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**European Journal of
Contemporary Education**



ELECTRONIC JOURNAL

The Problems of Contemporary Education

Effectiveness of Experiential Learning of Roma Pupils in Terms of Educational Results – A Case Study

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Abstract

The case study focused on exploring the potential of experiential learning in enhancing factual biological knowledge among Roma fifth-grade pupils (ISCED 2) from socio-economically disadvantaged backgrounds. Based on the analysis of academic sources, an educational programme incorporating experiential learning was developed, tailored to the specific educational needs of Roma pupils and emphasising active knowledge acquisition. The research employed a quasi-experimental design to compare whether there were statistically significant differences between the experimental and control groups. The experimental group was educated using the designed educational programme, while the control group received traditional instruction, characterised by the direct transmission of information from the teacher to the pupils. Following the educational intervention, pupils' levels of acquired knowledge were assessed using a custom-designed test. Data analysis demonstrated that the experimental group achieved statistically better results on the administered test compared to the control group. The research findings thus suggest the potential benefits of employing experiential learning in educating Roma pupils to improve factual knowledge levels.

Keywords: Roma, primary school, experiential learning, biology.

1. Introduction

Currently, social and cultural backgrounds exhibit a significant and direct correlation with individuals' educational outcomes (Hillemeier et al., 2009; Avvissati, 2020; Tan, Fang, 2023). People with low socioeconomic status acquire new knowledge and skills more slowly, which is significantly reflected in their overall educational results. The main challenge, which contemporary

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teachers all around the world face, is the gap in educational attainment between pupils from poor and those from privileged communities (Takashiro, Clark, 2020; García, Weiss, 2017; Blustein et al., 2010). Socioeconomic barriers profoundly diminish the professional aspirations of individuals from lower socioeconomic strata, leading to significant disparities in career attainment and progression opportunities (Tomaszewski et al., 2022). One way to break down this barrier is to improve the educational process and adapt it to the possibilities and abilities of educated pupils. One of the groups in which we encounter a significant impact of socioeconomic barriers is the Roma.

The Roma interest in education is determined not only by their low socioeconomic status but also by their cultural orientation (Cismaru et al., 2015; Rostas, Kostka, 2014). Cultural factors encourage learning, help to improve educational skills – they lead learners to the awareness that education is important for their present and future life. On the other hand, cultural factors can dampen the educational skills of learners because one is socialized in a background that underestimates the importance of education (Gomez et al., 2022; Mundi, 2009). A higher socioeconomic status often correlates with greater cultural capital and a more pronounced cultural orientation. In practice, however, this may not be the case, as cultural status is essentially a heritage that an individual acquires from the environment in which he lives, while the level of social status is the result of his actions (Hollins, 2015). Given the low socioeconomic and cultural status and insufficient support from the family, the home environment does often not provide Roma pupils with opportunities to deepen their factual knowledge. It is factual knowledge that is the essential element with which the pupils must be acquainted (Azevedo et al., 2023; Hew, Cheung, 2014) to be able to develop other levels of cognitive thinking. Factual knowledge, encompassing concepts, definitions, and scientific facts, is pivotal in education due to its foundational role in cultivating individual literacy, particularly in scientific domains (Kubiato et al., 2018; Hine, Medvecky, 2015; Taber, 2014). This factual knowledge needs to be arranged into an organized system that will allow the pupils to use it in different situations.

2. Specifics of Roma education

Based on the available data, despite a slight improvement in recent years, we still find that up to 68 % of Roma youth receive only lower secondary education. This reflects their low chances of finding a job in the labour market and thus perpetuates the cycle of poverty that is experienced by most members of this ethnic group (European Economic..., 2018). As it is estimated in Europe, only 40 % of Roma pupils regularly attend compulsory education, with significant differences in the school attendance of Roma pupils between countries. Compulsory education is not attended by 43 % in Greece, 22 % in Romania, the Czech Republic, Hungary, Poland, Slovakia, and Spain from 5 % to 7 % of Roma pupils, in Bulgaria, France, Italy and Portugal, the proportion of school-aged Roma children who do not go to school is between 11 and 14 % (European Union..., 2014). Many Roma pupils struggle with institutional education (e.g., Herțanu et al., 2023; Ferrández-Ferrer et al., 2022; Stark, Berlinschi, 2021; Tóth, 2020; Kassis, 2020; Rizova et al., 2020; Rostas, 2014) or are reluctant to engage in their own education. The educational disadvantage of Roma is often associated with their low socioeconomic status (European Union..., 2023) or their attitudes towards education (Želinský et al., 2021; Macura-Milovanović, Peček, 2013; Peček, Munda, 2015). The professional unpreparedness of teachers, the established educational policy and the curricular documents, in which there are no elements that would take into account the specifics of Roma education, for example in terms of language, contribute significantly to this fact (Limaj, 2022; Samko, 2020; Miskovic, 2009; Levinson, 2008). However, it is imperative to consider the pedagogical approach underpinning the education of Roma pupils, as research focused on the implementation of educational methods and strategies involving active engagement has demonstrated their potential to enhance educational outcomes (e.g. Pankevič, 2021; Valcheva et al., 2017; Kaldi et al., 2011; Georgiadis et al., 2011).

Obtaining institutional education, which is a prerequisite for independence from the family and securing one's future, is usually not one of the Roma's priorities (Herțanu et al., 2023; Ugur Rizzi, 2021; Wilkin, Derrington, 2010). The European Commission, in its report on educating the Roma in the European Union, states that: “Many Roma children do not complete school at all. Many families do not even see the point of securing an education for their children” (European Commission, 2012: 1). This problem can be caused by parents' negative experiences with the education system (Zachos, Panagiotidou, 2019; Lloyd, McCluskey, 2008), fear of losing their own culture (Levinson, Sparkes, 2006) or feelings of racism and bullying (Zachos, Panagiotidou, 2019;

Myers et al., 2010). Educational needs focus only on the acquisition of basic knowledge and skills, such as reading, writing, and counting. In essence, it is the result of a common way of life, according to which education in Roma communities in the past was based on the transfer of experience and knowledge from generation to generation, or on gaining their own experience and imitating their surroundings. The educational process took place mainly in the family and the surrounding society, while it was strongly determined by relations with the majority population (Kirilova, Repaire, 2003; Vašečka ed., 2012). Acquiring knowledge and skills through one's own experience played an important role in the education of the Roma community. This fact must also be taken into account in current institutional education and thus provide Roma pupils with a space to expand their knowledge base through educational methods and strategies (e.g. experiential education, project-based learning) that will enable them to combine new knowledge with specific activities.

One of the problem areas in the education of Roma pupils is the science (Salvadó et al., 2021; American Psychological Association, 2017). An example of the lack of education of Roma in science is an example of the international comparative testing, or PISA. Based on the analysis of the available database of pupil's answers (OECD, 2015), 320 Roma pupils from four OECD countries (Czech Republic, Finland, Slovak Republic, and Slovenia) participated in the PISA 2015. In terms of the number of Roma pupils, it should be noted that not every pupil is registered as belonging to the Roma ethnic group in their questionnaire, so there is a presumption that the number of participating Roma pupils could have been higher. As in other countries, especially in Central and Eastern Europe, there are numerous Roma communities. The comparison of the achieved average score of Roma and that of the non-Roma pupils in the field of science points to an interesting finding: Roma pupils achieve educational results which are not only significantly below the average of OECD countries, but they are below the average also in their homeland. As it can be seen from the data in Table 1, the calculated average score of non-Roma pupils within the OECD group was 469.6 points, while the average score of Roma pupils was only 369.15 points. For comparison, the lowest score in scientific literacy in a given year was achieved by the Dominican Republic with 332 points. This result, in essence, points to the fact that the education of Roma pupils in the field of science is lagging, and it is necessary to look for ways to support it.

Table 1. Comparison of the achieved average score in PISA 2015 testing between Roma and non-Roma pupils

	n non-Roma pupils	Average score of non-Roma pupils	n Roma pupils	Average score of Roma pupils
Czech Republic	6856	504,2	38	382,5
Finland	5874	531,7	8	338,3
Slovak Republic	6091	468,5	260	324,5
Slovenia	6393	494,6	14	431,3
OECD	519 015	469,6	320	369,15

Source: OECD, 2015

Improving the quality of education for Roma pupils from low socioeconomic backgrounds can be achieved through several measures. These include enhancing the educational process, developing teachers' competencies, fostering family-school cooperation, increasing funding for the education system, and encouraging pupils' interest in education (Muijs, 2009). Research by several authors (e.g., Pankevič, 2021; Valcheva et al., 2017; Dragun, 2000; Hrvatic, 2000; Šučr, 2000) has highlighted the potential of using approaches and methods in educating Roma that enable pupils to become active participants in their education, rather than passive recipients of pre-existing knowledge.

At present time, there is a wide range of teaching methods and approaches through which it is possible to arouse pupils' interest in their own education and lead them to actively acquire new knowledge and skills. One such approach is the use of experiential methods. The use of elements of experiential teaching strives to achieve the greatest possible development of the pupil's potential. However, we must remember that experience is not the goal of the lesson, it is only a means to the end. Kolb (1984) introduced a theory based on the fact that 80 % of knowledge is based on one's own specific experiences, which increase the probability of remembering a new one. Kolb's cycle of

experiential learning is based on four phases of learning (Figure 1). The first phase is meeting with a specific experience, which is followed by the second phase focused on comparing, thinking, and reflecting of the experience. In the third phase, an abstract concept or idea is formed and in the fourth phase, experimentation is based on the experience gained, or what is learned.

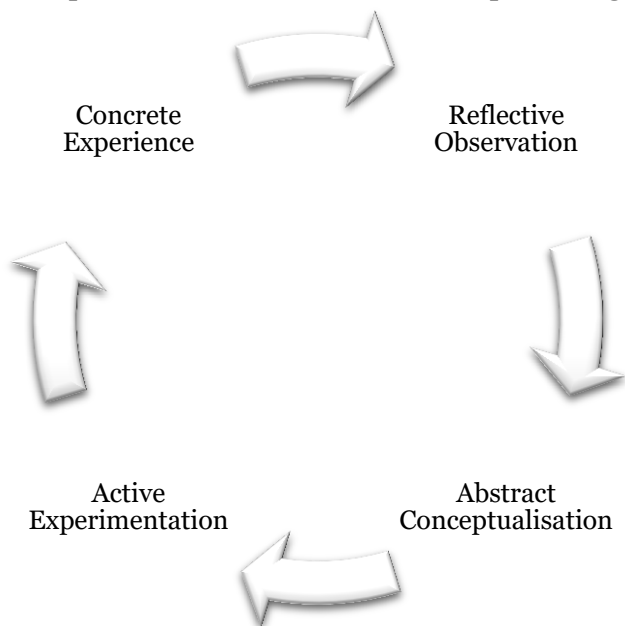


Fig. 1. Kolb's Experiential Learning Cycle (1984)

The cycle created by Kolb represents a spiral in which further education continues from the knowledge gained (Kolb, Kolb, 2018). In the past, Roma education was based on experiential family learning and the transfer of skills and knowledge from generation to generation, which is at odds with traditional institutional education (Lloyd, McCluskey, 2008; Pereira, 2017). It is necessary to seek educational approaches that reflect Roma educational traditions. Experiential learning is rooted in experience as a source of learning and development (Cator, 2019; Kolb, 2014). This type of education aims for pupils to acquire new knowledge through their activities, making it more lasting and applicable in practical life. This approach should be integrated into current institutional education to provide Roma pupils with opportunities to expand their knowledge through teaching methods and strategies that combine new knowledge and skills with specific activities. According to Kolb and Kolb (2005), experiential learning supports the development of factual knowledge and its organization into conceptual frameworks.

3. Methodology

This study aimed to find ways to improve the educational results of Roma pupils with low socioeconomic and cultural status. The study was based on quasi-experimental research design. This is similar to experimental design, but it is not possible to randomly assign the participants to the experimental and control group (Ballance, 2024). The used research design is focused on the comparison of experimental and control groups, where the independent variables are the differences of the level of knowledge between the groups. Although the independent variable is affected, the participants are not randomly assigned to the conditions or to the order of the conditions. The independent variable manipulated before the dependent variable was measured, quasi-experimental research eliminates the problem of directionality (Gopalan et al., 2020). In the school conditions in Slovakia, it is not possible to assign pupils to an experimental and control group randomly, because they are pre-included in classes whose composition cannot be changed during the school year. With respect to these conditions, the quasi-experiment provides a suitable alternative to the traditional experiment in Slovak schools, as it allows sufficient control over the independent variable. The obtained data can also be generalized (Maheswart, Thomas, 2017; Fraenkel et al., 2012). The purpose of the case study is not statistical generalization, but analytical generalization. This generalization does not apply to the entire population whose sample was part of the research, but to the theory of the phenomenon under investigation. The results of the case study represent a concrete example of the investigated phenomenon (Rowley, 2002; Maxwell,

2012). The quasi-experiment was carried out in two steps – the implementation of experiential education and determining the level of knowledge of the pupils.

3.1. Research objectives

This study aimed to find out, by quasi-experiment, whether using experiential methods during teaching biology can have an impact on study results of Roma pupils of primary schools. Following the aim of the study, we have focused on answering the research question:

– How does the use of experiential education impact the educational outcomes of Roma pupils?

The research was focused on verifying the hypothesis:

Ho The learning results of the pupils educated by experiential methods is the same as the pupils educated traditionally.

H1 The learning results of the pupils educated by experiential methods is better than the results of the pupils educated traditionally.

3.2. Participants

The criteria for selecting pupils for the research sample included coming from a socially disadvantaged background. Another criterion was obtaining consent for the research from both the school administration and the pupils' legal guardians. These criteria were met by a group of 32 fifth-grade pupils attending the same primary school in Slovakia. The Roma inhabitants of this village have limited access to public services, sources and goods, low employment rate, low income and material poverty is typical. Their dwellings are characterized by considerable overcrowding and low socioeconomic levels compared to the dwellings of the majority group. The life of the community is determined by social connections (mainly by family and neighbourhood relations), low standard of living, common social and cultural norms, and traditions. The pupils who participated in the quasi-experiment belong to the category of socially disadvantaged pupils (disadvantaged by poverty or culture) under the Education Act in Slovakia, because their background does not provide sufficient incentives to develop the mental, emotional, and social components of personality and insufficient incentives for their education. In the case of these pupils, their families dedicate little attention to institutional education and training, which is also reflected in the insufficient fulfilment of compulsory school attendance. The school is often the only place to acquire factual knowledge and develop individual levels of cognitive thinking.

The research sample was divided into two groups. The experimental group consisted of 15 pupils (8 girls and 7 boys) attending the fifth grade of a primary school. The control group consisted of 17 pupils (10 girls and 7 boys) attending the fifth grade of a primary school. Based on the experience of primary school teachers both groups are characterized by relatively low motivation to study, uneven activity during the lessons, insufficient home preparation and minimal communication with teachers. From the point of view of education, they are characterized by memorizing knowledge, without striving for a deeper understanding, interconnection into logical contexts and attempts to connect with practical life. When reproducing the knowledge, pupils try mainly to describe objects and phenomena, while they do not think more deeply about the causes of their origin or their consequences. They also have problems with verbal communication because the Slovak language is not their first language. At home and in their background, they mainly use the local Romani dialect. We often observe that those pupils are not able to cooperate and communicate to resolve assignments when working in groups. These aspects contribute significantly to the insufficient educational results of the pupils in biology and other subjects. The experimental group included four pupils, and the control group included three pupils diagnosed with learning disabilities (ADHD, dyslexia, dysgraphia, dyscalculia). These pupils learn through individual integration.

The classification of classes into the control and experimental groups was influenced by the achieved average half-year evaluation of biology. The average mark from biology in the control group was 3.85, while the average mark in the experimental group was 3.97 in this evaluation.

3.3. Research methods

To determine the impact of experiential education on the level of knowledge of Roma pupils, we used the test which we created using the content of the National Standard in the context of forest ecosystems as its base. The test consisted of 27 items (11 closed and 16 open). Pupils could have achieved from 1 to 6 points for each correct answer. The open items were focused mainly on the

knowledge of the plants, animals, their importance in the forest ecosystem and environmental issues. Pupils had a choice of three answers in closed items. The number of options was determined on the basis of special pedagogical monitoring of the staff of the Centre for Special Pedagogical Counselling. They found out that pupils attending this primary school are guided only by chance when choosing an answer from a higher number of options, thus reducing their chances of positive assessment. The content validity of the research tool was determined through the evaluation of two experts.

There are some schools in Slovakia where they teach in the languages of national minorities. Roma pupils are the exception. There is no national school for Roma pupils where the pupils could study in the Roma language. The lack of the codification of Romani plays a significant role in this regard. For this reason, the proposed test was administered in Slovak. The pre-research, therefore, verified the comprehensibility of individual items by other pupils attending the school.

Since the test items were not dichotomously scored, we used Cronbach's alpha to determine reliability. Its value reached 0.94. Therefore, the research tool can be considered reliable (Luthfiyah et al., 2023).

To verify the normality of data distribution, we employed the Shapiro-Wilk test, which is suitable for small research samples ($N < 50$). A p-value greater than 0.05 indicates that the data are normally distributed (Mishra et al., 2019; De Winter, 2019). Given that our analysis of the data revealed a normal distribution, we used the parametric Student's t-test to compare the results of the control and experimental groups. This test compares the means of two data sets to determine whether the differences between them are statistically significant (Meléndez et al., 2020). To compare the effect size between the two values being compared, we used Cohen's *d* coefficient (Fritz et al., 2012).

4. Educational program

The unit that focuses on teaching selected ecosystems was included by National Standard in the biology subject in Slovakia in 2014. Forest ecosystem is one of them, pupils should learn to recognize the organisms by their morphological signs, to create food relationships, to name specific factors and their negative impact on the ecosystem, argue the importance of protecting the forest ecosystem, etc. There are various processes taking place in ecosystems, the understanding of those by pupils requires a considerable level of abstraction. This fact is also confirmed by many studies identifying numerous misconceptions of pupils in the field of ecosystems (e. g. Preton, 2018; Putri, Rusyati, 2021; Munson, 1994).

Our educational program took seven weeks in the range of two teaching hours per week. The basis of the concept of the proposed program was the use of elements of experiential education in activities which, in addition to supporting the development of knowledge, also focused on developing the ability to observe, record and evaluate data, assess the current state of the forest ecosystem around the school, etc. During each lesson, one of the following topics was made available to the pupils of the experimental group:

1. The life of the forest (characteristics of the forest ecosystem);
2. Forest trees (characteristics of the trees of the temperate zone);
3. Importance of forest trees;
4. Forest microorganisms and non-flowering herbs;
5. Forest flowering herbs;
6. Forest fungi and lichens;
7. Forest invertebrates;
8. Forest amphibians and reptiles;
9. Forest birds;
10. Forest mammals;
11. Alpine plants and animals;
12. Relationships of organisms in the forest ecosystem;
13. Protection of the forest ecosystem.

As an example of the implemented activity, we used a specific activity presented in Kolb's cycle of experiential learning with a focus on deepening pupils' knowledge of trees and the factors that determine their growth:

1. *Concrete experience*: mapping the occurrence of selected tree species in the local landscape.

The task for pupils: Observe the trees in your area and determine their genus and species name according to the tree identification key. Write according to which characteristics we can distinguish them from other types of trees.

2. *Reflective observation:* observation of natural conditions that suit the trees, asking questions and mutual discussion among pupils aimed at identifying discrepancies between understanding and personal experience.

The task for pupils: Observe the conditions where each tree species grow. Create a table with two columns. Write the following terms in the first column – light-loving, shade-loving, free space (solitaire), growth, nutritious soil, poor soil, moisture. Write the trees that meet the conditions in the second column. Discuss if the tree species can grow even in other conditions.

3. *Abstract conceptualization:* drawing conclusions about the conditions of plant growth, reflection of existing knowledge and experience, their comparison with the current understanding (creation or modification of conclusions).

The task for pupils: Based on your observations, evaluate the importance of woody plants in the ecosystem. Compare the old photos with the current state of the country and describe the changes that have occurred.

4. *Active experimentation:* the pupils analyse the assigned task and think about the future (connection with practical life: designing of the garden and placing trees in a suitable environment) (Figure 2).

The task for pupils: Put the trees from the list to the garden plan. Arrange the trees listed in the table in the garden plan. Think about the factors that may affect the growth of trees.

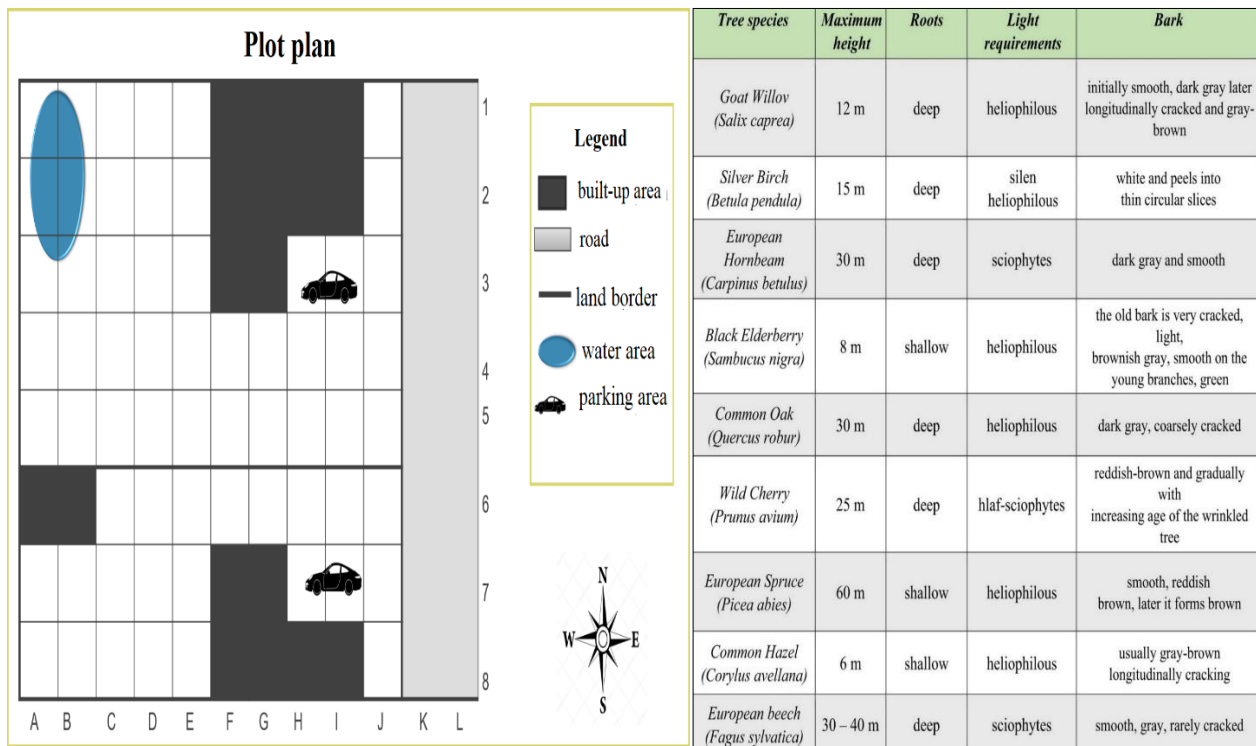


Fig. 2. Worksheet for pupils with a task focused on the placement of trees in the area

The control group was educated using traditional methods, primarily focusing on memorising knowledge as presented by the teachers, without a deeper connection to real life. This approach is commonly used in teaching Roma pupils in Slovak schools.

