaktan Eğitim Sistemi (Moodle) Memnuniyet Düzeyleri. *Electronic Turkish Studies*, 8(8).

[Yalman et al., 2013](#) – *Yalman, M., Gönen, S., Başaran, B.* (2013). High School Senior Students' use of Internet Technologies and Their Attitudes towards the Internet. *Academic Sight*, 39, 18.

[Yalman et al., 2016](#) – *Yalman, M., Basaran, B., Gönen, S.* (2016). Attitudes of Students Taking Distance Education in Theology Undergraduate Education Program Towards E-Learning Management System. *Universal Journal of Educational Research*, 4(7), 1708-1717.