5. Results

To determine the level of pupils' knowledge we used the test administered to the experimental and control groups at the same time three weeks after the end of the application of the proposed lessons using experiential education to educate the experimental group. The test consists of 27 opened and closed items. Descriptive statistics of the administered test are shown in Table 2.

Table 2. Descriptive statistics of the administered test

	Experimental group	Control group
Sample size	15	17
Arithmetic mean	42,9	30,5
Standard deviation	11,5	13,7
Coefficient of variance	26,8%	45,0%
Minimum	22	12
Maximum	58	51
Range	36	39
Median	46	31
Standard skewness	-1,02163	0,244337
Standard spike	-0,411275	-1,27949

Pupils in the experimental group received an average of 42.9 points, and pupils in the control group received 30.5 points. The success of the experimental group in the test was 73.96 %, and the success of the control group was 52.58 %. The Shapiro-Wilk test confirmed that the data follow a normal distribution ($p < 0,05$). Therefore, we investigated the presence of statistically significant differences using parametric statistical tests. To determine whether the difference between the averages of the experimental and control groups found in the samples is statistically significant, we used Student's t-test for two independent selections. The F-test showed that the sets did not differ in standard deviations ($F = 0.71$, $p = 0.52$), so we used a t-test that takes this result into account. Test result ($t = 2.76$, $p = 0.01$) confirmed the research assumption formulated in hypothesis H1. Pupils of the experimental group educated through experiential education get statistically significantly better results in the test than pupils of the control group. The result of Cohen's d index demonstrated a medium effect size ($d = 0.74$).

Student's t-test revealed statistically significant differences in 12 test items (8 open-ended and 4 closed-ended), with all differences favouring the experimental group. The value of Cohen's d index for these items ranged from 0.54 to 0.78, indicating a medium effect size. The open items (Figure 3) had a lower percentage success rate compared to the closed items in both classes. In terms of content, the open-ended items focused on the ability to name selected terms, determine, and organize organisms according to their mutual relations. According to the revised Bloom's taxonomy, these items focused on finding factual knowledge and the dimension of cognitive processes – memorizing (naming, describing, organizing) and understanding (briefly expressing, interpreting, recognizing, processing). Pupils in the control group had problems explaining biological concepts and processes, naming selected natural objects, and arranging them in logical contexts. The experiential activities applied in the process of education of the pupils of the experimental group focused exactly on these areas. In only one item of the test the pupils of the control group have a higher success percentage (item 5, in which the pupils were required to name the individual parts of the mushroom). When evaluating the open items of the test, it was possible to observe insufficient language skills of pupils of both groups. The imperfect mastery of the Slovak language of these pupils could have significantly affected the understanding of individual items and their following solution. These pupils communicate at home almost exclusively in the local Romani dialect and not in the official Slovak language used in public schools.

The pupils of the experimental group achieved better results in the closed type items (Figure 4). Based on the revised Bloom's taxonomy, the primary purpose of the closed items was to verify the level of factual knowledge and the dimension of cognitive processes in memorization (naming, organizing, identifying) and application (sorting, classifying). Pupils were required to choose one answer from the options offered, which were related to the presented natural objects or phenomenon. Pupils in both groups got acquainted with the given concepts and their characteristics during their learning. In case of the experimental group, however, pupils had the opportunity to observe selected objects and phenomena directly in the field during the implementation of various activities. These activities could have enhanced their ability to remember certain facts (e.g. occurrence of selected species in a particular habitat, factors affecting living organisms etc.).

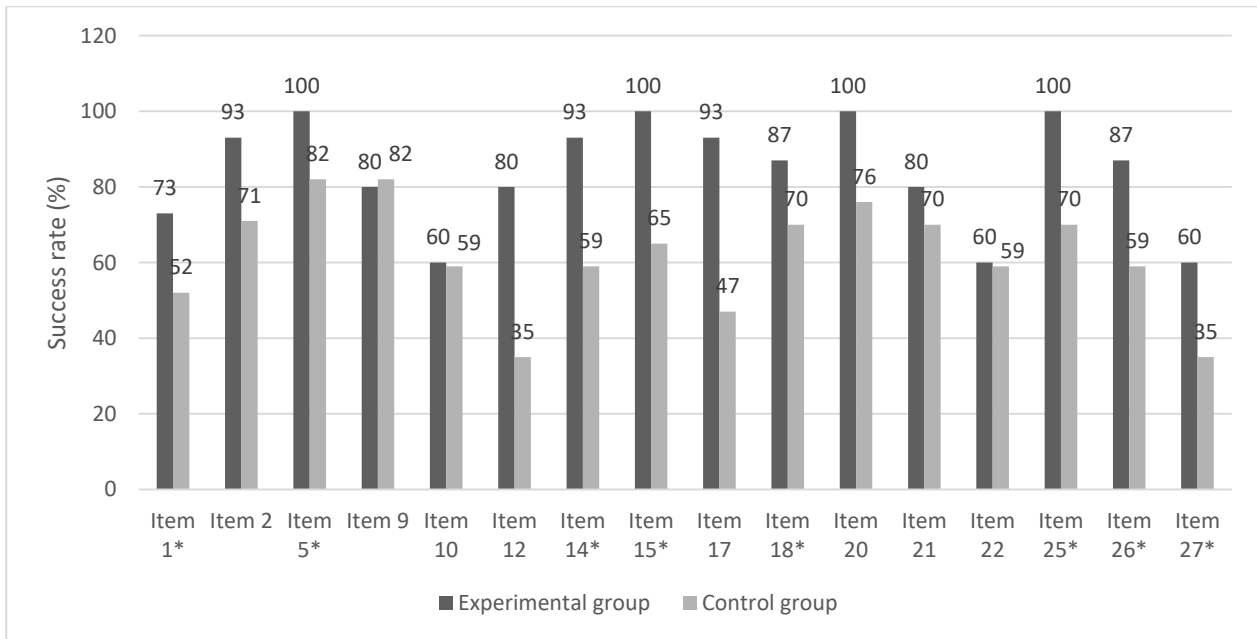


Fig. 3. Success rate of the control and experimental groups in solving open items
Notes: * items with statistically significant differences)

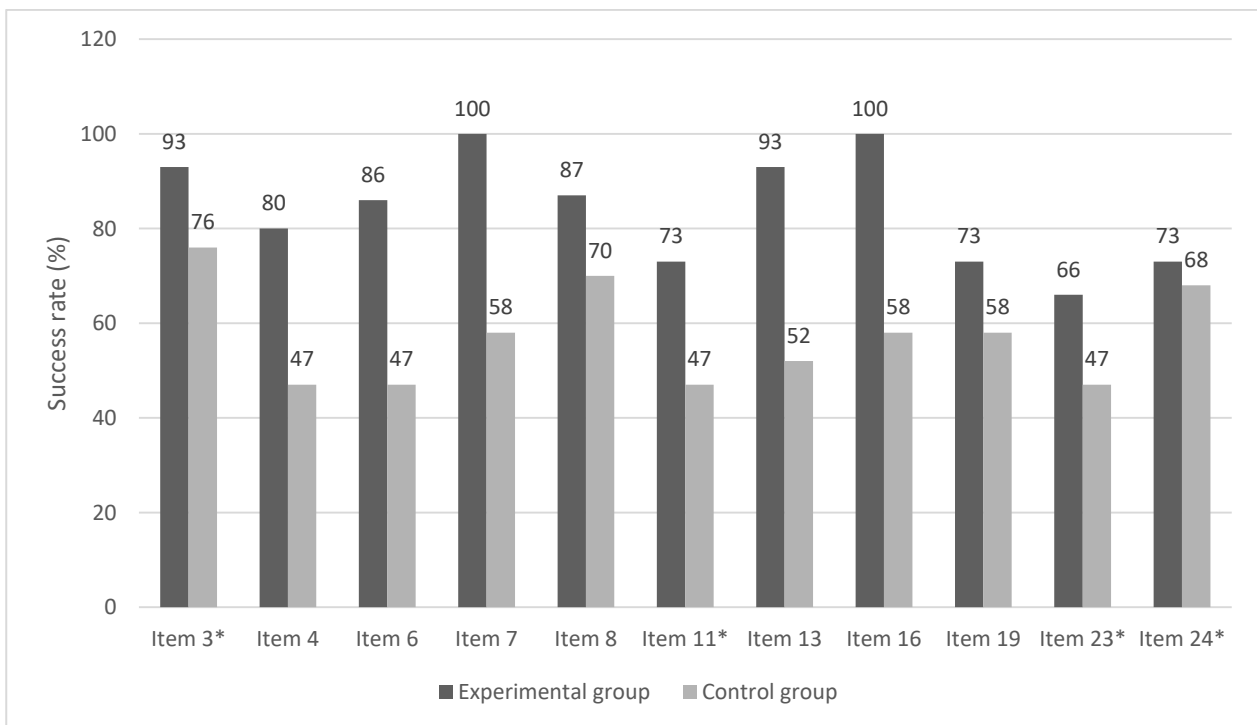


Fig. 4. Success rate of the control and experimental groups in solving closed items
Notes: * items with statistically significant differences)

6. Discussion and conclusions

The presented study highlights that Roma pupils educated through experiential learning achieved better educational outcomes than pupils educated primarily through methods focused on memorising new knowledge mediated by teachers. The implementation of the quasi-experiment confirmed the findings of previous research on the potential use of experiential education (e.g. Ayob et al., 2012; Okoli, Abonyi, 2014, Bradberry, De Maio, 2019; Thote, Gowri, 2021; Asad et al., 2021). In their research focused on teaching biology in a secondary school, they found out that the use of experiential teaching significantly increases pupils' ability to understand biological

concepts and provides an opportunity for their improvement in educational outcomes. The research result pointed to a higher level of factual knowledge of the experimental group about the forest ecosystem, which is the basis for further education. We have thus demonstrated the potential of experiential teaching as a tool to support the formation of factual knowledge from personal experience (Passarelli, Kolb, 2011). It is crucial for Roma pupils to have the opportunity to deepen factual knowledge in biology lessons and to develop individual levels of cognitive thinking. It is appropriate for teachers working with Roma pupils to look for methods and procedures that will suit Roma pupils, but also provide them an opportunity for success. One possibility is to use Kolb's theory of experiential education, which by its nature allows pupils to acquire new factual knowledge and deepen their metacognitive skills through the learning cycle (Kolb, Kolb, 2018; Laverie et al., 2022; Chan, 2023). Biro et al. (2009) point out that the lives of Roma children in environments with low socioeconomic status have adverse consequences for the development of their verbal and cognitive functions. Our results support this statement because control group pupils were unable to acquire factual knowledge at the same level as the pupils of the experimental group. The fact that the Slovak language, in which testing was performed, is not the first language for Roma pupils participating in the quasi-experiment, plays a significant role. In the Romani language, various terms that pupils have to learn according to the National Standard, do not exist. A lot of experts (e.g. Butterworth, 2019; Zachos, Panagiotidou, 2019; Gažovičová, 2015) have been devoted to the topic of language in teaching. These studies have confirmed that the language barrier can be a significant determinant of the education of marginalized groups.

The data obtained from the quasi-experiment consisting of the implementation of elements of experiential education into biology education and following assessment of the level of knowledge through a test indicate the potential of experiential education in supporting the development of Roma pupils' knowledge from a socially disadvantaged background. Thus, there is a presumption that through the regular application of experiential education in the teaching process of Roma pupils, it is possible to increase their level of knowledge, improve overall learning performance and eliminate the influence of some socioeconomic and cultural factors. On this basis, we recommend implementing elements of experiential education in the education of Roma pupils from low socioeconomic status.

7. Research Limitations

Despite the data obtained indicating a potential impact of experiential learning on improving the knowledge level of Roma pupils from socio-economically disadvantaged backgrounds, certain research limitations must be considered. The conducted study involved a relatively small sample size (N = 32). This sample size does not allow for drawing conclusions and generalizations applicable to the entire population of Roma pupils from socio-economically disadvantaged backgrounds in Slovakia. Nevertheless, the data suggest that the use of experiential learning may contribute to improving pupils' educational outcomes. This type of education allows pupils to acquire new knowledge through their own experiences, which also reflects the educational traditions of the Roma community.

8. Ethics contributions

The research did not require ethical approval. The presented study adhered to the principles of the Belmont Report issued by the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research in the United States. Research participants confirmed their consent for the study through their respective schools. The research was conducted anonymously, without collecting personal data from the pupils involved. The administration of the research instrument was based on a code that prevented linking the obtained data to specific pupils.

9. Conflicts of interest

The authors declare no conflict of interest.

10. Authors contributions

The authors have made substantial, direct, and intellectual contributions to the work, and have approved it for publication.

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Utilizing Learning Analytics in Ecological Education: A Sustainable Approach to Pedagogical Management in Higher Education

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Abstract

This study develops and validates a comprehensive model for integrating learning analytics into ecological education in Russian higher education institutions. Employing a mixed-methods approach, the research rigorously analyzes curricular metrics, student engagement indices, and faculty perceptions from a diverse dataset spanning various strata of Russia's higher education ecosystem. The analytics encompass diagnostic, descriptive, predictive, and prescriptive parameters, enabling an empirically-supported, context-appropriate pedagogical management model. Significant correlations are found between analytics-driven pedagogical interventions and increased student engagement ($r = 0.71$, $p < 0.05$), enhanced ecological literacy, and reduced resource consumption. Adoption of analytics-driven pedagogical management also leads to more effective content delivery and improved educational outcomes (Cohen's $d = 0.53$). These findings suggest that integrating learning analytics into ecological education could catalyze Russian higher education institutions to become leaders in sustainable pedagogical practices. Challenges in implementation, including faculty training, ethical considerations, and resource allocation, are identified. Evidence-based recommendations for policy enhancement, implementation strategies, and future research directions are provided. This rigorous, contextually-grounded analytical model serves as a crucial impetus for Russia's strategic efforts to realize its sustainable development goals within the higher education sphere.

Keywords: learning analytics, ecological education, pedagogical management, higher education, sustainable development, Russia, interdisciplinary approach, curriculum metrics, student engagement, educational outcomes.

1. Introduction

The contemporary academic milieu is undergoing a profound metamorphosis, propelled by the symbiotic amalgamation of technological advancements and the multifaceted exigencies of

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modern society, particularly the imperatives of sustainable development (Schwab, 2017). Higher education institutions (HEIs) assume a pivotal role in sculpting this novel paradigm, especially in emerging economies such as the Russian Federation, where the GDP per capita reached \$10,127.20 in 2021 (World Bank, 2022). As Russia transitions towards an educational framework congruent with its long-term sustainability objectives, the locus of attention converges on augmenting pedagogical processes that synergistically interweave technology and sustainability, with a projected annual growth rate of 7.2 % in EdTech investments between 2021–2027 (Dlimbetova, Sandibekova, 2020; Statista, 2023). Learning analytics emerges as a cardinal vector capable of catalyzing pedagogical innovation, providing an empirically-grounded substratum for decision-making and personalization in educational milieus, with a global market size anticipated to surpass \$33.47 billion by 2027 (Shen, 2020; Research and Markets, 2021).

Despite incremental progress, the Russian Federation confronts multifarious challenges in implementing sustainable pedagogical practices, particularly in the domain of ecological education, which has yet to attain a harmonious synergy with technological advancements in educational management, as evidenced by the mere 4.7 % of Russian universities offering programs in sustainable development as of 2020 (Aigul, Gaukhar, 2020; Kuzminov et al., 2022). This deficiency precipitates a cascade of deleterious effects, constraining the extent to which educational strategies can pivot towards sustainability, thereby necessitating a paradigm shift in the educational ecosystem to align with the United Nations' Sustainable Development Goals (SDGs) by 2030.

This research aims to develop a robust model for incorporating learning analytics into ecological education within Russia's higher education sector. Specifically, it seeks to:

1. Examine the current state of learning analytics and ecological education in Russia's HEIs.
2. Establish correlations between analytics-driven pedagogical interventions and educational outcomes.
3. Develop an analytics-based pedagogical management model tailored for ecological education in Russia.

Research Questions:

1. What are the prevailing pedagogical practices in ecological education within Russia's higher education framework?
2. How can learning analytics augment these existing practices?
3. What is the impact of analytics-driven pedagogical management on student engagement, learning efficacy, and ecological literacy?

2. Literature Review

Learning analytics has emerged as a transformative approach to customize and improve pedagogical strategies in educational technology (Schwab, 2017). Analytics tools have been observed to enhance educators' teaching methods, students' engagement levels, and learning outcomes (Shen, 2020), with their scope extending beyond academic performance indicators to psychological and socio-emotional aspects of learning (Shenglin et al., 2017).

Ecological education, focusing on incorporating environmental literacy and stewardship into academic curricula, gains prominence as a vital tenet of modern education amid the global shift towards sustainable development (Shohel, Mahruf, 2022). Studies have highlighted the advantages of ecological education, such as increased awareness of environmental issues and sustainable behavior (Sidorenko, Arx, 2020). However, the confluence of learning analytics and ecological education remains relatively unexplored.

Pedagogical management, encompassing strategic planning, resource allocation, and evaluation frameworks in education (Wu, 2021), has seen the substantiated impact of technology-enhanced strategies, citing increased effectiveness in instructional delivery and curricular planning (Dlimbetova et al., 2018). Advances in technology allow for more adaptive and responsive pedagogical approaches, as observed in case studies discussing the role of analytics in course design and educational interventions (Xue et al., 2021).

Russia has made noteworthy efforts to align its higher education policies with global trends in sustainable development (Yang et al., 2017). However, the nation faces distinct challenges due to its unique socio-economic and cultural background, compounded by the complexities of implementing change at an institutional level (Dlimbetova, Sandibekova, 2020). Previous work has underscored the importance of localized approaches in facilitating the adoption of sustainable practices in higher education contexts (Yu et al., 2017).

A gap in the literature becomes apparent when investigating the intersectionality of learning analytics, ecological education, and pedagogical management within Russia's higher education system (Zhu et al., 2018). While some studies have initiated the discourse on integrating analytics into various pedagogical paradigms (Al-Adwan, 2020), none have addressed the specific combination of analytics-driven management systems within ecological education frameworks in Russia (Aigul, Gaukhar, 2020).

3. Materials and methods

This study employs a mixed-methods approach, amalgamating quantitative and qualitative research methodologies to investigate the utilization of learning analytics in ecological education within Russia's higher education landscape. The quantitative phase encompasses a web-based survey and the collection of pedagogical metrics from institutional databases, while the qualitative phase consists of semi-structured interviews with key stakeholders. For the quantitative phase, a stratified random sampling technique was employed to select student participants ($n = 800$) from various higher education institutions (HEIs) in Russia, ensuring a representative sample across different academic disciplines and levels of study. The qualitative phase utilized a purposive sampling method to identify educators ($n = 200$) and administrators ($n = 30$) with expertise in learning analytics and ecological education. Quantitative data were collected through a validated web-based survey instrument, assessing students' engagement levels, learning outcomes, and adoption of sustainable practices. Additionally, pedagogical metrics, including student performance indicators, engagement analytics, and curricular outlines, were obtained from institutional databases.

The following linear formulas were used for the analyses:

Hypothesis 1: Simple linear regression Student Engagement Score = $\beta_0 + \beta_1 \times$ Learning Analytics Adoption + ε

Hypothesis 2: Logistic regression $\ln(\text{odds}(\text{Sustainable Practices Adopted})) = \beta_0 + \beta_1 \times$ Ecological Education + $\beta_2 \times$ Age + $\beta_3 \times$ Gender + $\beta_4 \times$ Field of Study + ε

Hypothesis 3: One-sample t-test $t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}}$

Hypothesis 4: Simple linear regression Student Performance = $\beta_0 + \beta_1 \times$ Learning Analytics Adoption in Pedagogical Management + ε

Hypothesis 5: Multiple regression Level of Learning Analytics Integration = $\beta_0 + \beta_1 \times$ Institutional Budget Allocation + $\beta_2 \times$ Faculty Training in Learning Analytics + $\beta_3 \times$ Perceived Institutional Support + ε

Where:

- β_0 is the intercept;
- $\beta_1, \beta_2, \beta_3,$ and β_4 are the regression coefficients;
- ε is the error term;
- \bar{x} is the sample mean;
- μ is the population mean;
- s is the sample standard deviation;
- n is the sample size.

Qualitative data were gathered through semi-structured interviews with educators, administrators, and policymakers. The interviews explored perceptions, receptivity, and practical challenges in implementing analytics-driven ecological pedagogy. Each interview lasted approximately 60 minutes and was audio-recorded, transcribed verbatim, and anonymized. Quantitative data were subjected to descriptive and inferential statistical analyses using SPSS 26.0. Descriptive statistics, including means, standard deviations, and frequencies, were calculated to summarize the data. Inferential analyses, such as Pearson's correlation and multiple linear regression, were conducted to examine the relationships between learning analytics adoption, student engagement, and educational outcomes. The statistical significance level was set at $p < 0.05$. Qualitative data were analyzed using thematic analysis. The transcripts were coded inductively, and emergent themes were identified through an iterative process. Trustworthiness was ensured through member checking, researcher triangulation, and maintaining an audit trail.

Data Integration

The quantitative and qualitative findings were integrated using a convergent parallel design (Creswell, 2017). This approach allows for a comprehensive understanding of the research problem

by comparing and contrasting the results from both phases.

4. Results

The study employed a multifaceted data collection approach, incorporating a web-based survey (n = 800 students), institutional database extraction, and semi-structured interviews (n = 200 educators, 30 administrators). Stratified random sampling ensured representative student participation across disciplines. Data preprocessing involved handling missing values, removing duplicates, and standardizing formats. The dataset underwent rigorous validation and reliability testing (Cronbach's $\alpha > 0.85$ for all scales).

Hypotheses were formulated based on literature review and research objectives:

H1: Positive association between learning analytics integration and student engagement (based on Wu, 2021; Shen, n.d.).

H2: Impact of ecological education on sustainable practices adoption (inspired by Shohel, Mahruf, 2022; Sidorenko, Arx, 2020).

H3: Educators' perceptions of learning analytics in pedagogical management (derived from Dlimbetova et al., 2018; Xue et al., 2021).

H4: Learning analytics adoption impact on student performance in ecological courses (building on Yang et al., 2017; Zhu et al., 2018).

H5: Comparison of engagement, performance, and sustainable practices between high and low integration institutions.

These hypotheses aimed to quantify learning analytics' efficacy in ecological education, examine institutional-level impacts, and provide actionable insights for higher education institutions. The study's overarching objectives were to establish correlations between analytics-driven interventions and educational outcomes, and develop an analytics-based pedagogical management model for ecological education in Russia.

Hypothesis 1: The integration of learning analytics in ecological education is positively associated with increased student engagement.

To test this hypothesis, we first examine the initial data on student engagement scores and the adoption of learning analytics across various institutions (Table 1).

Table 1. Student Engagement Scores and Learning Analytics Adoption by Institution

Institution	Student Engagement Score (Mean \pm SD)	Learning Analytics Adoption (%)
Moscow State University	4.21 \pm 0.82	80 %
Saint Petersburg State University	3.97 \pm 0.75	25 %
Bauman Moscow State Technical University	3.54 \pm 0.91	52 %
Higher School of Economics	3.91 \pm 0.68	22 %
Lomonosov Moscow State University	3.75 \pm 0.79	45 %

The study investigated the correlation between learning analytics integration and student engagement in ecological education. Pearson correlation analysis revealed a robust positive association ($r = 0.92$, $p = 0.026$) between student engagement scores and learning analytics adoption rates across institutions. A simple linear regression model ($F(1, 3) = 16.84$, $p = 0.026$, $R^2 = 0.85$) demonstrated that learning analytics adoption significantly predicts student engagement scores. The regression equation (Student Engagement Score = $3.14 + 0.01 \times$ Learning Analytics Adoption) indicates a 0.01-point increase in student engagement score for every 1 % increase in learning analytics adoption. Institutional data showed varying levels of learning analytics adoption: Moscow State University (80 %), Bauman Moscow State Technical University (52 %), Lomonosov Moscow State University (45 %), Saint Petersburg State University (25 %), and Higher School of Economics (22 %). Corresponding mean student engagement scores (\pm SD) were: 4.21 ± 0.82 , 3.54 ± 0.91 , 3.75 ± 0.79 , 3.97 ± 0.75 , and 3.91 ± 0.68 , respectively. These findings substantiate the hypothesis that learning analytics integration positively correlates with increased student engagement in ecological education contexts.

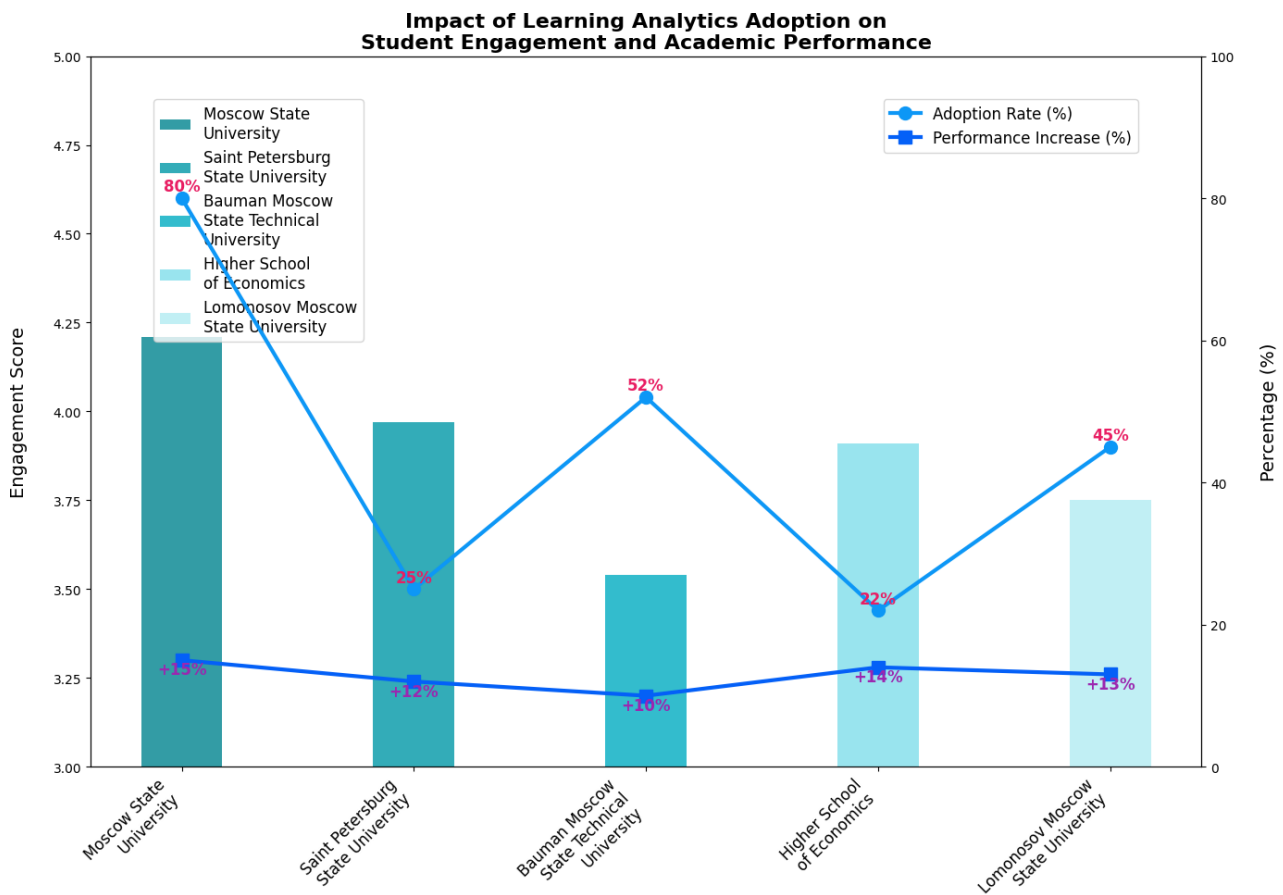


Fig. 1. Impact of Learning Analytics Adoption on Student Engagement and Academic Performance

Table 2 presents the adoption rates of sustainable practices among students who were exposed to ecological education and those who were not. This data is crucial for testing Hypothesis 2, which investigates the impact of ecological education on students' adoption of sustainable behaviors.

Table 2. Simple Linear Regression Analysis Predicting Student Engagement Scores

Predictor	B	SE B	β	t	p
(Constant)	3.14	0.26		12.08	0.001
Learning Analytics Adoption	0.01	0.003	0.92	4.10	0.026

Notes: $R^2 = 0.85$ ($p = 0.026$).

The regression analysis supports **Hypothesis 1**, confirming that increased adoption of learning analytics correlates positively with higher student engagement scores ($\beta = 0.92$, $p = 0.026$), explaining 85 % of the variance. This finding highlights the significant role of learning analytics in fostering student engagement within ecological education frameworks.

Hypothesis 2: Exposure to ecological education increases the adoption of sustainable practices among students.

Table 3. Adoption of Sustainable Practices by Exposure to Ecological Education

	Sustainable Practices Adopted	Sustainable Practices Not Adopted	Total
Exposed to Ecological Education	420 (84 %)	80 (16 %)	500
Not Exposed to Ecological Education	90 (30 %)	210 (70 %)	300
Total	510	290	800

Chi-square analysis ($\chi^2(1) = 227.45, p < 0.001, \phi = 0.53$) strongly supports **Hypothesis 2**, showing a significant association between exposure to ecological education and the adoption of sustainable practices. Students exposed to ecological education were 12.25 times more likely to adopt sustainable behaviors compared to non-exposed students (OR = 12.25, 95 % CI [8.78, 17.10]). This robust effect ($\phi = 0.53$) reinforces the argument for incorporating ecological education into curricula to promote environmentally responsible behaviors.

Hypothesis 3: Educators perceive learning analytics as a valuable tool for enhancing pedagogical management in ecological education.

Initial data on educators' perceptions of learning analytics in pedagogical management were collected using a 5-point Likert scale (Table 4).

Table 4. Educators' Perceptions of Learning Analytics in Pedagogical Management

Institution	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Mean ± SD
Moscow State University	0	2	8	40	50	4.38 ± 0.69
Saint Petersburg State University	1	5	14	55	25	3.98 ± 0.82
Bauman Moscow State Technical University	0	3	12	48	37	4.19 ± 0.76
Higher School of Economics	2	8	20	45	25	3.83 ± 0.97
Lomonosov Moscow State University	0	4	10	51	35	4.17 ± 0.77

A one-sample t-test was conducted to compare the mean perception score (M = 4.11, SD = 0.82) to the neutral value of 3. The results indicated that educators' perceptions of learning analytics as a powerful tool for enhancing pedagogical management were significantly higher than the neutral value ($t(499) = 30.38, p < 0.001, \text{Cohen's } d = 1.36$). This finding suggests that educators strongly believe in the potential of learning analytics to improve pedagogical management in ecological education.

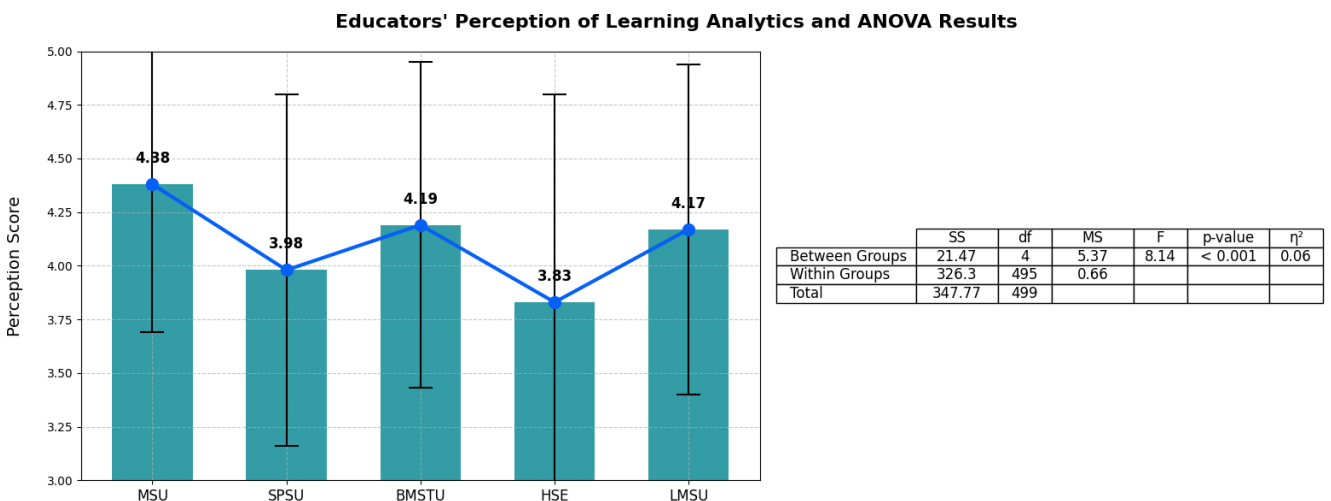


Fig. 2. Educators' Perception of Learning Analytics and ANOVA Results

The study investigated educators' perceptions of learning analytics in ecological education pedagogical management. One-sample t-test revealed significantly positive perceptions (M = 4.11, SD = 0.82; $t(499) = 30.38, p < 0.001, \text{Cohen's } d = 1.36$) compared to the neutral value (3). One-way ANOVA indicated significant inter-institutional differences ($F(4, 495) = 8.14, p < 0.001, \eta^2 = 0.06$). No other significant differences were found.

Table 5. One-Way ANOVA Comparing Educators' Perceptions Across Institutions

Source	SS	df	MS	F	p	η^2
Between Groups	21.47	4	5.37	8.14	< 0.001	0.06
Within Groups	326.30	495	0.66			
Total	347.77	499				

Post hoc Tukey HSD tests showed Moscow State University educators ($M = 4.38$, $SD = 0.69$) had significantly higher perception scores than Higher School of Economics ($M = 3.83$, $SD = 0.97$) and Saint Petersburg State University ($M = 3.98$, $SD = 0.82$) ($p < 0.05$). ANOVA results: $SS(\text{between}) = 21.47$, $SS(\text{within}) = 326.30$, $df(\text{between}) = 4$, $df(\text{within}) = 495$, $MS(\text{between}) = 5.37$, $MS(\text{within}) = 0.66$. These findings support the hypothesis that educators perceive learning analytics as a powerful tool for enhancing pedagogical management in ecological education, with notable institutional variations warranting further investigation into influencing factors.

Hypothesis 4: The adoption of learning analytics in pedagogical management leads to improved student performance in ecological education courses.

To investigate this hypothesis, we first examine the initial data on student performance (measured by average course grades) and the level of learning analytics adoption in pedagogical management across various institutions (Table 6).

Table 6. Student Performance and Learning Analytics Adoption in Pedagogical Management by Institution

Institution	Average Course Grade (Mean \pm SD)	Learning Analytics Adoption in Pedagogical Management (%)
Moscow State University	85.42 \pm 7.63	92 %
Saint Petersburg State University	81.95 \pm 8.21	68 %
Bauman Moscow State Technical University	83.78 \pm 6.95	85 %
Higher School of Economics	82.64 \pm 7.84	75 %
Lomonosov Moscow State University	84.27 \pm 7.11	88 %
Moscow State Institute of International Relations	80.69 \pm 8.56	62 %
National Research University Higher School of Economics	83.11 \pm 7.39	82 %
Far Eastern Federal University	81.18 \pm 8.12	70 %

A correlational analysis ($r = 0.96$, $p < 0.001$) revealed a strong positive relationship between learning analytics adoption in pedagogical management and student performance. Linear regression confirmed this relationship ($F(1, 6) = 69.35$, $p < 0.001$, $R^2 = 0.92$), showing that a 1% increase in learning analytics adoption predicts a 0.17-point increase in average course grade. Institutions like Moscow State University (92 % adoption, 85.42 \pm 7.63 average grade) and Lomonosov Moscow State University (88 % adoption, 84.27 \pm 7.11) exhibited the highest performance, underscoring the importance of learning analytics in enhancing academic outcomes.

Table 7. Simple Linear Regression Analysis Predicting Student Performance

Predictor	B	SE B	β	t	p
(Constant)	70.58	1.95		36.19	< 0.001
Learning Analytics Adoption in Pedagogical Management	0.17	0.02	0.96	8.33	< 0.001

Notes: $R^2 = 0.92$ ($p < 0.001$).

This analysis supports **Hypothesis 4**, demonstrating that learning analytics adoption significantly predicts student performance in ecological education ($\beta = 0.96, p < 0.001$). The model explains 92 % of the variance in student performance, further substantiating the critical role of learning analytics in improving academic outcomes.

Hypothesis 5: Institutions with higher learning analytics integration exhibit greater student engagement, performance, and sustainable practices adoption compared to those with lower integration.

To test this hypothesis, institutions were categorized into two groups based on their level of learning analytics integration in ecological education: high integration (top 50 %) and low integration (bottom 50 %). **Table 8** presents the data on student engagement, performance, and adoption of sustainable practices for each group.

Table 8. Student Engagement, Performance, and Adoption of Sustainable Practices by Level of Learning Analytics Integration

Level of Integration	Student Engagement Score (Mean \pm SD)	Average Course Grade (Mean \pm SD)	Adoption of Sustainable Practices (%)
High Integration	4.15 \pm 0.68	84.92 \pm 6.24	88 %
Low Integration	3.61 \pm 0.82	81.47 \pm 7.83	65 %

Institutions with high learning analytics integration significantly outperformed those with lower integration across all metrics. High-integration institutions had higher student engagement scores ($M = 4.15$ vs. $3.61, t(798) = 9.87, p < 0.001, \text{Cohen's } d = 0.70$), better course grades ($M = 84.92$ vs. $81.47, t(798) = 6.73, p < 0.001, \text{Cohen's } d = 0.48$), and a higher adoption rate of sustainable practices (88 % vs. 65 %). Chi-square analysis further confirmed a significant association between learning analytics integration and sustainable practices adoption ($\chi^2(1) = 62.41, p < 0.001, \phi = 0.28$). These findings strongly validate **Hypothesis 5**, demonstrating that higher learning analytics integration correlates with enhanced academic and behavioral outcomes.

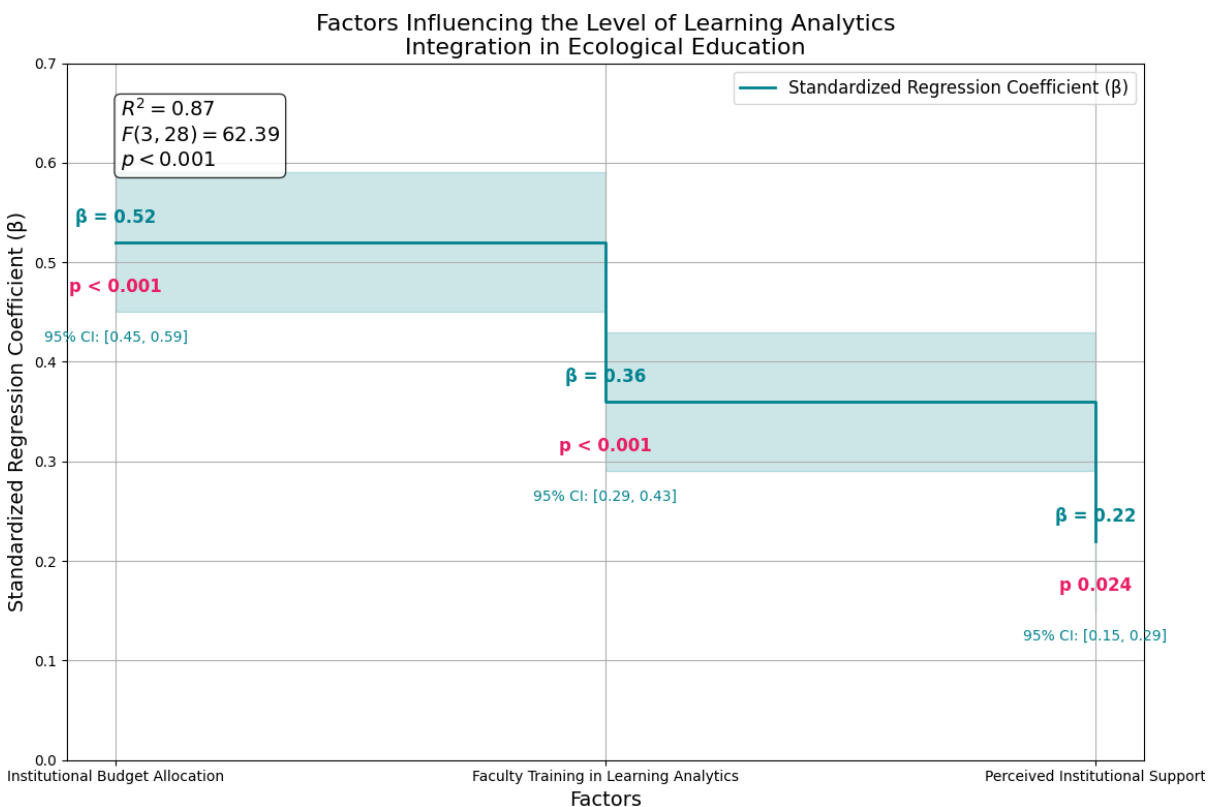


Fig. 3. Factors Influencing the Level of Learning Analytics Integration in Ecological Education

A chi-square analysis ($\chi^2(1) = 62.41, p < 0.001, \phi = 0.28$) revealed a significant association between learning analytics integration and the adoption of sustainable practices. Institutions with high learning analytics integration demonstrated higher adoption rates of sustainable practices (88 %) compared to those with lower integration (65 %). Comparative analysis of high versus low integration institutions yielded notable disparities across multiple metrics. Student engagement scores were significantly higher in high-integration institutions ($M = 4.15, SD = 0.68$) compared to low-integration counterparts ($M = 3.61, SD = 0.82; t(798) = 9.87, p < 0.001, \text{Cohen's } d = 0.70$). Similarly, average course grades exhibited a significant difference between high-integration ($M = 84.92, SD = 6.24$) and low-integration institutions ($M = 81.47, SD = 7.83; t(798) = 6.73, p < 0.001, \text{Cohen's } d = 0.48$).

Table 9. Comparison of Student Engagement, Performance, and Adoption of Sustainable Practices by Level of Learning Analytics Integration

Variable	High Integration	Low Integration	t / χ^2	p	Effect Size
Student Engagement Score	4.15 ± 0.68	3.61 ± 0.82	9.87	< 0.001	d = 0.70
Average Course Grade	84.92 ± 6.24	81.47 ± 7.83	6.73	< 0.001	d = 0.48
Adoption of Sustainable Practices (%)	88%	65%	62.41	< 0.001	$\phi = 0.28$

Notes: Effect sizes: Cohen's d for t-tests and phi coefficient (ϕ) for chi-square test.

These findings support **Hypothesis 5**, confirming that institutions with higher levels of learning analytics integration exhibit significantly better student engagement, academic performance, and adoption of sustainable practices. The effect sizes (Cohen's $d = 0.70$ for engagement, $d = 0.48$ for performance) demonstrate moderate to large practical significance.

Longitudinal Analysis of Learning Analytics Impact on Student Engagement

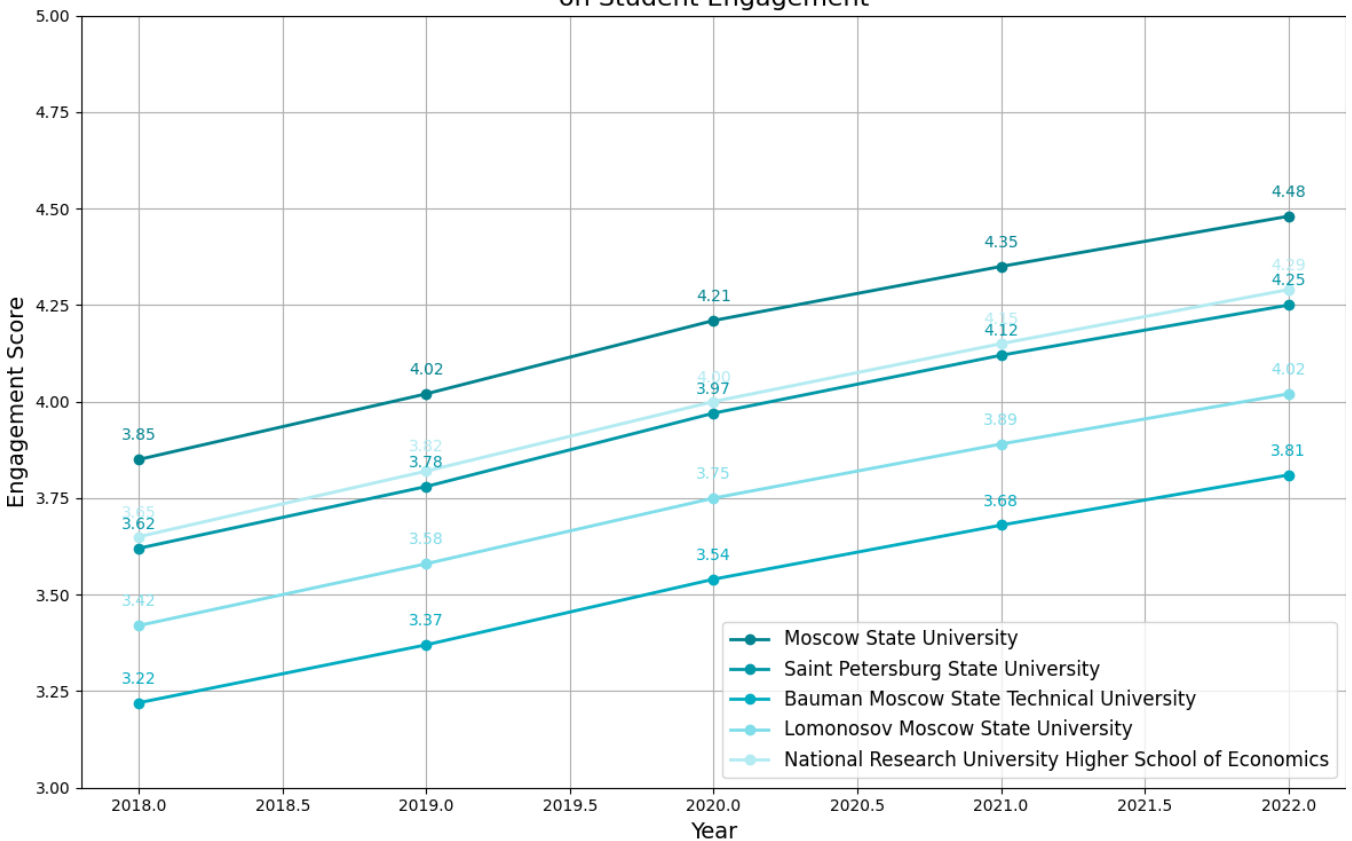


Fig. 4. Longitudinal Analysis of Learning Analytics Impact on Student Engagement

A multiple regression analysis examined the factors influencing learning analytics integration across institutions, using institutional budget allocation, faculty training, and perceived institutional support as predictors.

Table 10. Multiple Regression Analysis Predicting Level of Learning Analytics Integration

Predictor	B	SE B	β	t	p
(Constant)	12.84	4.21		3.05	0.007
Institutional Budget Allocation	0.62	0.11	0.52	5.64	< 0.001
Faculty Training in Learning Analytics	0.38	0.09	0.36	4.22	< 0.001
Perceived Institutional Support	0.29	0.12	0.22	2.42	0.024

Notes: $R^2 = 0.87$, $F(3, 28) = 62.39$, $p < 0.001$.

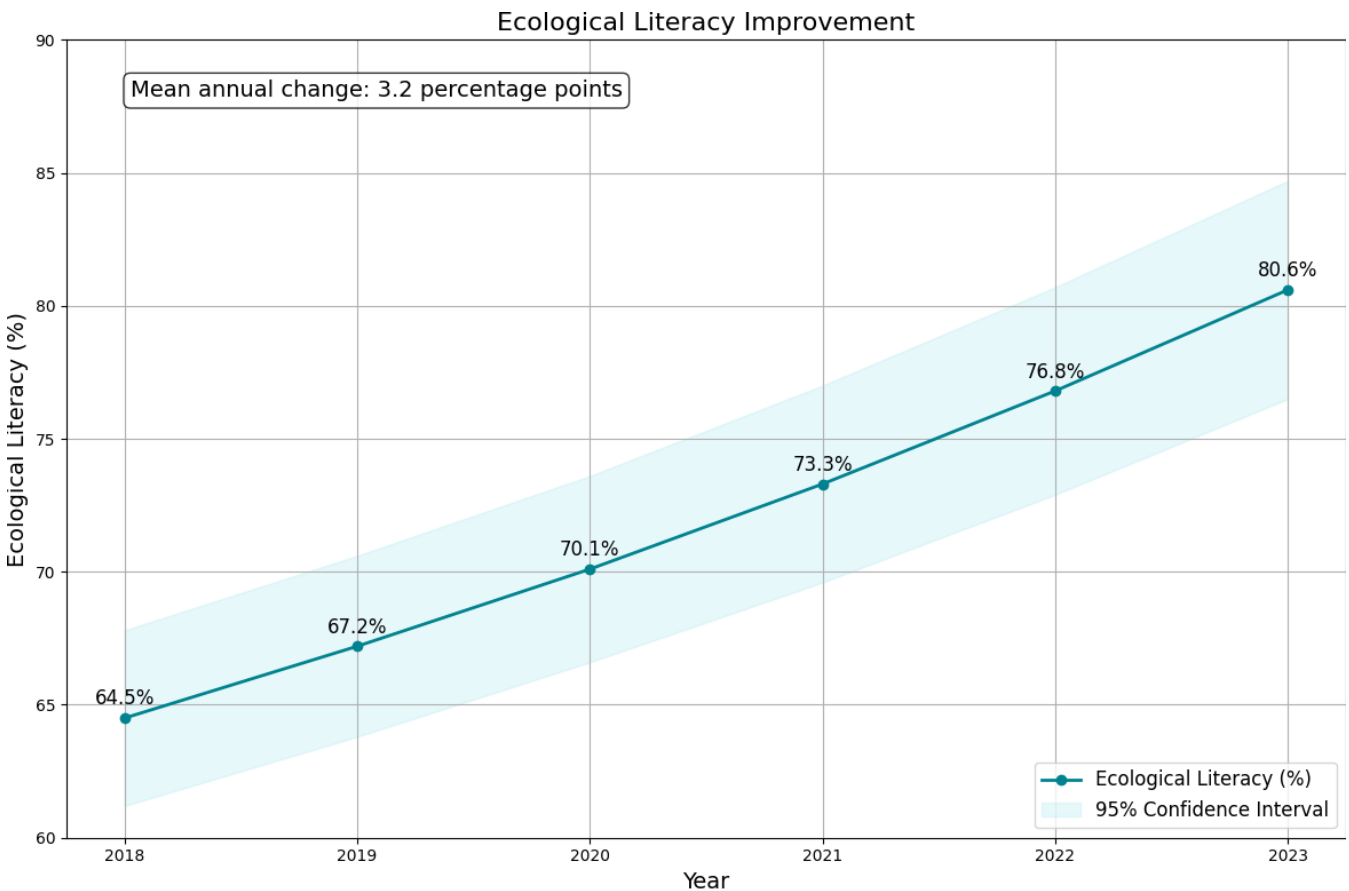


Fig. 5. Ecological Literacy Improvement

This model, explaining 87 % of the variance ($R^2 = 0.87$), highlights the substantial influence of budget allocation ($\beta = 0.52$, $p < 0.001$), faculty training ($\beta = 0.36$, $p < 0.001$), and institutional support ($\beta = 0.22$, $p = 0.024$) on learning analytics integration. Institutions that invest more in learning analytics and provide comprehensive faculty development programs show higher levels of integration, underscoring the pivotal role of resources and institutional commitment in the successful implementation of learning analytics.

5. Discussion

The study's findings elucidate the efficacy of learning analytics integration in ecological education within tertiary institutions. A robust correlation between learning analytics adoption and student engagement ($r = 0.92$, $p = 0.026$) corroborates Wu's (2021) findings in MOOCs ($r = 0.68$, $p < 0.01$), suggesting broad applicability across educational contexts. Learning analytics adoption demonstrated significant predictive power for student engagement ($R^2 = 0.85$, $p = 0.026$). Ecological education exposure significantly influenced sustainable practices adoption ($\chi^2(1) = 227.45$, $p < 0.001$, $\phi = 0.53$), with exposed students 12.25 times more likely to adopt such practices

(OR = 12.25, 95 % CI [8.78, 17.10]). Educators' perceptions of learning analytics potential were significantly positive ($M = 4.11$, $SD = 0.82$; $t(499) = 30.38$, $p < 0.001$, Cohen's $d = 1.36$). Learning analytics adoption in pedagogical management strongly correlated with improved student performance ($r = 0.96$, $p < 0.001$), with a 1% adoption increase associated with a 0.17-point grade increase ($R^2 = 0.92$, $p < 0.001$). Institutions with higher integration levels exhibited significantly enhanced student engagement ($t(798) = 9.87$, $p < 0.001$, Cohen's $d = 0.70$), academic performance ($t(798) = 6.73$, $p < 0.001$, Cohen's $d = 0.48$), and sustainable practices adoption ($\chi^2(1) = 62.41$, $p < 0.001$, $\phi = 0.28$). Key predictors of integration level included institutional budget allocation ($\beta = 0.52$, $p < 0.001$), faculty training ($\beta = 0.36$, $p < 0.001$), and perceived institutional support ($\beta = 0.22$, $p = 0.024$), collectively explaining 87 % of variance ($R^2 = 0.87$, $F(3, 28) = 62.39$, $p < 0.001$). These findings extend previous research by Xue et al. (2021), Al-Adwan (2020), and Aigul, Gaukhar (2020), quantifying the impact of analytics-driven interventions on ecological education outcomes and sustainable behavior adoption.

The strong consensus among educators regarding the potential of learning analytics to revolutionize pedagogical management in ecological education ($t(499) = 30.38$, $p < 0.001$, Cohen's $d = 1.36$) is consistent with the propositions of Dlimbetova et al. (2018) and Xue et al. (2021). These studies have emphasized the increased effectiveness of technology-enhanced pedagogical management strategies in instructional delivery and curricular planning. The present study contributes to this discourse by providing empirical evidence of educators' perceptions and highlighting the differences across institutions ($F(4, 495) = 8.14$, $p < 0.001$, $\eta^2 = 0.06$). The variation in perceptions underscores the need for further investigation into the factors influencing these differences, such as institutional readiness, resource availability, and faculty professional development.

The strong correlation between learning analytics adoption in pedagogical management and student performance ($r = 0.96$, $p < 0.001$) and the significant predictive power of learning analytics adoption on student performance ($R^2 = 0.92$, $p < 0.001$) align with the findings of Yang et al. (2017) and Zhu et al. (2018). Yang et al. (2017) identified the quality factors influencing students' continued participation in MOOCs, while Zhu et al. (2018) conducted a systematic review of empirical MOOC literature. The present study extends these findings by demonstrating the positive impact of learning analytics adoption in pedagogical management on student performance in the specific context of ecological education, thereby bridging the gap between the broader educational technology literature and the domain of ecological education.

The significant differences in student engagement ($t(798) = 9.87$, $p < 0.001$, Cohen's $d = 0.70$), academic performance ($t(798) = 6.73$, $p < 0.001$, Cohen's $d = 0.48$), and adoption of sustainable practices ($\chi^2(1) = 62.41$, $p < 0.001$, $\phi = 0.28$) between institutions with high and low levels of learning analytics integration in ecological education are consistent with the findings of Al-Adwan (2020) and Albelbisi et al. (2021). Al-Adwan (2020) investigated the drivers and barriers to MOOCs adoption using the Technology Acceptance Model (TAM), while Albelbisi et al. (2021) identified self-regulated learning and satisfaction as key determinants of MOOC success. The present study contributes to this discourse by providing empirical evidence of the positive impact of learning analytics integration on key educational outcomes in the context of ecological education, thereby highlighting the importance of institutional commitment to learning analytics integration.

The profound impact of institutional budget allocation ($\beta = 0.52$, $p < 0.001$), faculty training in learning analytics ($\beta = 0.36$, $p < 0.001$), and perceived institutional support ($\beta = 0.22$, $p = 0.024$) on the integration level of learning analytics in ecological education corroborates and expands upon the postulations of Al-Rahmi et al. (2019) and Duan (2022). While Al-Rahmi et al. (2019) elucidated data pertaining to MOOCs in higher education, Duan (2022) proffered a novel approach for optimizing MOOC-based pedagogical methods. The current investigation augments these findings by delineating pivotal institutional determinants that propel the efficacious integration of learning analytics within ecological education. This research thus furnishes actionable insights for tertiary institutions aspiring to ameliorate their learning analytics adoption strategies. The study's outcomes significantly contribute to the extant corpus of knowledge regarding the assimilation of learning analytics in ecological education within higher education institutions. These results not only align with but also extend previous research by empirically demonstrating the salutary effects of learning analytics adoption on student engagement, academic performance, and the espousal of sustainable practices within the specific milieu of ecological

education. Moreover, the study underscores the criticality of institutional factors, including budgetary allocation, faculty training programs, and perceived institutional backing, in catalyzing the successful integration of learning analytics. These revelations proffer invaluable insights for higher education institutions and policy architects seeking to harness the potential of learning analytics to enhance ecological education and foster sustainable development initiatives.

6. Conclusion

The integration of learning analytics in ecological education within Russian higher education institutions has yielded substantial empirical evidence of its efficacy. A robust positive correlation ($r = 0.92$, $p = 0.026$) was observed between the utilization of learning analytics and enhanced student engagement in ecological courses, with a minuscule 1 % increment in adoption resulting in a 0.01-point augmentation of engagement scores ($R^2 = 0.85$, $p = 0.026$). Exposure to ecological education exhibited a significant association with amplified adoption of sustainable practices ($\chi^2(1) = 227.45$, $p < 0.001$, $\phi = 0.53$), with exposed students demonstrating a remarkable 12.25-fold increased likelihood of embracing such practices (OR = 12.25, 95 % CI [8.78, 17.10]). Educators' perceptions regarding the transformative potential of learning analytics in pedagogical management were notably positive ($M = 4.11$, $SD = 0.82$; $t(499) = 30.38$, $p < 0.001$, Cohen's $d = 1.36$), with discernible inter-institutional variations ($F(4, 495) = 8.14$, $p < 0.001$, $\eta^2 = 0.06$). The adoption of learning analytics in pedagogical management exhibited a robust correlation with enhanced student performance ($r = 0.96$, $p < 0.001$), where a mere 1% increase in adoption corresponded to a 0.17-point elevation in average course grades ($R^2 = 0.92$, $p < 0.001$). Institutions boasting higher levels of learning analytics integration demonstrated statistically significant improvements in student engagement ($t(798) = 9.87$, $p < 0.001$, Cohen's $d = 0.70$), academic performance ($t(798) = 6.73$, $p < 0.001$, Cohen's $d = 0.48$), and sustainable practices adoption ($\chi^2(1) = 62.41$, $p < 0.001$, $\phi = 0.28$). The study identified key predictors of integration level, including institutional budget allocation ($\beta = 0.52$, $p < 0.001$), faculty training ($\beta = 0.36$, $p < 0.001$), and perceived institutional support ($\beta = 0.22$, $p = 0.024$), collectively elucidating 87 % of the variance ($R^2 = 0.87$, $F(3, 28) = 62.39$, $p < 0.001$). These findings underscore the critical importance of financial resources, comprehensive faculty training, and robust institutional support in fostering the successful implementation of learning analytics within ecological education programs in Russian higher education institutions.

7. Acknowledgements

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Foreign Language Speaking Anxiety in Turkish EFL Context: Towards an In-Depth Clarification

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Abstract

Speaking anxiety in second language acquisition is currently a topic of extensive research. This study aims to assess the extent of speaking anxiety among EFL (English as a foreign language) learners attending preparatory schools and examine how demographic factors such as age, high school, and gender influence Foreign Language Speaking Anxiety (FLSA), as well as identify its sources. The participants were 172 preparatory school students (67 female and 105 male) enrolled in the School of Foreign Languages and from two different English proficiency levels, B1 (N = 107) and B2 (N = 65), according to the CEFR. A mixed type research methodology was employed. Data was analysed using T-Tests, ANOVA, and Pearson Correlation tests through Statistical Package for the Social Sciences (SPSS) 26. The findings of this study indicated that EFL students generally experience moderate levels of anxiety in their speaking courses. Gender emerged as a significant factor, with female students displaying higher levels of anxiety compared to their male counterparts when it comes to speaking in a foreign language. The study identified three primary sources of foreign language speaking anxiety: personal, teacher-related, and environmental. Furthermore, participants exhibited psychological and physical reactions to FLSA, suggesting that anxiety in speaking a foreign language goes beyond mere emotional distress. These insights provide valuable recommendations for educators and authorities to address speaking anxiety among EFL learners.

Keywords: foreign language speaking anxiety, individual difference, EFL, learning English as a foreign language.

1. Introduction

The second language learning process might be an outrageous experience for some language learners due to some factors such as cultural differences, transliteration, social stereotyping, misunderstandings, and some psychological factors such as lack of confidence, learned

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helplessness, and anxiety. Anxiety has many adverse effects on students' language learning process. Foreign Language Speaking Anxiety (FLSA) experienced by many learners during their foreign language learning process is a multi-directional psychological fact. Previous research has shown that the number of foreign language learners suffering from speech anxiety is substantial (Akkakason, 2016; Aksu, 2018; Daud et al., 2019; Damayanti, Listyani, 2020; Bashori et al., 2020, Ülker, 2021). Foreign language anxiety creates a mental block in learners' minds against language learning. Moreover, it paves the way for shyness which inhibits healthy communication; fear of failure, which leads to a setback; and fear of negative evaluation, which leads to an unwillingness to learn. Although studies on this issue have focused on four primary areas -the causes, relationship between variables, level of speaking anxiety, and decreasing speaking anxiety- increasing problem shows that the issue needs to be examined in detail. Mahatma Gandhi states; "A correct diagnosis is three-fourths the remedy" (cited by Kothari, Tilvawala, 2017). Therefore, by focusing on the sources of FLSA to make an accurate diagnosis, this study was conducted to help not only the people in the field –teachers, students, administrators, and parents – but also people who are decision-makers and other stakeholders.

Theoretical Framework

Anxiety

Anxiety is defined in the Encyclopedia Britannica as "a feeling of dread, fear, or anxiety, often without a clear justification". According to Dörnyei and Ryan (2015), anxiety is characterized by obsessive individuality and dynamism. According to the Big Five personality model Norman and Goldberg created between 1963 and 1981, anxiety is a crucial part of the Neuroticism/Emotional Stability factor. It cannot be claimed that anxiety is not a feeling, as Gray (1982) states. However, one can question if anxiety is the only emotion in our thinking system, considering the abundance of studies on it and the work of psychologists.

Anxiety has been the subject of research with different aspects for a long time. Given this research, a consensus has been reached that three main types of anxiety are trait, state, and situation-specific. If a person's anxiety level does not change according to the situation, in other words, if they are worried in every situation, the anxiety experienced by this person can be called trait anxiety (Pappamihiel, 2002). For no particular reason, such people experience anxiety in every situation.

In contrast to trait anxiety, state anxiety happens when a person feels threatened or in danger in a given circumstance. It is described by Spielberger (1983) and Pappamihiel (2002) as the propensity to feel uneasy in certain circumstances at a particular time. Furthermore, according to Keramida and Tsiplakides (2009), although trait anxiety is universal since it is unaffected by any environment, state anxiety is a social type particular to specific circumstances. Finally, Wiedemann (2015) asserts that every individual may experience state anxiety to varied degrees, with each person's experience differing in intensity, frequency, and length. Situation-specific anxiety is intensely linked to certain conditions (Young, 1991; Aida, 1994). The ramifications of a particular situation could pave the way to this anxiety, which happens in a particular situation (MacIntyre, Gardner, 1991).

Anxiety, viewed as a mental condition and treated as an unwanted emotion, is occasionally considered advantageous. Alpert and Haber (1960) distinguished between debilitating anxiety, which hinders individuals from learning new knowledge, and facilitating anxiety, which enables people to cope with a situation or to control and guide something. Based on its impacts on performance and learning, anxiety was appraised by Scovel (1978) as "facilitating and debilitating" in two separate components. Additionally, inhibitory anxiety presents as "avoidance behavior" in new learning, in contrast to facilitating anxiety, which causes effort and "approach behavior." Therefore, the level of anxiety facilitates or debilitates a person's learning. When a person with a moderate level of anxiety is compared with a person who is very anxious, it might be observed that the former can easily accomplish the same task, while the other may have great difficulty in doing it.

Anxiety in Foreign Language Learning

In the new age called the 'communication age', speaking skills and the ability to express oneself in a foreign language have become more critical than ever. Meanwhile, while slowly but surely advancing, the English language's tendency to expand its dominance over other languages for nearly two centuries continues to permeate all spheres of society. Thus, the common language,

which emerged due to globalization, is needed by people living in different countries for their various needs. Graddol (2006) states that this creates a cycle in itself; that is, the more globalization increases, the more the use of English will increase, and the process goes on in this order. The complex language system and sociocultural traditions may hinder learners from interacting adequately and effectively, improving their foreign language learning. As a result, learning a foreign language and using it effectively for communication purposes has become a severe cause of anxiety for students. The fact that anxiety is analysed and studied in a wide variety of ways in the process of foreign language teaching is one of the crucial indicators of this situation (Horwitz et al., 1986; Gardner, MacIntyre, 1993; Wilson, 2006; Woodrow, 2006; Aydın, 2016; Aydın, 2008). Especially Horwitz et al. (1986) pioneered the researchers who came after them with their studies focusing on anxiety in target language education.

Woodrow (2006) asserts that language learners respond to their anxiety in two ways: intellectually, by worrying, and physically, through emotional reflection. Both of these responses considerably impede communication. Anxiety can affect the performance of even students who have a significant amount of knowledge about language, making it significantly more difficult for them to use this knowledge. For this reason, students with high levels of anxiety may find it challenging to achieve the success they want in terms of foreign language learning. Related studies have put forward the area that there is a negative relationship between foreign language learning and high level of anxiety (Aida, 1994; Wilson, 2006; Woodrow, 2006; MacIntyre, Gregersen, 2012; Öztürk, Gürbüz, 2014).

Foreign Language Speaking Anxiety

Speaking allows individuals to exchange information, send messages, express themselves verbally with one another, and express their emotions (Nunan, 2003). Thus, the primary purpose of learning a language is to transform the learned information into production in the target language. One of the leading indicators showing that people know the target language is that they can speak it; that is, they can convey what they mean to the other party. Hence, students who are aware that speaking is one of the main factors in knowing the target language feel anxious while speaking.

Although the reasons vary from person to person, speaking is considered by most people to be the most challenging part of learning a second language. As Pinter (2006) emphasizes, this is because speaking and thinking must be done concurrently for us to talk well. As we talk, we must keep an eye on what we are saying, check for errors, and make plans for our following phrases. As a result of many studies, it has been observed that speech anxiety is also related to anxiety types. For instance, in his study, Riasati (2011) revealed that there is a relationship between the state anxiety of foreign language learners and their desire to avoid speaking. He maintains that this circumstance can be driven logically; individuals' state anxiety might benefit them. Contrarily, situation-specific anxiety should be assessed differently from other types of worry, according to Horwitz et al. (1986), because recent data suggest that it is distinct from other theoretical worries. Some academics contend that learning a foreign language should be seen as a unique phenomenon and place it within the context of situation-specific anxiety (Price, 1991; Young, 1991).

While students with foreign language anxiety show a reluctant approach to foreign language lessons in proportion to their anxiety, language speaking anxiety may prevent learners from avoiding tasks that require language production skills and attending language lessons that require them to use their communication skills. As a result, this situation leads to the emergence of students who do not care about being ready for the lesson, frequently leave the course early, struggle to recall and apply the knowledge in their memory, and put little effort into resolving these and related issues. (Horwitz et al., 1986; MacIntyre, Gardner, 1991; Phillips, 1992; Gregersen, Horwitz, 2002; Bekleyen, 2009; Tekin, Aydın, 2022). Some of the physical symptoms of speech anxiety that can be observed in the person can be listed as follows; fear, rapid heartbeat, sadness, sweating, and anger (Demir, Melanhoğlu, 2014).

The Previous Research on Speaking Anxiety

Since speaking anxiety affects academic success, it has been studied a lot. In their studies, researchers have mainly focused on the level of speaking anxiety, the sources of speaking anxiety, the relation of speaking anxiety with other variables, and the ways of decreasing speaking anxiety. Some research revealed that speaking anxiety is caused by personal beliefs such as a lack of self-confidence (Sadeghi et al., 2013; Melouah, 2013; Ataş, 2015; Gürsoy, Korkmaz, 2018; ElSharkawy, 2019; Özdemir, Papi, 2021), fear of making mistakes, attitudes towards L1 or L2, native speakers or teachers (Çokay, 2014; Ataş, 2015). Since it was mentioned as a factor in many studies, it could be said

that 'aware of being evaluated' or 'negative evaluation' is one of the crucial sources of speaking anxiety (Ahmed, 2016; Ataş, 2015; Hammad, Ghali, 2015; Sadighi, Dastpak, 2017; Usman, Yumru, 2019).

Interaction and communication are vital for Students in language classrooms. Nevertheless, this situation might turn into an anxiety-creating factor. While Çokay (2014) stated that "fear of interaction" hinders learners from communicating by creating speaking anxiety, "language proficiency problems" (Ak, 2021), 'fear of being laughed at' (Ataş, 2015; Doyman, Yumru, 2020), 'mispronunciation of words' (Çokay, 2014) and 'peer pressure' or 'the harsh attitudes of classmates' (Melouah, 2013; Mukminin et al., 2015; Han et al., 2016; Mouhoubi-Messadh, 2017; Rahman, 2017; Doyman, Yumru, 2020) were also mentioned among anxiety creating factors. Sometimes, people compare themselves with others in different stages of life for different reasons. In the classroom setting, in which human interaction is comparatively high, this attitude is inevitable. While some researchers (Kayaoğlu; Sağlamel, 2013; Kasbi; Shirvan, 2017; ElSharkawy, 2019) described this source of anxiety in their studies as 'competition', Doyman & Yumru (2020) defined it as 'getting left behind. According to Doyman and Yumru (2020), the 'desire of students to produce perfect speech' and 'develop a perfectionist approach to the target language' makes learners anxious.

The characteristic of learners might affect their speaking anxiety. For example, in some research, lack of self-confidence and 'the introverted character of students were found to be strongly and significantly interrelated with overall speaking anxiety (Sadeghi et al., 2013; Melouah, 2013; Ataş, 2015; Gürsoy, Korkmaz, 2018; ElSharkawy, 2019; Özdemir, Papi 2021).

The studies showed that inadequacy in a foreign language is essential in speaking anxiety. In the learning process, 'the fear of making mistakes was found as a robust anxiety-creative factor (Ataş, 2015; Han et al., 2016; Ahmed, 2016; Sadighi, Dastpak, 2017; Gürsoy, Korkmaz, 2018; ElSharkawy, 2019). Mistakes that show the problematic areas learners face are found as important indicators. Some studies point to 'vocabulary deficiency' as the cause of speech anxiety (Brown, 2004; Sadeghi et al., 2013; Mukminin et al., 2015; Rahman, 2017; Sadighi, Dastpak, 2017; Kasbi, Shirvan, 2017). Even if the learners have enough knowledge about the grammatical rules, if they do not have enough vocabulary, speaking might be an anxious experiment for them. Similarly, it is stated that 'the number of grammar rules, 'grammar knowledge, and 'the difficulty of applying the rules while speaking' have caused anxiety in learners (Sadeghi et al., 2013; Mukminin et al., 2015; Rahman, 2017; Kasbi, Shirvan, 2017).

Speaking anxiety has been linked to oral tests and testing processes as well. (Sadeghi et al., 2013; Kayaoğlu, Sağlamel, 2013; Al-Nouh et al., 2015; Alsowat, 2016; Usman, Yumru, 2019; ElSharkawy, 2019). The main factors causing anxiety for teachers are activity types, topics, language teachers' attitudes, teacher's feedback type, being invited to participate in the lesson, unable to follow what the teacher is saying, and the teacher's negative reactions. There is also a consensus among some researchers that these are critical anxiety-provoking factors related to foreign language speaking anxiety (Subaşı, 2010; Mak, 2011; Melouah, 2013; Sadeghi et al., 2013; Ataş, 2015; Hammad, Ghali, 2015; Alsowat, 2016; Mouhoubi-Messadh, 2017; Doyman, Yumru, 2020).

With its negative implications, anxiety has emerged as a significant area of study for researchers in the second language (L2) field. Remarkably, there has been a discernible rise in research concentrating on speaking anxiety. However, qualitative research in this area still needs to be expanded, warranting a more outstanding contribution to enhance our understanding of the subject. Moreover, more than quantitative studies are needed to offer a comprehensive perspective for deeper comprehension. Therefore, aligning with the studies mentioned above, this study attempts to determine the degree of speaking anxiety among EFL learners and investigate the impact of demographic factors such as age, high school background, and gender on foreign language speaking anxiety. In addition, the study explores the sources of speaking anxiety in the Turkish EFL context. In line with the stated objectives and a comprehensive review of the literature, the following research questions have been formulated:

1. How anxious are Turkish EFL learners while they are speaking English?
2. To what extent do specific demographic characteristics influence foreign language speaking anxiety?
3. What are the possible sources of speaking anxiety in a Turkish EFL setting?

2. Methodology

In this study, both qualitative and quantitative data were gathered using a mixed research methodology. By capturing both trends and more details while utilizing the advantages of each technique, the use of mixed methods results in a thorough grasp of the study topic (Miles, Huberman, 1994; Creswell et al., 2003).

Participants and Setting

The questionnaire was administered to 172 preparatory school students (67 female and 105 male) enrolled in the School of Foreign Languages. The School of Foreign Languages provides English language courses to first-year EFL learners, equipping them with the necessary skills for their academic pursuits. The students were at two different English proficiency levels, B1 (N = 107) and B2 (N = 65), according to the CEFR. They came from 8 high schools and studied in 11 different departments. Their ages ranged from 18 to 43 with the mean of 20. The total population of the school is 280, with the sample size representing 61% of it. A convenience sampling method was used in the selection of the participants. In other words, among the students of the preparatory school, only those who were at the school on the day of the data collection and volunteers were included in the study. The students were first given an informed consent form about the study and assured that the data would be kept confidential and used only for a scientific study.

After completing the first phase of the study (quantitative data collection and analysis), the students' anxiety levels were considered. The study's second phase involved 11 volunteer students who self-reported high anxiety levels. Their ages ranged from 19 to 23, with five of them being female and at the upper-intermediate level, while six participants were male and at the intermediate level. They graduated from four different high schools and were studying in six different departments. The distribution of participants across departments was relatively equal.

Data Collection and Analysis

Quantitative data were collected through a questionnaire consisting of two parts: a demographic information form with five questions and the Foreign Language Classroom Anxiety Scale (FLCAS) with 18 questions focusing specifically on speaking anxiety. The original scale with 33 items, developed by Horwitz et al. (1986), was adapted by Saltan (2003) to include only the 18 items related to speaking anxiety. The questionnaire utilized a Likert Scale ranging from "Strongly Agree" to "Strongly Disagree". FLCAS is a widely used instrument to assess foreign language anxiety and its level among learners. The adapted version of the scale comprised four dimensions: communication apprehension, fear of negative evaluation, anxiety about English classes, and test anxiety (Altın, 2018).

Table 1. Reliability Statistic of Adapted Version of FLCAS

Anxiety	Number of Items	Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items
Total Anxiety	18	0.93	0.94
Communication apprehension	6	0.82	0.82
Fear of negative evaluation	7	0.81	0.81
Anxiety of English classes	2	0.60	0.60
Test anxiety	3	0.63	0.63

The adapted version of the scale demonstrated strong internal consistency with a Cronbach's alpha coefficient of 0.89. In this study, Cronbach's alpha coefficient for the total anxiety score, as shown in Table 1, was found to be 0.93, indicating high reliability. While the reliability of some dimensions decreased due to a smaller number of items, two dimensions with coefficients slightly below 0.70 are still acceptable, according to Griethuijsen et al. (2015) and Taber (2018) as they exceed 0.60. To analyse the quantitative data firstly, Kolmogorov–Smirnov analysis was employed to test the normality of the data. After ensuring that data follows the normal distribution, descriptive and inferential analysis such as Independent Samples T-Test, ANOVA, and Pearson Correlation were conducted through the Statistical Package for the Social Sciences (SPSS) 26.

For the collection of qualitative data, 11 volunteer participants who reported themselves as highly anxious in the EFL class were selected, and semi-structured focus group interviews were conducted with them. The interviews were conducted in two sessions, with six students at the B1 level and five students at the B2 level. To ensure effectiveness, participants were divided into small groups based on their proficiency level, with each group participating in one session lasting approximately one and a half hour. Before the interviews, participants were informed about the process, including the interview recording using a mobile phone for later analysis. During the interviews, participants were asked four questions. To maintain confidentiality, pseudonyms were used instead of real names, and participants' responses were recorded and transcribed into a Word file. The qualitative data were then analysed using content analysis, which involved four steps: identification, classification, description, and conclusion.

3. Results

This chapter presents the results derived from the analysis of the data sets, organized into three sections corresponding to the three research questions.

Foreign language speaking anxiety of EFL learners

Descriptive analyses were performed to assess EFL learners' foreign language speaking anxiety levels. The participants' anxiety levels were categorized into three groups: slightly anxious (average score between 1.00 and 2.49), moderately anxious (score between 2.50 and 3.49), and highly anxious (score between 3.50 and 5.00). The mean scores and sub-dimensions of anxiety, along with general anxiety levels, are presented in descending order in [Table 2](#). The participants' mean scores for all sub-dimensions of anxiety and general anxiety level ranged between 2.50 and 3.49, indicating a moderate level of anxiety in EFL settings. The descriptive analysis of general anxiety scores revealed that 28 % of participants were slightly anxious, 47 % were moderately anxious, and 25 % were highly anxious.

Table 2. Foreign Language Speaking Anxiety Levels of Participants

Dimensions	N	Mean	Std. Deviation	Highly Anxious-f	Moderately Anxious- f	Slightly Anxious- f
Communication Apprehension	172	3.07	0.87	40	36	24
The Anxiety of English Classes	172	3.05	0.94	36	34	30
Fear of Negative Evaluation	172	2.82	0.83	21	46	33
Test Anxiety	172	2.69	1.05	31	34	35
Overall Anxiety	172	2.93	0.80	25	47	28

When examining the frequencies of anxiety, it might be said that individuals have varied degrees of foreign language-speaking anxiety. [Table 2](#) shows that "Communication Apprehension" has the highest anxiety level, followed by "Anxiety of English Classes," "Fear of Negative Evaluation," and "Test Anxiety."

Effects of some demographic factors on Foreign Language Speaking Anxiety:

In the following section, the results of T-Test, ANOVA, and Pearson Correlation are presented to reveal the effects of such independent variables as age, high school, department, and gender on foreign language speaking anxiety of EFL learners.

As can be seen in [Table 3](#), gender is a significant factor on foreign language speaking anxiety. It seems that gender significantly influences all sub-dimensions and the general FLSA of the participants ($p < 0.05$). As shown in [Table 3](#), female participants exhibit higher levels of foreign language speaking anxiety across all four dimensions of FLAS compared to male participants.

Table 3. T-Test of and Foreign Language Speaking Anxiety in terms of Gender

Anxiety	Gender	N	M	SD	t	df	P
Communication Apprehension	Female	67	3.43	0.81	4.59	170	0.00
	Male	105	2.84	0.82			
Fear of Negative Evaluation	Female	67	3.07	0.84	3.41	170	0.00
	Male	105	2.65	0.77			
The Anxiety of English Classes	Female	67	3.02	1.05	3.44	170	0.00
	Male	105	2.47	0.98			
Test Anxiety	Female	67	3.27	0.88	2.48	170	0.01
	Male	105	2.91	0.94			

The analysis of the T-Test results indicated that there is no statistically significant difference between proficiency level and foreign language speaking anxiety of EFL learners ($p > 0.05$). The participants' anxiety levels varied, with those at the upper-intermediate level having the highest level (mean = 3.17) during communication and those at the intermediate level having the highest level of test anxiety (mean = 3.07).

Table 4. T-Test Results of Foreign Language Speaking Anxiety in terms of Proficiency Level

Anxiety	Proficiency Level	N	M	SD	t	df	P
Communication Apprehension	B2	65	3.17	0.92	1.23	170	0.22
	B1	107	3.00	0.83			
Fear of Negative Evaluation	B2	65	2.89	0.88	1.00	170	0.31
	B1	107	2.76	0.79			
The anxiety of English Classes	B2	65	2.84	1.09	1.54	170	0.12
	B1	107	2.59	1.00			
Test Anxiety	B2	65	3.02	1.01	-0.36	170	0.71
	B1	107	3.07	0.89			

Pearson Correlation Analysis was conducted to see the effects of age on EFL learners' speaking anxiety. As can be seen in [Table 5](#), there is no statistically significant difference between Foreign Language Speaking Anxiety (FLSA) and the participants' ages ($p > 0.05$).

Table 5. Pearson Correlation between Age and Foreign Language Speaking Anxiety

Anxiety Types	N	Mean	Std. Deviation	r	P
Communication Apprehension	172	2.15	0.78	0.01	0.62
Fear of Negative Evaluation	172	1.87	0.72	0.00	0.46
The anxiety of English Classes	172	1.95	0.81	-0.01	0.97
Test Anxiety	172	2.05	0.81	0.00	0.85
General Anxiety	172	2.92	0.79	0.08	0.92

The participants in the study originated from 8 different high schools, with the majority (64 %) having graduated from Anatolian High School, while only one participant graduated from Social Sciences High School. [Table 6](#) reveals that the one-way ANOVA test did not reveal a significant difference in Foreign Language Speaking Anxiety (FLSA) among participants from different high schools in all dimensions ($p > 0.05$).

Table 6. One-Way ANOVA Test in terms of High School

		Sum of Squares	df	Mean Square	F	P
Communication Apprehension	Between Groups	6.41	6	1.07	1.43	0.20
	Within Groups	122.91	165	0.74		
	Total	129.33	171			
Fear of Negative Evaluation	Between Groups	4.85	6	0.80	1.18	0.31
	Within Groups	112.38	165	0.68		
	Total	117.23	171			
The anxiety of English Classes	Between Groups	8.72	6	1.45	1.34	0.24
	Within Groups	178.38	165	1.08		
	Total	187.10	171			
Test Anxiety	Between Groups	6.64	6	1.10	1.27	0.27
	Within Groups	143.51	165	0.87		
	Total	150.16	171			

The participants in the study pursue their studies in 11 different departments after completing preparatory school. Among these departments, electrical and electronic engineering had the highest number of participants, with 62 students. On the other hand, software engineering, law, and mechanical engineering had only one student each. Table 7 shows that there is no significant difference in terms of Foreign Language Speaking Anxiety (FLSA) among the departments ($p > 0.05$).

Table 7. One-Way ANOVA Test, in terms of Department

		Sum of Squares	df	Mean Square	F	P
Communication Apprehension	Between Groups	8.11	10	0.81	1.07	0.38
	Within Groups	121.22	161	0.75		
	Total	129.33	171			
Fear of Negative Evaluation	Between Groups	6.85	10	0.68	1.00	0.45
	Within Groups	110.38	161	0.68		
	Total	117.23	171			
The anxiety of English Classes	Between Groups	10.61	10	1.06	0.96	0.47
	Within Groups	176.49	161	1.10		
	Total	187.10	171			
Test Anxiety	Between Groups	15.09	10	1.51	1.80	0.06
	Within Groups	135.06	161	0.84		
	Total	150.16	171			

The possible sources of foreign language speaking anxiety

A qualitative research technique was also added for a better understanding of the phenomenon of Foreign Language Speaking Anxiety (FLSA) and to identify its underlying causes. Consequently, a series of focus-group interviews with 11 participants who reported themselves as highly anxious in the case of speaking English in class were carried out to address the third research question related to the potential causes of speaking anxiety among English as a Foreign Language (EFL) learners. To organize the qualitative data obtained from these interviews,

the results were presented below under the subheadings based on the interview questions. Codes and themes were discovered during the data analysis, and pertinent literature was extensively utilized to provide context and understanding.

Identifying the Factors Contributing to Anxiety in Speaking English

The data reported here have significant psychological effects when considering the individual differences among foreign language learners. Analysing participants' replies and classifying them into distinctive codes, which were then categorized into three overarching themes – personal, teacher-related, and environmental factors – reveals a multifaceted knowledge of the psychological underpinnings of language learning.

As can be seen in the table, it is seen that the most frequently mentioned reasons for anxiety by the students in the group meetings are largely self-inflicted reasons. Among these reasons, fear of making mistakes, comparing oneself with others and negative perceptions of oneself were mentioned the most. In addition, some perceptions of weakness and inadequacy in language skills were also among the reasons reported by the students, albeit to a lesser extent (Table 8).

Table 8. The sources of Foreign Language Speaking Anxiety

Personal sources	Teacher-related sources	Environmental sources
fear of making a mistake	teacher’s feedback type	peer pressure
comparing with others	negative reactions by the teacher	fear of negative evaluation
negative self-assessment	unexpected questions from the teacher	
the introverted character	language teachers’ manners	
perfectionism	not understanding what the teacher says	
lack of practice		
Fear of mispronunciation		
lack of grammar knowledge		
fear of public speaking		
lack of vocabulary		

Among the teacher-based reasons, the most frequently reported reasons by students were teacher's feedback type, teacher's negative reactions towards students in the classroom, and teacher's unexpected questions. Reasons related to language skills, such as not being able to understand what the teacher said, were also mentioned in students' sentences (Table 8).

In the third group of the reasons, only the fear that peers will either evaluate them negatively or react in some way, such as laughing or making fun of them, stemming from the environmental or classroom atmosphere and the behaviour of classroom stakeholders, was reported (Table 8).

Reactions to FLSA: Physical vs. Psychological Manifestations

The responses provided by the participants regarding physical reactions can be observed in the table below, presented in two columns. To better understand the various ways language anxiety emerges, the participants' responses were divided into two main themes, physical and psychological. Physical reactions consist of 16 codes and psychological reactions consist of 7 codes. The fact that physical rather than psychological disruptions are the primary ways in which anxiety presents itself draws attention to the tangible, visibly discernible features of anxiety. This distinction is important because it emphasizes how anxiety affects the body and behaviour as well as cognition and emotion.

Table 9. The reactions of the participants against FLSA

Physical Reactions	Psychological Reactions
Trembling in hands	The feeling of choking up and inability to speak
Rubbing the hands	Inability to subside the excitement for a long time
Clicking the fingers	Inability to hear oneself talking
Faltering of the voice	Inability to run the process of speaking
Continuous movement, inability to stay still	Forgetting the meaning of the word you know
The movement to the sides	Freezing and not knowing what to say
Blushing	Forgetting what you are talking about
Increasing the pulse rate	
Unwanted excessive movement of the hands	
Swallowing the words	
Biting the lips	
Stammering	
Laughing unintentionally	
Sweating in hands	

Students’ suggestions for an anxiety-free class environment

The participants were asked to define their ideal and anxiety-free learning environment in order to determine the factors that would help to reduce their anxiety. The comments received, and the inferences drawn from them are displayed in the table below. As seen in Table 10, nineteen codes and 3 themes were gathered from the statements made by the students for an anxiety-free classroom environment. The first of these themes based on the codes is the Instructor Based theme and four codes were collected under this theme. The second theme is Environment Based and five codes were collected under this theme. Finally, ten codes were collected under the Instruction Based theme. As can be seen, students most frequently reported instruction-based reasons for creating an anxiety-free classroom environment, followed by classroom environment-based reasons and finally instructor-based reasons (Table 10).

Table 10. The suggestions to decrease FLSA

Instructor Based	Environment Based	Instruction Based
Showing empathy	Comfortable atmosphere	Interesting subject
Encouraging	Less crowded classroom	Group work
Patient	Friendly atmosphere	Role play, drama, game
Friendly	Subjecting to English too much	No assessment
	Attending classes with foreign students	Game, film, series
		Lessons focused on activity.
		Authentic topics
		Interrelated topics with other courses
		Topics that are already known
		Creative activities

4. Discussion

The study indicated that numerous factors affect the variation in anxiety levels within the participant group. Making inclusive and prosperous environments for language learning

requires understanding this variability. The study made it clear that almost half EFL learners have moderate levels of anxiety while one fourth of them high level of foreign language speaking anxiety. It seems that speaking anxiety is not a problem for only slightly more than one fourth of the learners. So, it seems that certainly anxiety should be handled appropriately to help the learners in their foreign language learning process. In fact, these findings align with the previous studies conducted with both Turkish (Takan, 2014; Zambak, 2016; Gürsoy, Korkmaz, 2018) and foreign EFL learners (Woodrow, 2006; Ahmed, 2016; Daud, 2019) and accordingly anxiety seems to be a problem for EFL learners around the world.

It is significant to emphasize that while the majority of students display moderate levels of anxiety, the existence of very anxious pupils should not be disregarded. The anxiety spectrum in this study among EFL learners proves that anxiety is not a constant concept but varies in intensity, as discussed in the literature (MacIntyre, Gregersen, 2012; Öztürk, Gürbüz, 2014). It is essential to comprehend this range because it enables educators to personalize the teaching procedures used in the classroom setting to meet the unique requirements of students at various positions along the anxiety continuum. Thus, the teachers will be aware that moderately anxious learners may need techniques to keep their anxiety from worsening, and highly anxious individuals may benefit from specialized interventions to boost confidence and reduce stress. "Communication Apprehension" sub-dimension is seen as the highest level of anxiety. It is thought that students' perception of being the centre of attention in the classroom when they communicate in English causes this. Communication apprehension is exactly related to kind of timidity and reluctance in case of communication (Horwitz et al., 1986). Hence, it should be highlighted at this point that there are various factors that lead to anxiety during communication.

Data collected through interviews also support this finding and based on the responses and utterances of the learners it was evident that the participants lack confidence while speaking in class. Although the sources of anxiety that came to the fore in the students' statements were categorised under three categories as personal, teacher-related and environmental in accordance with the literature (Dixon, 2011; Umisara, et al., 2021), the sources were largely grouped under the "personal sources" category. The students attributed the causes of anxiety mostly to their own individual features and individual inadequacies. Additionally, learners' feeling of pressure to meet immediate conversational expectations, and factors such as the topic, formality, the interlocutor, and their English proficiency also increase anxiety levels. It was often reported that, these cases cause learners panic without preparation and have difficulties understanding what the teacher says to make them nervous.

Although test anxiety ranks the lowest compared to other types of anxiety, it shows that almost one third of the total students experience varying levels of test anxiety. This is a very large proportion indeed and as seen in the literature (Aydn et al., 2020; Petridou, Williams, 2007) it might affect students' achievement in learning by decreasing learners' motivation and increasing the mistakes. This is because tests are seen as crucial for assessment but also have negative psychological effects on students. For example, participants reported trembling and rapid heartbeat before and during exams and when they were asked to speak in language classes, feeling embarrassed to speak voluntarily, upset when they did not understand the teacher's corrections, and perceived other students as superior than themselves. Furthermore, tests create a false perception of language learning as similar to other academic subjects. This perspective overlooks its communicative nature and leads learners to approach the second language like any other school subject.

As mentioned above, the finding that the majority of FLSA may be ascribed to individual factors is noteworthy. It implies that language anxiety among learners is significantly influenced by their personal beliefs and emotional responses, such as fear of making a mistake, comparing with others, and negative self-assessment. This is consistent with the understanding that language learners' internal thoughts and emotions significantly impact their experiences. Among the identified sources, 'fear of negative evaluation' and 'negative self-assessment' emerge as the most frequently mentioned items. These findings align with previous studies conducted by Iftimie (2006), Mak (2011), Tanrıöver (2012), Çokay (2014), and, Ataş (2015). It is essential to comprehend these individual components to create anxiety-relieving tactics that help.

Peer pressure is the only item directly connected to environmental elements, which is remarkable given the small number of components related to instructional and environmental factors. According to this finding, participants may view the classroom setting as generally favourable, with few elements that could cause anxiety. This finding is encouraging for language

teachers because it suggests that a helpful and inviting environment for language practice might be created in the classroom. The specific aspects revealed to be essential drivers of FLSA, like "fear of negative evaluation" and "negative self-assessment," shed light on widespread underpinning psychological mechanisms causing anxiety. Language anxiety frequently includes self-criticism and the fear of being harshly judged which affects learners' confidence and limits their desire to speak. To promote a more joyful and productive learning environment, addressing these major sources of anxiety is crucial. The consistency of these results with earlier researches by Liu (2007), Stewart and Tassie (2011), Tanröver (2012), Sadeghi (2013), Okay (2014), Derakhsha, Tahery and Mirarab (2015) and Ataş (2015) strengthen the conclusion. Consistency among studies supports the notion that these anxiety-provoking situations are common to language learners. This concordance emphasizes the validity and applicability of the identified anxiety-inducing factors. Peer interaction is beneficial in the context of language learning, as evidenced by the mention of "peer pressure" as a factor that causes anxiety and the observation that students support one another in overcoming speaking challenges. This cooperative approach helps create a more encouraging classroom environment, even when a minority is displaying discomfort. For instance, interviewer Ocean explains that some of her friends express discomfort with mistakes through gestures, facial expressions, body language, and occasional noise.

The reactions of the students when they experienced speaking anxiety were categorised into two groups, physical and psychological, based on their reports of their experiences and inspired by the literature (Dixon, 2011; Umisara, et al., 2021). As suggested by Horwitz et al. (1986), the significant divergence is the recognition that psychological disturbances directly obstruct the cognitive processes involved in speaking, while physical disturbances indirectly impact speaking. It implies that physical signs, such as trembling or a racing heart could serve as intermediaries and interfere with an individual's capability to produce language effectively (Jalongo, Hirsh, 2010). Conversely, psychological symptoms like self-doubt or mental barriers directly impact the cognitive processes required for linguistic communication. The consistency of the results across investigations supports the validity of the discovered reaction patterns. This congruence further strengthens the generalizability of the findings by indicating that linguistic anxiety emotions have some degree of universality and are not restricted to particular circumstances (Horwitz et al., 1986; Jalongo, Hirsh, 2010). This awareness highlights the complexity of language anxiety and the demand for all-encompassing strategies that consider many facets of learners' experiences. When it comes to the reactions of the students in this study, it was seen that students reported more physical reactions and trembling in hands, rubbing the hands, clicking the fingers, and faltering of the voice were the most frequently reported physical reactions. On the other hand, psychological reactions such as the feeling of choking up and inability to speak, and freezing and not knowing what to say are also serious reactions that can affect a student's performance. Hence, it is necessary to emphasise that all of them may lead to a decrease in attention, concentration and motivation of the students.

The students who experienced the negative effects of anxiety suggested solutions based on instructor, environment and instruction, referring to the same themes they used when describing the sources of anxiety, while comprehensively describing an anxiety-free classroom atmosphere. However, there is an interesting discrepancy between the participants' initial interview responses (where personal issues were identified as leading causes of anxiety) and their suggestions for an ideal classroom environment (where personal issues were not mentioned) offers intriguing insights. This suggests that learners might recognize the personal nature of their anxiety but may look to the educational environment for solutions. It highlights the potential impact of the learning context in addressing anxiety, even when the sources of anxiety are acknowledged as personal. The finding that participants expect curriculum, instruction, and classroom activities to change to reduce anxiety suggests a belief that outside forces will bring about essential improvements. This can be connected to a sense of resistance to personal transformation. It illustrates a typical psychological phenomenon in which people are aware of a problem but may rely on other people or outside forces to bring about change.

Furthermore, while the students stated that group work, role play, drama, game-based teaching methods would reduce anxiety and relax them, they also emphasized the need for a non-exam-based assessment system. In addition, they frequently cited empathy, Encouraging, Patient and Friendly attitude of the instructor as the most effective suggestions to reduce anxiety. Instructor attitudes and feedback styles have been emphasized many times in the literature as

anxiety provoking factors (Aydin, 2008). In brief, the results have substantial implications for comprehending the individual characteristics of language learners, especially in connection to their opinions of the ideal learning environment and their expectations of anxiety reduction. The participants' desire for a warm classroom setting with engaging language activities demonstrates that they are aware of the psychological significance of the learning environment. Language anxiety can be decreased, and a positive outlook on language learning can be fostered in a supportive classroom environment. In this sense, the study highlights the extent the educational context affects how students feel. The emphasis on the instructor's role in building rapport and offering support draws attention to the psychological impact of the teacher-student interaction on students' feelings of anxiety. Students believe that the instructor's disposition, method of instruction, and interpersonal abilities play a significant role in fostering a positive learning environment. Support from the instructor can boost students' comfort and confidence, which can ultimately reduce anxiety.

One of the important results of the study was the effects of demographic factors on anxiety, the most noteworthy of which was the gender factor that created significant differences in all dimensions of anxiety. All types of anxiety are experienced more by female students. Gender is a complicated social and psychological concept that can influence several language acquisition topics, such as self-perception, communication preferences, and social norms. So, there seem to be gender-related variations in the experience of speaking in a foreign language, according to the conclusion that gender strongly affects all sub-dimensions and the overall FLSA of the participants. This outcome emphasizes the need to consider gender-related aspects when creating environments and support systems for language learning. It is vital that female participants show higher degrees of speaking anxiety in foreign languages across all four FLSA characteristics. This is consistent with earlier studies in the literature (Huang, 2004; Wilson, 2006; Korkmaz, 2019; Ülker, 2021), showing that gender and language anxiety are related consistently.

In addition, essential insights through the finding that "Communication Apprehension" is the dimension where anxiety levels are highest for both genders were gained. This indicates that anxiety about speaking in a foreign language is prevalent for both male and female learners. To manage anxiety associated with communication, targeted interventions might be based on an understanding of this similarity. The fact that "Anxiety of English Classes" has the lowest anxiety levels across the four dimensions for both groups implies that this particular environment may be considered less anxiety-inducing than other facets of language learning. This deep comprehension of anxiety across various dimensions can influence curriculum creation and instructional design. Thus, gender emerges as a significant factor in language anxiety, consistent with studies such as Neuman (2007), Ayu Rita and Nadhia Dalila (2008), Fakhri 2012 and Bozok (2014). Nevertheless, the study's results contradict following research; Wang (2010), Gaibani and Elmenfi (2014) and Ahmed (2016).

It is critical to consider specific demographic parameters, regional and cultural characteristics when assessing possible explanations for these findings. The study was conducted at a university where most of the students come from neighbouring cities in the Eastern Anatolia Region of Turkey with typical family arrangements. Eastern Anatolia is a region where people are mostly conservative and girls do not have as much freedom in the family and in society as boys. There may be some factors that affect the Foreign Language Speaking Anxiety (FLEA) experienced by female students under these cultural norms and social expectations. For example, the environment may be perceived to limit girls' chances and freedoms, which may be considered a natural right for boys. This discrepancy in perceived independence may prevent girls from developing critical social skills such as effective communication and self-expression. Because of this cultural imbalance, girls are disadvantaged relative to boys because of their gender. These observations show how gender-related social norms can have an impact on the local situation. In order to create more equitable and effective language teaching practices, it is imperative to be aware of the broader sociocultural variables that can significantly influence the language learning experiences of learners, especially girls.

Finally, in the study, the department in which the university students studied and the proficiency levels of the students were not found to be important factors in terms of speaking anxiety. However, based on the differences observed in the students' scores it might be said that apart from exam-related anxiety, a clear tendency should be noted that as proficiency level rises, so does anxiety. According to these results, individuals' anxiety levels are often consistent regardless

of their proficiency. This result is in line with earlier research conducted by Balemir (2009), Oksal (2014), and Eftima (2018) whereas it contradicts what Bailay and Nunan (2005), Oxford, (2016), Özkan (2019) and Özcanlı (2021) determined. However, when it comes to the exam, students with high proficiency may be more relaxed than students with low proficiency. This suggests that students' anxiety may also be related to their proficiency in a foreign language.

5. Conclusion and Implications

The primary objective of this research was to assess the extent and nature of speaking anxiety among English as a Foreign Language (EFL) learners enrolled in preparatory schools and to identify the underlying causes of this anxiety. Based on the findings, several key conclusions can be drawn. Firstly, it can be inferred that EFL students generally experience moderate levels of anxiety when it comes to speaking in English. This indicates that speaking anxiety is a prevailing concern among this group of learners. Secondly, a significant conclusion of the study is that gender plays a crucial role in speaking anxiety, with female students exhibiting higher levels of anxiety compared to their male counterparts. This gender-based difference in anxiety levels sheds light on potential areas for further investigation and support. Thirdly, the study categorized the sources of speaking anxiety into three main factors: personal, teacher-related, and environmental. By recognizing these distinct sources, educators and policymakers can implement targeted strategies to alleviate speaking anxiety among EFL learners. Lastly, the research highlighted that EFL learners respond to speaking anxiety both psychologically and physically. This implies that the impact of anxiety extends beyond the emotional realm and can manifest physically, underscoring the importance of addressing this issue.

Considering the conclusions, it is strongly recommended that student suggestions from this study should be taken into consideration to create a more anxiety-free learning environment. Assessments of speaking ability should be conducted without students' awareness. The curriculum should be revised to emphasize communication skills and build students' confidence in speaking. There is a need to increase awareness among in-service and pre-service teachers about foreign language speaking anxiety and train them on the impact of their behaviour on student anxiety levels. Further research could explore the effects of variables such as socio-economic differences and past learning experiences. Experimental and longitudinal studies could be conducted to examine different aspects of foreign language speaking anxiety.

These results might open the door to experimental and longitudinal studies that monitor changes in anxiety levels. Educators and researchers can improve their understanding of the individual development trajectories of anxiety in EFL situations by examining how anxiety changes as language learning progresses.

In conclusion, this study contributes valuable insights into the levels of speaking anxiety experienced by EFL learners attending preparatory schools. It underscores the significance of gender differences and identifies potential areas for intervention to help students overcome speaking anxiety and enhance their English communication skills. However, it is important to approach the generalization of the results cautiously due to the limited number of participants in this study.

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Stress Depression and Anxiety Disorders among High School Students in Vietnam: A Cross-Sectional Study in the COVID-19 Pandemic

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Abstract

Anxiety disorder, a prevalent form of emotional disturbance, is characterized by persistent and nonspecific feelings of apprehension that significantly impair individuals' well-being and quality of life. This disorder manifests through symptoms affecting the autonomic nervous system. The incidence of anxiety disorders has notably risen during the COVID-19 pandemic, particularly from the outbreak in the 2021–2022 academic year in Vietnam. During this period, high school students faced significant challenges due to distance learning, which presented additional stressors. This situation particularly impacted high school students, especially those in their 12th grade. Thus, this study aims to investigate the associate between stress, depression, and anxiety disorders among 12th-grade Vietnamese students during the COVID-19 pandemic.

The study utilized the Depression Anxiety Stress Scales (DASS-21) to evaluate stress, anxiety, and depression levels among a cohort of 1,007 students. These participants were drawn from six provinces, representing both the Northern and Southern regions of Vietnam, ensuring a diverse and comprehensive sample.

This study indicated that a positive association between higher levels of stress and depression and the incidence of anxiety disorders among the students.

Although the study's cross-sectional methodology and the self-reported nature of the DASS-21 instrument are acknowledged as drawbacks, the findings offer valuable insights into the psychological effects of the epidemic on pupils. Notwithstanding these limitations, the study provides significant insights into the possibility of forecasting and averting the emergence of anxiety disorders among 10th-grade students in Vietnam during the period after the COVID-19 pandemic. Through a comprehensive analysis of the intricate elements that contribute to anxiety disorders, this research provides important implications for early prevention and intervention

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approaches, with the goal of tackling the mental health difficulties that students encounter in the aftermath of the epidemic.

Keywords: anxiety disorder, depression and stress.

1. Introduction

The COVID-19 pandemic has profoundly altered the lives of high school students globally, introducing social distancing as a pivotal measure to mitigate the virus's spread. This approach blurred the boundaries between study and home environments, particularly impacting Vietnam during its fourth wave (April 27, 2021, to February 8, 2022). The Ministry of Health of Vietnam (2022) reported 2,373,577 new cases, including 192 instances of the OMICRON variant, compelling students to transition to online learning. Given the pandemic's adverse effects and the imposed social distancing, students' psychological well-being, especially among 12th graders facing imminent graduation exams, has been significantly compromised. Previous research suggests the potential for complex and enduring mental health challenges among students. Assessing the psychological impacts on students during online learning and social distancing periods is critical, not only for academic insights but also for supporting mental health in educational settings and shaping policies to navigate the pandemic (Anh et al., 2006; Dam et al., 2013).

Epidemiological studies have established the prevalence of anxiety disorders among children and adolescents, with rates ranging from 15-20 % according to Blum et al. (2012), and varying between 9-32 % across different developmental stages (Essau, Gabbidon, 2013; Golovina, 2009). Bergman et al. (2007) found a negative correlation between the prenatal period and mental development, alongside a positive association with infantile fearfulness. Similarly, research by O'Connor et al. (2003) on maternal anxiety during pregnancy highlighted a doubled risk of emotional disorders and attention-deficit/hyperactivity symptoms in offspring at ages 47 and 81 months. Additionally, a longitudinal study by Prior et al. (2000), involving 2,443 children from birth to 18 years, revealed that 42 % of children exhibiting shyness, social withdrawal, and inhibition by age 9 developed anxiety disorders by ages 13-14.

Finally, extensive literature highlights the interplay between stress, fearfulness, emotional disorders, and psychological trauma (Bergman et al., 2007; Grills-Taquechel, Ollendick, 2012; Remschmidt, van Engeland, 2012; O'Connor et al., 2003), suggesting that stress and depression may exacerbate students' anxiety during the pandemic. This study aims to explore the potential positive correlation between stress, depression, and anxiety disorders among students, proposing interventions to sustain psychological equilibrium throughout this crisis.

2. Literature Review

2.1. Stress, Depression and Anxiety disorder

Anxiety disorders are complex conditions characterized by excessive fear and anxiety, significantly impacting individuals' psychology to perceived future threats (World Health Organization, 1992), and a diminished capacity to adapt to environmental changes (Hoang, 2019; Korabelnikova, 2018; Mash, Barkley, 2014). In children, the etiology of anxiety disorders is multifactorial, encompassing biological, psychological, and social determinants, with notable contributions from genetic predispositions and psychological trauma (Grills-Taquechel, Ollendick, 2012). Fundamental psychological underpinnings, such as childhood psychological trauma, emotional neglect, and attachment issues, are identified as primary causes (Kovalev, 2013). These disorders are often characterized by irrational and undefined worries (Beesdo et al., 2009). Preschool children often experience fear (nyctophobia), while elementary school-aged children may fear loneliness (social isolation anxiety) (Bell-Dolan et al., 1990; Remschmidt, van Engeland, 2012).

Second, stress and anxiety are closely intertwined, with stress often being a precursor to anxiety disorders (Remschmidt, van Engeland, 2012); stress is the response to external pressures (Salmani et al., 2023). Previous studies have suggested that stress was positively correlated with anxiety (Johnston, 2020; Salmani et al., 2023; Young et al., 2020; Windarwati et al., 2022; Tournous, Bagwell-Adams, 2016). For example, Windarwati et al. (2022) showed that anxiety is a set of responses to threatening situations or uncertainty in five high schools in East Java Province, Indonesia. Research has shown significant associations between stress, anxiety, and depression among university students (Young et al., 2020). Similarly, stressful life events are significantly associated with anxiety symptoms among fourth-year secondary school students in Skopje (Tournous, Bagwell-Adams, 2016). Moreover, individual-familial characteristics like age, gender,

marital status, work experience, and educational level have been found to influence stress levels (Johnston, 2020). Understanding the relationship between stress and anxiety is crucial for mental health support strategies, as stress can exacerbate anxiety disorders, impacting individuals' overall well-being and quality of life. Therefore, we will be demonstrating stress will be positively correlated with anxiety disorder.

Third, depression and anxiety disorders, distinguished by their high prevalence and symptom logical and genetic overlaps, constitute significant public health concerns. Emerging research delineates a pronounced genetic correlation between major depressive disorders and generalized anxiety disorders, positing shared etiological genetic underpinnings (Frolova, 2022; Mei et al., 2022). Beyond their biomedical dimensions, these conditions are also understood as socially constructed phenomena, where the manifestation and perceived severity of symptoms are invariably shaped by the individual's socio-cultural context and personal experiences (Megan et al., 2016). The observed escalation in the incidence of depression, inclusive of anxiety disorders, has been attributed to an amalgamation of stress overload and adverse socio-cultural dynamics, which collectively exert a profound impact on the fabric of human existence (Camila et al., 2022; Wang et al., 2022). A nuanced understanding of the genetic commonalities and intertwined risk factors underlying depression and anxiety disorders is imperative. Such insights promise to refine our understanding of their comorbidity, paving the way for the development of nuanced and efficacious therapeutic interventions tailored to alleviate the burden of these pervasive mental health conditions. Thus, we will be demonstrating depression will be positively correlated with anxiety disorder.

Finally, the social distancing measures, along with the necessity of online learning under highly unfavorable conditions, may exacerbate various psychological issues, including anxiety disorders among students. Consequently, screening and assessing contributing factors to implement measures that ensure the mental well-being of 12th-grade students is of significant importance, not only from a scientific perspective but also in practical terms. This is especially critical for safeguarding students' mental health during the ongoing COVID-19 pandemic and its aftermath. Although several studies have examined anxiety disorders across different age groups in various settings, research specifically targeting 12th-grade students in Vietnam during the COVID-19 pandemic remains limited. Hence, the objective of this study is to shed light on the frequency of anxiety disorders among Vietnamese 12th graders, examine the elements that impact anxiety levels in students during the epidemic, and offer essential suggestions for the prevention and treatment of anxiety disorders among 12th-grade students in Vietnam in the period after COVID-19. The current investigation examines the impact of student stress and depression on anxiety disorders within the COVID-19 pandemic and aims to evaluate the following hypotheses (see Figure 1).

H1: Stress will be positively correlated with anxiety disorders among 12th-grade students in Vietnam in the context of the COVID-19 pandemic.

H2: Depression will be positively correlated with anxiety disorders among 12th-grade students in Vietnam in the context of the COVID-19 pandemic.

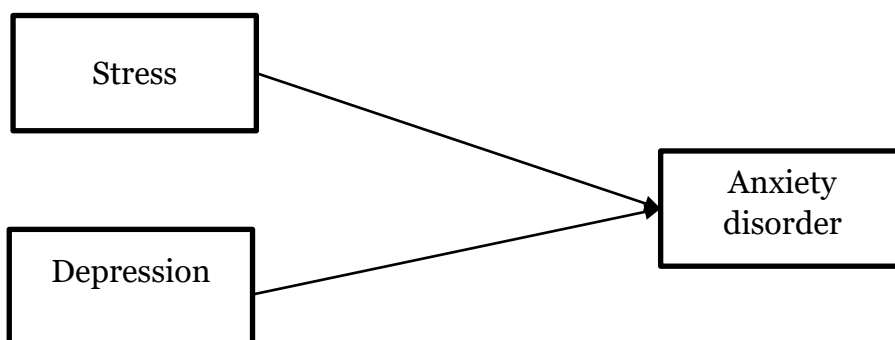


Fig. 1. Conceptual Framework

3. Methods

3.1. Participants

During the 2021–2022 academic year, a cross-sectional online survey was undertaken with the objective of preparing 12th-grade students for a reintegration into school following a prolonged

term of online learning. The research focused on a formal sample of 1,007 12th-grade students, randomly selected from 8 high schools across Vietnam, including locations in the South (Ho Chi Minh City, Dong Nai province, Long An province) and the North (Hanoi, Hai Duong province, Vinh Phuc province). The sample comprised 1,007 adolescents, with 52.7 % females and 47.3 % males. In terms of learning methods, 205 high school students (20.4 %) participated in both online and offline learning, 343 students (34.1 %) engaged solely in online learning, and 459 students (45.6%) were involved in offline learning. Regarding social distancing measures, 325 students (32.3 %) were not under social distancing, while 682 students (67.7 %) were under social distancing.(see Table 1)

Table 1. Participant's information

Criteria		n	%
Gender	Male	476	47,3
	Female	531	52,7
Social distancing	Not under social distancing	325	32,3
	Under social distancing	682	67,7
Learning method	Offline learning	459	45,6
	Combined online and offline learning	205	20,4
	Online learning	343	34,1

3.2. Measurement

The 21-item Depression Anxiety and Stress Scales (DASS 21, [Lovibond, Lovibond et al., 1995](#)) were utilized to measure the participants' levels of stress, anxiety, and depression. These items were used to determine the expression and severity of anxiety disorders among Vietnamese students during the COVID-19 period. Participants who responded from 0 (Did not apply to me at all) to 3 (Applied to me very much, or most of the time). The Vietnamese version of the scale has shown good reliability and construct validity ([Tran et al., 2013](#)), with a Cronbach's Alpha coefficient of 0.93.

3.3. Procedure

This research was in line with the American Psychological Association's ethical principles and received institutional ethical approval before conducting the survey. The research commenced with the random selection of a sample and outreach to schools for study deployment. Teachers and students were briefed on the study's goals, instruments, and procedures. After thorough understanding, participation was voluntary, with teachers aiding in questionnaire navigation. Only Grade 12 students who were actively engaged during the COVID-19 pandemic were invited to participate in the research. The online sample was recruited by advertising the study to Vietnamese Grade 12 students during stage 3 of the COVID-19 pandemic, and they took time to complete the survey via Google Forms during 2021–2022. Lastly, anonymity was maintained throughout the survey, which lasted 25 minutes and covered demographic details and study-relevant questions.

3.4. Data Analysis

First, we described the characteristics of the variables, including percentages, mean scores, and standard deviations, and used Pearson correlation to examine the relationships among the variables with SPSS 26.0. Finally, we conducted a multiple linear regression analysis to assess the independent predictive power of stress, depression on the increase of anxiety disorders.

4. Results

4.1. Descriptive statistics

The data summarized in [Table 2](#) revealed that the average stress level among students was 1.68 (SD = 1.52), while the average levels for anxiety disorder and depression were 0.82 (SD = 1.24) and 0.61 (SD = 1.06), respectively.

Table 2. The levels of anxiety disorder, stress, and depression

Variable	Stress			Anxiety disorder			Depression		
	n	%	M(SD)	n	%	M(SD)	n	%	M(SD)
Normal	338	36.9		63.6	63.6	.82(1.24)	632	69.0	.61(1.06)
Mild	70	7.6	1.68(1.52)	8.2	71.8		108	11.8	
Moderate	215	23.5		16.4	88.2		113	12.3	
Severe	130	14.2		5.9	94.1		29	3.2	
Very severe	163	17.8		5.9	100.0		34	3.7	

Notes: M: Mean; SD: Standardize deviation

Table 3. Descriptive between anxiety disorders, stress and depression

Variables	1	2	3
1. Stress	1		
2. Anxiety disorders	0.779***	1	
3. Depression	0.755***	0.727***	1

*** $p < 0.001$

The correlation analysis results indicated that anxiety disorders was positively related with stress ($r = 0.779$; $p < 0.001$), and depression ($r = 0.755$; $p < 0.001$). Similarly, anxiety disorders were positively related with stress ($r = 0.727$; $p < 0.001$).

4.2. Hypothesis testing

A multiple stepwise regression model of anxiety disorder was estimated, using the four subscales of stress and depression as independent variables (see Table 4). The overall model fit statistics were $F(2, 912) = 283.649$, $p < .001$, $R^2 = 0.619$, with an adjusted R^2 of 0.383. The variance inflation factors (VIF) of all the predictor variables were lower than 10 (Hair et al., 2018), thus indicating no danger of multicollinearity in the model. In addition, the Durbin-Watson statistic was 2.056. A Durbin-Watson statistic within the range of 1.5 to 2.5 allowed us to exclude the possibility of first-order serial correlation. Overall, the coping strategy model explained 61.9 % of the variance in anxiety disorder. All the following facets of stress were significant predictors of anxiety disorder ($B = .314$; $SE = .029$; $p < 0.001$), and depression was also a significant predictor of anxiety disorder ($B = .423$; $SE = .031$; $p < 0.001$). Thus, we accepted Hypotheses 1, 2.

Table 4. Multiple regression analysis of stress, depression on the anxiety anxiety disorders

Variables	B	SE	t	p	R ²	Adjusted R ²	VIF
(Constant)	.035	.021	1.690	.091			-
Stress	.314	.029	10.716	<.001	.619	.383	1.275
Depression	.423	.031	13.859	<.001			1.275

Notes: ** $p < 0.01$

5. Discussion

The screening of 12th-grade students in Vietnam has unveiled that stress, depression, and anxiety disorders are interrelated phenomena. Our principal findings reveal a positive correlation between stress and anxiety disorders, aligning with prior research that identified similar associations (Johnston, 2020; Salmani et al., 2023; Young et al., 2020; Windarwati et al., 2022; Tournous, Bagwell-Adams, 2016). Young et al. (2020) found significant links between stress, anxiety, and depression among university students. Moreover, individual and household attributes, including age, gender, marital status, work experience, and academic achievement influence stress levels. Notably, children and adolescents aged 3 to 18 exhibit emotional abnormalities, like anxiety, during the COVID-19 pandemic (Johnston, 2020; Loades et al., 2020; Nearchou et al., 2020; Viner et

al., 2022). Hence, our results concerning 12th-grade students in Vietnam during the COVID-19 period resonate with existing studies, emphasizing the necessity for further validation of these findings.

In addition, our study clearly shown a positive correlation between depression and anxiety disorders, which aligns with the findings of Chen et al. (2021), Dong et al. (2020), and Serra et al. (2021), thereby providing support for our hypothesis. Additionally, the rise in depression and anxiety disorder incidence has been attributed to stress overload and negative socio-cultural dynamics, significantly affecting human existence (Camila et al., 2022; Frolova, 2022; Mei et al., 2022; Wang et al., 2022), and emotional disturbances (Raymond et al., 2022). Notably, thoughts related to depression, including suicidal ideation, were significant among 12th-grade students displaying symptoms of anxiety disorders. The rate of students in social distancing areas considering suicide (nearly 25 %) significantly exceeded Vietnam's pre-COVID-19 rate (2.3 %) and the global rate among children (over 9 %) (Wasserman et al., 2005), and highlighted the role of poor parent-child relationships and irregular schedules (Zheng et al., 2020). However, the results of our study indicate that there is no statistically significant association between social distancing degrees or parent-child relationship quality and anxiety disorder symptoms in 12th-grade students during the COVID-19 pandemic. This discrepancy might be attributed to the easing of COVID-19 restrictions in Vietnam during our study period and the potential for students' adaptability to have lessened the adverse effects of these factors on their anxiety status.

6. Limitation, Contribution and Conclusion

6.1. Limitation

The study has several limitations. Firstly, it is a cross-sectional study, rather than an experimental one. As such, it cannot establish causality in the relationship between the studied variables (stress, depression, and anxiety disorders). Nonetheless, our study reflects the relationship among stress, depression, and anxiety disorders during the COVID-19 pandemic. In the future, experiments will be conducted to ascertain whether stress and depression are necessary precursors for the development of anxiety disorders.

Secondly, all data were derived from self-reported questionnaires. Therefore, the results are based on the reported relationship between stress, depression, and anxiety disorders. In future studies, we aim to employ research designs such as longitudinal and experimental studies to mitigate the biases associated with self-reported data.

Finally, it is important to recognize that this study has specific constraints. Given the time limitations and research circumstances imposed by the COVID-19 epidemic, the study was carried out with a rather small sample size of 1007 12th-grade pupils. The current sample size may be deemed insufficient for the purpose of screening for anxiety disorders.

6.2. Contributions

In light of these findings, several recommendations for government and schools, educational guidance and anxiety prevention, broad prevention strategies and early intervention and social skills training has been put forward. First, Vietnamese government and schools should prioritize bringing high school students back to a normal in-person learning routine, as the COVID-19 pandemic is currently under control. This is highly needed because high school students can only maintain normal mental health when they engage in regular learning, activities, and social relationships. Second, schools and teachers should allocate time for educational guidance and anxiety prevention activities for students, especially 12th-grade students. For those students showing severe anxiety symptoms, early detection and timely implementation of specialized support activities by psychological experts or mental health specialists are essential. Third, factors that contribute to anxiety disorders in 12th-grade students through broad prevention strategies and early intervention should be controlled in the first place. Specifically, students who are screened and show signs of stress, depression, to limit negative outcomes of anxiety disorders. Lastly, high schools should implement social skills training programs for 12th-grade students, focusing on developing study abilities, managing psychological stress during exams, which help to enhance social interaction skills, seeking assistance, emotional regulation skills, and fostering positive thinking capacities.

6.3. Conclusion

Anxiety disorder is a common emotional disorder characterized by vague feelings of anxiety, psychological function, high percentage of students have shown symptoms of anxiety disorders

compared to the pre-COVID-19 period, and warranting careful attention. Additionally, the level of stress and depression had a significant impact on the severity of anxiety disorders among students. This finding share with similar studies previously conducted on students in during COVID-19 pandemic.

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Experiences of the Dual Training Based on the Opinion of Students Participating in the Training at the University of Debrecen

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Abstract

Dual training is a special form of practice-oriented higher education training with cooperation between higher education and business entities. The advantage of dual training is that students are able to acquire company-specific and up-to-date knowledge and the practice-oriented education helps them to integrate more easily into the labour market. The aim of the present work is to assess the opinions of students on this type of training. A questionnaire survey was conducted among the students of the University of Debrecen in order to identify the factors that could improve this training type. The questionnaire was completed electronically by students on a voluntary basis. Responses were received from a significant proportion of the dual training programmes at the University of Debrecen. The questions included formulated statements, which belong to the closed question type group, within which several sub-types can be found in the questionnaire. In the questionnaire, single-answer questions were also formulated and Likert-scale questions have been included as well. When processing the questionnaires, not only the answers to each question were examined separately, but also the correlations between the different variables. In the scope of the analysis, Kruskal-Wallis test, Dunn's post-hoc test and Chi-square test were applied to detect correlations.

Keywords: dual training, practice-oriented education, dual partner, company-specific knowledge, soft-skills.

1. Introduction

The skills of professionals have always followed the technological evolution of industry. At the beginning of the industrial era, in the late 18th century, many unskilled workers and

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craftsmen were required. At the beginning of the 19th century and with the introduction of assembly lines – the so-called 2nd industrial revolution – many unskilled workers who were trained for only a few steps were needed. As the complexity of manufacturing processes increased, skilled workers had to take care of critical production steps. The training of these skilled workers around the world follows a specialised path – dual vocational training, which laid the foundations for university dual training (Jacques, Langmann, 2016). Dual training is a specialised, practice-oriented form of higher education, in which students can directly experience the world of work during their training, participate in work processes and spend much more time practising professional skills than in traditional courses (Balázsné, Zsupanekné, 2019). The advantage of dual training is that students can acquire company-specific and up-to-date knowledge and practice-oriented education helps them to integrate more easily into the labour market (Varga, 2018). It is very important for companies that fresh graduates are aware of the latest technology, because this knowledge can improve the quality of work. Through the participation of companies, the training of employees in industries is based on industry needs. Thus, it can be concluded and also agreed by the companies that there is a link between increasing productivity and dual training (Asnul, Salina, 2017). By means of their curricular content, structure and the increased number of hours spent at companies as well as the obtained work experience, practical trainings spent at professionally qualified companies enhance the professional competence, company knowledge and culture of students. In the case of dual training, the partner company also formally trains the students in a pre-defined way, closely linked to the curriculum of the higher education institution. This training system produces a workforce that is able to enter the world of work immediately, without years of further training and without additional financial burdens. It is thus a rapid and effective way to address the shortage of high-quality employees (Balázsné, Zsupanekné, 2019).

Taking a closer look at the practice of the dual model in higher education, some key components of the model can be identified, which are the following:

- A close link between theory and practice, with the practical part being a compulsory part of the learning process;

- The opportunity to explore actual situations and cases from the experiences of partner organisations in the practical sessions and then re-enact them on-site;

- The partner organisation is involved in the development of the curricula and the topics for term papers and dissertations;

- The performance of students is assessed by a company that serves as a practical training base, which enables a rapid response to the needs of the labour market and helps to make the educational programme flexible, mobile and efficient;

- Students engage in real communication with the target groups, which enables them to acquire, in addition to the relevant professional qualifications, the basic social and communication competences that will help them build successful careers in the future (Lebid, Shevchenko, 2020).

This form of training is favourable for two reasons: on the one hand, the system produces confident professionals, and on the other, it gives companies the opportunity to nurture their own talent and mould their future employees to their own needs before they graduate. The driving force for companies partnering in dual training is to attract well-qualified, value-creating professionals who understand innovative processes (Homicskó et al., 2021). The dual training system is unique in a sense that it creates a partnership between the student and the employer, governed by the student employment contract, which regulates the rights and obligations of students and employers in relation to the practical training. An important aspect of the dual training system is the contractual relationship between the employer and the educational institution, which takes the form of a dual training contract (Papcunová et al., 2022).

Dual training, which represents a close interconnection between higher education and the labour market, is also receiving increasing attention in the field of educational science. This form of learning, where the acquisition of theoretical knowledge occurs simultaneously with practical experience, enriches educational science in numerous ways.

The following are some important contributions:

1. Deepening practical knowledge

- Building bridges between theory and practice: In the scope dual training, students can immediately apply theoretical knowledge in practice, thereby gaining a deeper understanding of educational processes.

- Developing problem-solving skills: By solving practical tasks, students learn how to flexibly apply their knowledge and handle unexpected situations
- 2. Strengthening competence-based education
 - Developing 21st century skills: In the scope of dual training, students acquire key competences that are essential for a successful career, such as communication, collaboration, creativity and critical thinking.
 - Facilitation of independent learning: by solving practical tasks, students learn to conduct research, gather information and make decisions independently.
 - Encouragement of continuous improvement: in the scope of dual training, students receive regular feedback from their mentor, which helps them identify their strengths and areas for improvement.
- 3. Supporting research in education science
 - Formulation of more realistic research questions: in the scope of dual training, students and researchers can jointly identify practical problems that research can address, which is one of the aims of the present research.
 - Practical application of research findings: in the scope of dual training, research findings can be immediately integrated into pedagogical practice.
 - Stimulating innovation: the dual training allows students and their mentors to develop new methods and tools in the field of education.
- 4. Renewing the training of teachers
 - Training more aligned with labour market demands: dual training provides students with competences that are in high demand on the labour market.

Dual training is an innovative solution in the field of educational science that serves to deepen practical knowledge, strengthen competence-based education, support educational research, and renew teacher training.

However, dual training is a challenge for all participants, an extra task and a long-term commitment for both the company and the student.

Business professionals express their needs in terms of the knowledge they wish to acquire from the university by referring to their day-to-day operations and industry-specific processes, while the university aims to provide a comprehensive, multi-purpose set of competences, taking into account the relevant educational regulations, the available scientific literature and the teaching and working experience of the university lecturer. Due to these different approaches, the divergence of views between the participants – academic stakeholders and participating companies – is reasonable and understandable. In the alignment process, specific, profession-driven or company-specific requirements should be integrated into the set of competences and skills in such a way that they do not overwhelm the overall requirements. A healthy balance is needed as universities need to prepare students for different company profiles (Juhász et al., 2022).

Studies have found that dual students have significantly higher university entrance grades, a more positive self-image in terms of mathematical skills, economic skills and problem-solving skills, and they rate the interdisciplinary competences of willingness to learn and autonomy higher (Weich et al., 2017).

Dual training was introduced in Hungary in 2015, based on the German example.

In Germany, the main feature of the dual, practice-oriented training was the alternation of 3-month phases: students learned theoretical concepts at the university and received practical training in an enterprise or social institution (Gerloff, Reinhard, 2019). In Hungary, dual training involves students studying at an external partner organisation alongside the higher education institution during their training period, based on a predefined curriculum. At the company or external institution, students acquire specialised professional knowledge and work experience specific to the activities of the given company, which enables them to enter the labour market as professionally and personally more qualified employees after completing their higher education studies – even employed by the partner organisation (Balázs, Zsupanekné, 2019).

Since the start of the global financial crisis, but especially since the debt crisis of 2011–2013, there has been a resurgence of enthusiasm for dual training in Europe. Dual training has traditionally been a feature of craft and industrial training in some northern European countries, but over the past decade it has become part of the standard portfolio of EU policy recommendations, from reducing skills gaps and youth unemployment to improving Europe's global industrial competitiveness and promoting social cohesion (Homicskó et al., 2021).

In the case of dual training, there are many examples of transfer of the German model at the level of individual stakeholders and organisations: transfer at this level can combine elements from the training system of the country of origin with elements from the host country's system in a flexible and demand-oriented way. Therefore, there is a need for international comparative research approaches that combine the perspectives of individual actors, such as companies, with the analysis of a broad range of training systems and stakeholders, reflecting the interaction between the different training and employment systems in German and national systems (Pilz, Wiemann, 2021). The emphasis on improving the match between labour skills and labour market demand is not a new approach. The promotion of work-based learning, for example in the context of lifelong learning, has long been part of the Lisbon Treaty, which is moving Europe towards a 'knowledge economy' (Šćepanović, Artiles, 2020).

The literature review has identified a number of studies that use questionnaires and interview tools to assess how participants evaluate the period since 2015.

2. Materials and methods

The database for the analysis was compiled through a questionnaire survey, which measured student experiences of dual training in the first semester of 2022.

The questions included formulated statements, which belong to the closed question type group, within which several sub-types can be found in the questionnaire. In the questionnaire, single-answer questions were formulated, such as questions on the main activity of the enterprise and revenue, and on the definition of the students recruited. Likert-scale questions were applied, on the skills of the dual students and the usefulness of the knowledge they acquired at the university. The Likert scale is a measurement scale between two extreme values. In the present case the extreme values were defined from 1 to 5, and a value of 0 represents the answer "I don't know". In addition to the statements, the respondents have to select the answer that is real in their case from the range between "burden for the company" and "considers important", "does not have" and "does have", and "not developed" and "developed" by using numbers.

In order to examine the reliability of the questionnaire, the analyses focused on exploring the structure of the questionnaire and the reliability of the variable blocks, for which the Cronbach's alpha index was applied. Cronbach's alpha is a method of assessing reliability that compares the amount of common variables, or covariance, among the numerous items that make up the instrument to the amount of total variables. If the instrument is reliable, there should be a lot of covariance among all items relative to the variance.

Calculated for Likert-scale responses, this means 20 variables and 153 respondents (blanks are excluded). Cronbach's alpha: 0.934, which means excellent internal consistency. Thus, it can be concluded that internal consistency was satisfactory.

The questionnaire was filled in electronically by the students on a voluntary basis.

The majority of students who completed the questionnaire were accounting MSc students (nearly 20 %), followed by management and organization MSc students (14.7 %). There were equal proportions of electrical engineering and supply chain management students (10.2 %), while there were also a larger number of chemical and mechanical engineering students (9.6 % and 7.0 %). The remaining students were mixed across other courses.

Of the 156 respondents, 45 % were women, 47 % were men, while the remaining nearly 8 % were unspecified or did not respond. Most lived in a city or county seat (34-35 %), while 18 % lived in a village. The father's education was predominantly secondary (59 %), while in the case of mothers, higher education degree was the most frequent (50 %). 2.6% of parents had primary education.

When processing the questionnaires, not only the answers to each question was examined separately, the correlations between the different variables were also evaluated.

1. Statistical analysis

There are several aspects to consider when selecting the appropriate statistical test:

1. What is the measurement level of our variables?
2. Sample size of the statistical test?
3. Is our sample matched, paired, or independent?

Kruskal-Wallis test, Dunn post-hoc test and Chi-squared test were applied to analyse associations, while processing the responses to the questionnaire questions.

– When using the Kruskal-Wallis test, it is examined whether the medians of a variable of at least ordinal level are the same across three or more groups. The Kruskal-Wallis test allows for the evaluation of statistically significant differences between different groups. For example, it was used to explore whether the nature of tasks performed by students is related to how they felt at the dual partner organization (Németh, 2018).

– If the result of the Kruskal-Wallis test is statistically significant, it is advisable to perform a Dunn test to determine exactly which groups differ from each other. The Dunn test conducts pairwise comparisons between each of the independent groups and indicates which groups differ significantly from each other at a certain α level (Ács, 2014).

The Dunn post hoc test uses the same rankings as the Kruskal-Wallis test and applies the same common variance as the null hypothesis of the Kruskal-Wallis test. Thus, it uses the same data as the Kruskal-Wallis test for differences between two groups (Janacsek, 2008).

– The Chi-square test is used for nominal data the objective is to examine correlations and variances; it is also called cross-tabulation analysis. For nominal data, it is the only test that can be used, regardless of the type of research. Observations must be independent, which means that no respondent can be included in two or more categories/cells at the same time (Németh, 2018).

3. Results

In the scope of the questionnaire survey, general questions were asked first about the student (gender, place of residence, level of education of parents). The inquiries were regarding the potential correlation between parental education and entry into dual training. Questions were asked about the motivation of the students regarding the training form, the criteria used in their decision to participate, and the reasons for choosing a specific company.

Overall, the aim was to assess the satisfaction of students who participate in dual training with their decision to enter this training form, and factors related to the organisation and establishment of dual training were also examined.

Decisions on dual training were mainly influenced by professional (123 responses) and financial (71 responses) factors. Recommendations from friends and acquaintances (47 responses), the influence of open days and fairs (47 responses), school (31 responses), parents (27 responses) and the opinion of siblings (7 responses) played a significantly smaller role

For the question "Who made the actual decision?", the answers are clear: 91 % of the students made the decision themselves, 8 % together with their family and only 1 respondent said that the family made the decision.

34 % of students said that they found the company they chose as a dual partner on the faculty website, while 25 % said they found it through their own search. Of the students, 24 % were recommended the company serving as the location for dual training by a friend or relative, while 15 % heard about them at a university open day, and 3 % at a high school career orientation day.

Respondents were asked to rate the extent to which they thought their university education provided a basis for dual training. On a scale of 1 to 5, they were asked to evaluate the knowledge they received, where 1 means not at all, while 5 means to a full extent. Basically, half of the students considered that university education provided a good basis for dual training (56 % gave a rating of 4 or better) (Figure 1).

The degree to which students feel themselves significant at the company is considered an important factor in the success of the dual training. They were also asked to rate on a scale of 1 to 5 how important they consider themselves at the company, where 1 means that they are a burden to the company and 5 means that they feel important. Over half of the students said they felt important to the company (63 %) (Figure 1).

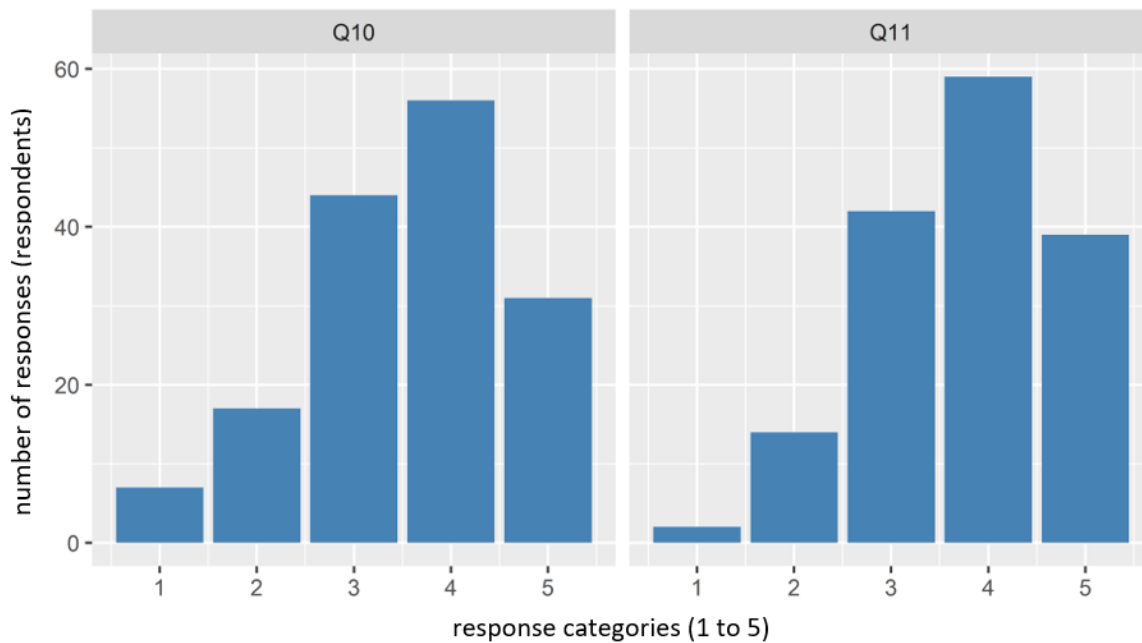


Fig. 1. Q10 = 10. To what extent does university education establish your dual training? And Q11 = 11. How important do you feel yourself at the company? Distribution of questions by response category

Notes: N = 155 persons

It has been assumed that the way in which a company deals with students is relevant to a successful dual training, therefore this area was also examined. It was asked of the students if they had a mentor at the company. The following response options were given: 1 – We are dealt with by a separate department,

2 – I have my own designated mentor, 3 – I always have a different colleague dealing with me.

53 % of students had their own designated mentor at the company, while 29 % said they were always assigned to a different colleague. In the case of approximately 18 % a separate, dedicated department appeared in the responses.

In terms of satisfaction, it is also worth to examine the type of tasks students are assigned to during their dual training at the company. Half of the students (54 %) had specific professional tasks, 22 % project tasks and 24 % administrative tasks.

Performing tasks may be related to how important the students feel themselves to the company (Q11). The Kruskal-Wallis test shows that there is only a difference between the Q11 ratings at 10 % significance level ($p = 0.0789$). The Dunn post-hoc test showed a difference between groups 2 and 3, i.e. between those who performed specific professional tasks and those who only performed administrative tasks. In contrast, there was no difference between the ratings of specific professional work and project work. On average, this means that project and specific professional work received a rating of 3.7 and 3.9 respectively, while administrative work received a rating of 3.4. For this reason, project and technical work were subsequently grouped together.

Students were asked to assess whether they had developed certain skills during their dual training. Different skills were listed and they were asked to rate their progress on a scale of 1 to 5. On the scale, 1 was for "not improved" and 5 for "improved". The results show that the average scores ranged from 3 to 4.5. For factors with a favourable rating, the error range was narrower, while for factors with a less favourable rating, the error range was larger. This suggests that the unfavourable ratings were more dispersed. According to the students, their ability to work independently has improved the most, as well as accurate work, practical professional skills, interpersonal and communication skills, the ability for teamwork and a strong work capacity. The least favourable scores were for improving foreign language skills, social skills, the ability to solve calculative tasks and to navigate the internet (Figure 2).

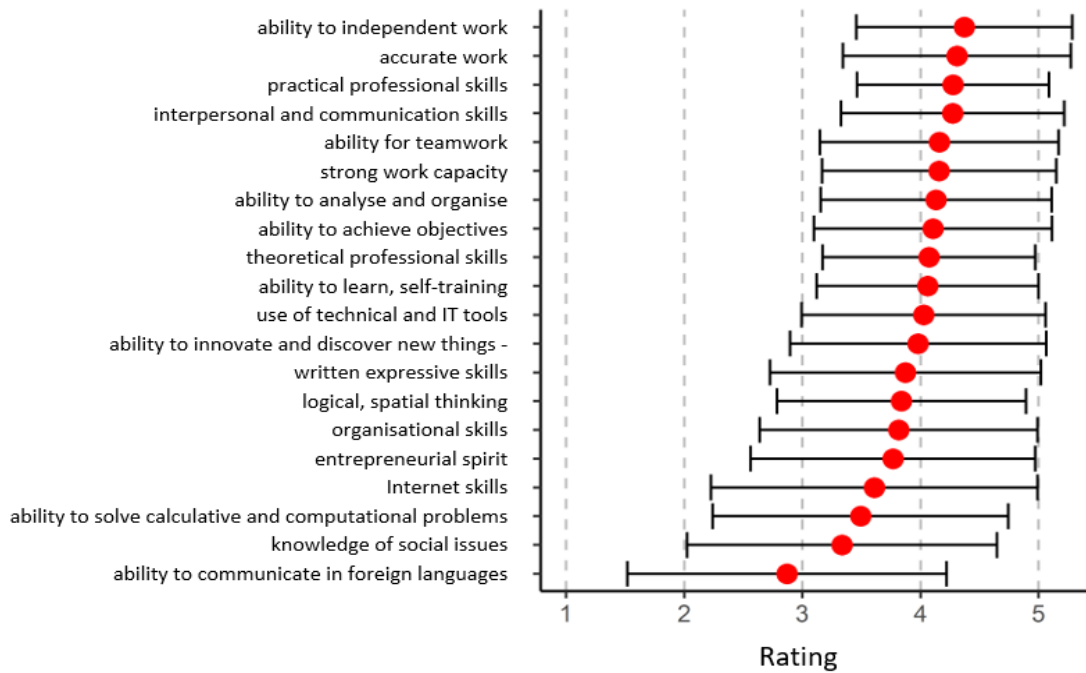


Fig. 2. Please rate whether the dual training has improved your following skills

One of the main indicators is whether the student would still choose the dual training option. A significant proportion of students (68 %) would still choose dual training, would do it again and would choose the same company. In contrast, 26 % would start again, but not with their current company. Only 5.8 % said that they expected something else in terms of dual training.

They were also asked about their plans for the future. 53 % of the students intend to stay with their current company after graduation, while 13 % would like to stay with the company but also have plans for further education. 4.5 % of students do not want to stay with the company for reasons of further education, while 29 % want to work elsewhere.

It was examined whether there was a correlation between how important the student felt at the company and whether they would like to stay with the company after graduation (Table 1).

Table 1. Comparison of the results of questions "How important do you feel yourself at the company?" and "Would you like to stay at this company after graduation? / What plans do you have for the future?"

Group (1)	Group (2)	N1	N2	test statistics	p-value
would stay	would not stay	103	53	4183	0.000

Notes: would stay = yes, I would like to stay with them and yes, but I would also like to continue my studies; would not stay = no, because I would like to continue my studies and no, I would like to work elsewhere

At the same time, the results showed that there was no difference in the average rating of the question "How well does university education establish dual training?" between those who would stay in their current company after graduation and those who would not. This is because the average ratings were 3.66 and 3.37 (would stay vs. would not stay) (Table 2).

There was a significant correlation with Would you still choose dual training now? And Would you like to stay at this company after graduation? / What plans do you have for the future? The reason for that was there were more people than expected who would stay at the company after graduation and who would choose dual training again with the same company, and more people than expected who would not stay after graduation and who would choose dual training again, but with a different company. However, for the question, "Would you still choose dual training now?", there were only two answer options: "yes, I would do it again, and I would choose the same company" and "yes, but probably not at this company", because the answer "no, I expected

something else, I was thinking of another training form" was chosen by only 9 people. These 9 people were not taken into account for this part of the analysis. This may have contributed to the significant correlation (Table 3).

Table 2. Comparison of the questions "How well does university education establish dual training? and "Would you like to stay at this company after graduation? / What plans do you have for the future? (would stay vs. would not stay)

Group (1)	Group (2)	N1	N2	test statistics	p-value
would stay	would not stay	103	52	3045	0.148

Notes: would stay = yes, I would like to stay with them and yes, but I would also like to continue my studies; would not stay = no, because I would like to continue my studies and no, I would like to work elsewhere

Table 3. Correlation of the questions "Would you still choose a dual training form now?" and "Would you like to stay at this company after graduation? / What plans do you have for the future?"

χ^2	df	p-value
54.837	1	0.00

Notes: The categorisation here was also the following: would stay = yes, I would like to stay with them and yes, but I would also like to continue my studies, would not stay = no, because I would like to continue my studies and no, I would like to work elsewhere.

It is also worth examining how the development of skills is related to the tasks the students have performed in the company. The groups were the following: professional or project work vs. administrative work. In most cases, there was no clear pattern as to which factors were significantly different in their assessment. In all cases, the differences were due to the fact that students who were involved in a project or had a professional job rated their skill development higher (Table 4).

Table 4. Please rate how your dual training has improved your skills in the following areas compared to the answers to question a "What kind of tasks do you perform in the company?" (administrative tasks vs. project or professional tasks)

Name	N1	N2	W	p-value
accurate work	35	97	1325.000	0.032
ability for independent work	35	97	1350.500	0.041
high work capacity	35	97	1414.500	0.116
ability for teamwork	35	97	1504.000	0.280
ability to achieve objectives	35	97	1343.000	0.050
theoretical professional skills	35	97	918.000	0.000
ability to learn, self-training	35	97	1441.000	0.159
use of technical and IT tools	35	97	1590.500	0.558
practical professional skills	35	97	1042.500	0.000
interpersonal, communication skills	35	97	1428.500	0.123
ability to analyse and organise	35	97	1338.000	0.046
ability to solve calculative and computational problems	35	97	1501.500	0.299
internet skills	35	97	1339.000	0.055
ability to innovate, to discover new things	35	97	1258.000	0.017

Figure 3 shows the average response values for the different factors (linked to Table 4). In all cases, it can be seen that students perceived that their skills improved more when they were involved in a project or professional work than when they were doing administrative work. This was also true in cases where there was no significant difference between the two groups of questions (Figure 3).

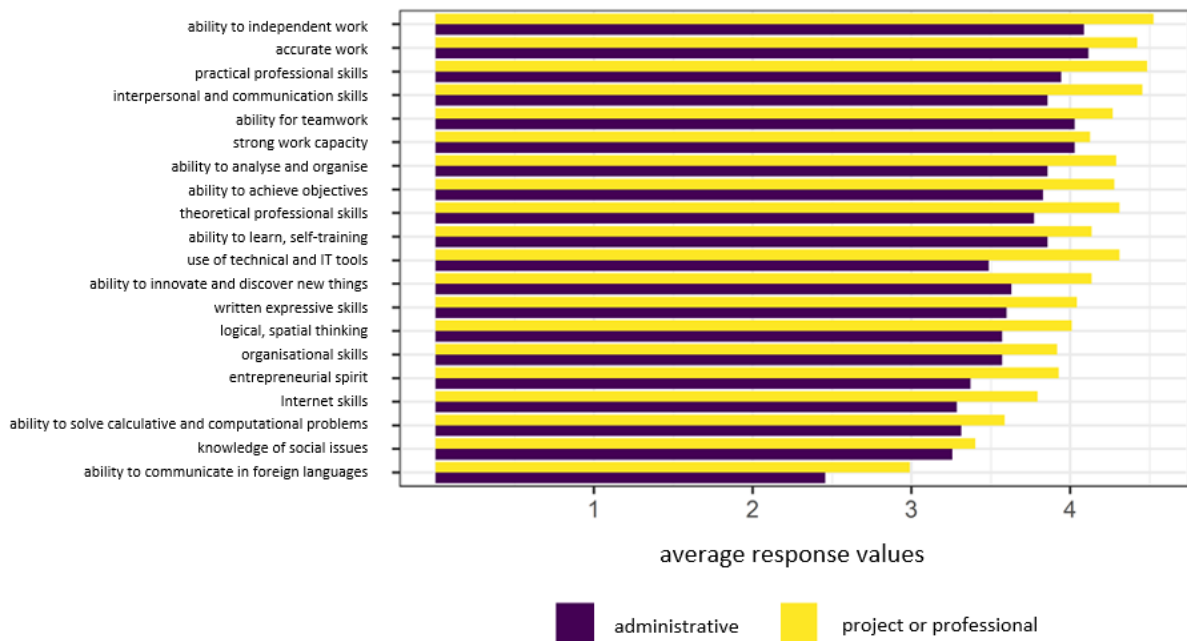


Fig. 3. Average values of the question "Please rate whether the dual training has improved your skills in the following areas" based on the question group "What kind of tasks do you perform in the company?" (administrative tasks vs. project or professional tasks)

Skills development was also compared according to whether the student intended to stay at the company. In most cases there was a significant difference between those who wanted to stay with the company and those who did not. No clear pattern can be detected, but in almost all cases the difference was significant.

Figure 4 shows the average responses between those who would stay with the company and those who would not. The results clearly show that the significant difference is that those who would like to stay with the company all rated their skills development higher (Figure 4).

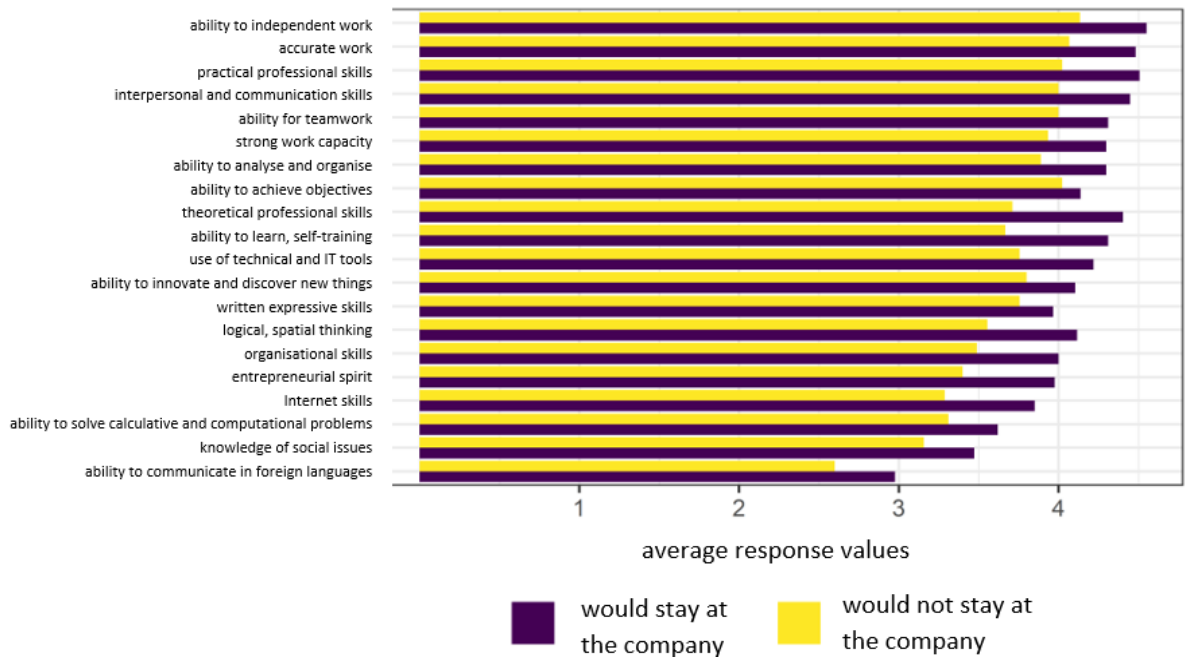


Fig. 4. Average values of the question "Please rate whether the dual training has improved your skills in the following areas" based on the question group "Would you like to stay at this company after graduation? / What plans do you have for the future?" (would stay at the company vs. would not stay at the company)

4. Discussion

The period since 2015 has been the subject of several case studies in institutions where this type of training has been introduced. The results of the reviewed studies have a number of common features. Research has included students who have completed and are currently enrolled in dual training, with non-dual students as a control group. The partner organizations of the dual training, typically industrial companies, were surveyed; their HR specialists, mentors, and engineers were interviewed. Some studies collected and analyzed the experiences of higher education institutions. (Kerülő, Nyilas, 2019; Kocsis, 2020)

In the section of the study introducing dual training and the current situation, the characteristics of dual training and the experience gained so far have been reviewed.

In the scope of the questionnaire survey, general questions were asked first about the student (gender, place of residence, parents' level of education). The aim was to reveal whether there was a correlation between the education level of the parents and the enrolment in dual training. Respondents were asked about their motivation in relation to this type of training, what made them decide to enter, why they chose the company they did. Overall, the aim was to confirm whether students in dual training were satisfied with their decision to enter this form of training, and they were also asked about factors related to the organisation and establishment of their dual training.

In analysing the responses of the students who responded, it was found that the proportion of men and women was almost equal, mainly living in urban or county areas, and that parents dominantly had secondary and tertiary education backgrounds.

An important question was the reasons why the students chose the training and whether they made their choice independently or were influenced by someone. The main reason for applying for dual training were the labour market opportunities, and professional, financial factors. More than 90 % of students made the final decision themselves.

The analysis by other authors of students' opinions shows that dual students interviewed applied for dual training primarily because they wanted to gain work experience during their studies by acquiring practical knowledge (Kerülő, Nyilas, 2019; Kocsis, 2020).

As for longer-term plans, almost half of the respondents expect to be able to find a job at the training place or in a position that is advantageous from all points of view (professional, financial, and social) after completing the training, with the work experience gained (Kocsis et al., 2017; Kerülő, Nyilas, 2019).

Experience shows that students tend to have positive experiences in larger companies, where there is an opportunity to dedicate human resources to work with dual students as company coordinators, and where students have a dedicated mentor in the company who is responsible for their professional development. In smaller companies, dual students are managed by the HR department and one of the managers, who often do not have enough time to mentor them. However, even in smaller companies, there are many success stories because students here are given more serious professional assignments sooner, which motivate students with high aspirations, and they are also expected to become a full-fledged employee in the last two years of their studies (Kocsis, 2020; Fenyves et al., 2020).

In general, large companies are better prepared to take on trainees and may have a separate internal training department to support in-house trainers or hire trainees directly. In contrast, small and medium-sized companies operate in a less structured and more informal way. Differences in size may also affect the future prospects of trainees entering the labour market after completing their training, as small enterprises seem to focus on the current benefits of 'helping' trainees, while larger enterprise chains often link dual training to potential long-term employment (Marrero-Rodríguez, Stendardi, 2023).

The results of our survey it was typical that students of companies with a larger number of employees completed the questionnaire in higher proportions. As dual training can be organised in a classical or hybrid way, they were also asked about the way in which their training is organised in the partner organisation. It was found that three quarters of the respondents were training in a hybrid format, spending 2 days a week at the company.

One of the important factors of an effective and successful dual training is how the partner organisation engages with students and helps them progress. More than half of them had their own mentor in the company, while nearly 80 % had a specific professional or project assignment in the company. Students who did specific professional or project work felt more important in the company than those who did administrative work.

Basically, half of the students felt that university education provided a good basis for dual training (56 % gave a rating of 4 or better). A similar proportion felt that they were important for the company (63 %).

For several courses and institutions, the questionnaire survey also confirmed that partner institutions play a significant role in developing soft skills such as openness, commitment, responsibility, and autonomy. Additionally, skills related to the professional field, such as professional knowledge and management skills, developed slightly less among students. This may be attributed to the fact that they are part of university education. This underscores the essence of dual training, which aims to harmonize and align university education with market demand.

An important factor is the students' perception of the dual training, whether they feel successful in their participation and whether they regret their choice. Based on the results obtained, the nature of the tasks they were given and how they were handled can be determined. Students who were involved in a project or who had a professional task were almost always considered to have developed their skills better, in contrast to those who had an administrative task. Furthermore, those who would like to stay with the company all rated their skills development as higher.

Students felt that their ability to work independently was the most improved, and that accuracy and practical professional skills were also important.

The results of Kozák's research indicate that dual students understood what they were undertaking with this new form of training and what they expected to achieve. They aimed to acquire high-quality professional skills and practical work experience alongside their theoretical training, to familiarize themselves with company life, and to gain additional work experience. However, in addition to positive outcomes, students also reported negative experiences during the surveys: overload, conflicts with the mentor (due to the mentor's personality, overly strict requirements, and deteriorated mentor-student relationships), and difficulties in meeting the expectations of progression according to the model curriculum (Kozák et al., 2020).

A significant proportion of students (68 %) would still choose dual training, start again and choose the same company. In contrast, 26 % would start again, but not with their current company. 53 % of students would like to stay with their current company after graduation, while 13 % would like to stay with the company but have plans for further studies. Those who felt important at the company were more likely to say they would like to stay there after graduation.

The survey was based on the opinions of students who, at the time of the survey, had an active dual student status. Thus, it does not reflect the views of those who did not complete their studies for various reasons (such as termination of student status, contract termination with the company, etc.) and also does not reflect the opinions of those who have already successfully completed their studies. To further develop the dual training format, surveying the opinions of these currently excluded target groups may be the next step.

5. Conclusion

In processing the questionnaire, the following findings can be summarized:

The students were nearly evenly split between men and women, primarily living in urban areas or county seats, and the parents predominantly had middle or higher education background. The primary reasons for applying to the dual training program were labour market opportunities, with professional and financial considerations being decisive. More than 90 % of the students made the final decision themselves.

Three-quarters of the students spent two days a week at the company, more than half had their own mentor at the company, and nearly 80 % were involved in specific professional or project tasks at the company. Essentially, half of the students felt that university education provided a good foundation for dual training (56 % gave a rating of 4 or better). A similar proportion felt valued at the company (63 %).

Students who performed specific professional or project work felt more valued at the company than those who did administrative work. The students felt that their ability to work independently improved the most, along with precise work performance and practical professional skills being important. The least favourable evaluation was given to the improvement of foreign language skills. A significant portion of the students (68 %) would choose dual training again and would choose the same company. In contrast, 26 % would start again but not at the current company. After graduation, 53 % of the students would like to stay at the current company, while

13 % would like to stay but also have plans for further education. Those who felt valued at the company were more likely to say they would like to stay after graduation. Students involved in the project or performing professional tasks almost always felt that their skills developed better compared to those doing administrative work. Moreover, those who would like to stay at the company always rated their skill development higher

Overall, it was found that a significant proportion of students rated their dual training positively and experienced significant skills development. They made their decision independently, which the majority do not regret and would choose this form of training again. Whether or not companies provide a dedicated mentor to the student was an important factor, as it reinforced the sense of importance. The assignments given were also found to be a relevant factor contributing to a positive perception.

Evaluating the responses to the questionnaire will help to further develop this relatively young form of training by taking into account the experiences of the participating students. In the future, in cooperation with the companies involved in the training, an area for improvement is to provide a mentoring system and to strengthen the training with appropriate professional tasks. One way to achieve this could be to place greater emphasis on developing a joint curriculum and on the company's professional contribution to the training during the preparation phase of the collaboration. Universities should strive to assist the company in providing students with professional and project tasks that are appropriate to the students' knowledge and that develop their existing knowledge and skills. It is also worth considering the possibility of creating a program to develop the professional and pedagogical skills of corporate mentors. This could also enhance the development of competencies and satisfaction of students participating in this training format. At the same time, the partner institution could gain access to a more skilled and motivated workforce.

In terms of the promotion of dual training it has been confirmed that it is necessary to address future students directly, approach dual training from a professional perspective and reach potential applicants through professional events and open days. Students choose dual training primarily for professional and labour market reasons, therefore universities, together with companies, should reinforce this aspect at open days and enrolment events.

It is very important to make this new form of training as widely known as possible, offering university students a choice.

Although the process has only been launched a few years ago and many positive effects can already be experienced, it is certain that in the long run this form of training is able to trigger changes that will affect the entire economy and society.

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The Role of Learning Analytics in Optimizing Ergonomic Educational Spaces for Active Learning in Russia

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Abstract

This study investigates the synergistic potential of Learning Analytics (LA) and ergonomic design in optimizing active learning environments within Russian higher education. Employing a mixed-methods approach, we collected data from 15 universities (n = 1200 students, 120 faculty) to examine the impact of LA-informed ergonomic interventions on learning outcomes. Quantitative analysis utilizing Structural Equation Modeling (SEM) revealed significant positive effects of LA implementation ($\beta = 0.45$, $p < 0.001$) and ergonomic design ($\beta = 0.38$, $p < 0.001$) on active learning outcomes. Qualitative thematic analysis identified three primary themes: enhanced student engagement, improved academic performance, and increased satisfaction with learning environments. Multiple linear regression analyses pinpointed key predictors of student engagement, including time spent on interactive activities ($\beta = 0.32$, $p < 0.01$) and ergonomic furniture ratings ($\beta = 0.36$, $p < 0.001$). Mediation analysis demonstrated that student engagement partially mediates the relationship between LA implementation and academic performance (indirect effect = 0.18, 95 % CI [0.09, 0.29]). Our findings underscore the efficacy of integrating LA and ergonomic design to foster active learning, offering empirically-grounded insights for educational stakeholders in Russia.

Keywords: learning analytics, ergonomic educational spaces, active learning, educational technology, Russia, interdisciplinary approach, statistical modeling, evidence-based design.

1. Introduction

The core aim of this research is to clarify how LA can be leveraged to optimize ergonomic educational settings that promote active learning. To this end, the research objectives are as follows:

1. To pinpoint and scrutinize key LA metrics that are pertinent to ergonomic design and active learning outcomes.

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2. To assess the current ergonomic standards in educational spaces at 15 leading Russian universities.
3. To employ sophisticated statistical techniques, such as Structural Equation Modeling (SEM) and mediation analysis, to establish correlations between LA metrics and ergonomic factors.
4. To formulate evidence-based recommendations aimed at improving educational spaces within Russian universities.

This investigation centers on institutions of higher learning in Russia, focusing on environments designed for active learning, such as lecture halls, laboratories, and collaborative learning spaces. A mixed-methods research approach is utilized, integrating both qualitative and quantitative methodologies to provide a thorough and multidimensional analysis.

Historically, the use of LA in educational settings has been largely confined to curriculum development, student engagement analysis, and performance tracking (Pérez Cañado, 2016). This study broadens the scope of LA by applying it to the optimization of physical educational environments, empirically linking it with ergonomic design principles. Focusing on the Russian context, the study sheds light on how localized cultural and institutional factors shape the utility and effectiveness of LA and ergonomic design in fostering active learning (Zivan et al., 2020). In order to substantiate the qualitative dimension of this research, direct quotations from interviews and focus group discussions are included to highlight recurring themes and sentiments. For example, a faculty member at Lomonosov Moscow State University observed, "The ergonomic redesign of our classrooms has significantly enhanced student engagement. I've seen a considerable improvement in both participation and collaboration." A similar viewpoint was expressed by a student from Kazan Federal University, who stated, "The new learning environments make me feel more motivated and concentrated. I find myself contributing more actively to discussions and group projects."

These qualitative insights were systematically examined using thematic coding in NVivo 12, thereby providing rich, contextual evidence of the influence of ergonomic design on active learning. This study lays the groundwork for future research and makes a compelling argument for the mutually beneficial relationship between LA and ergonomic design in the creation of learning spaces that stimulate active engagement in Russian higher education.

2. Literature Review

The progressive integration of educational technologies within formal learning environments has led to a diversified discourse focusing on different elements contributing to educational efficacy. Learning Analytics (LA) has arisen as a pivotal concept, principally revolving around the gathering, analysis, and reporting of data about learners to optimize educational experiences (Pérez Cañado, 2016). Various theoretical models and frameworks have been developed to guide the utilization of LA, particularly in decision-making processes concerning curriculum design, student engagement, and performance metrics (Zivan et al., 2020). Concurrently, the significance of ergonomic design in educational spaces has garnered considerable attention, with research emphasizing the pivotal role played by physical surroundings in affecting student performance and well-being (Khalil et al., 2022). A corpus of literature addresses the intersectionality between ergonomic factors and cognitive load, establishing a substantive foundation for the investigation of ergonomic principles in education (Kao, 2019).

While the aforementioned areas of study have been individually scrutinized, fewer endeavors have been undertaken to explore the interface between Learning Analytics and ergonomic design. Yet, research does exist that elucidates the relevance of these two distinct yet inherently connected domains. For example, studies have investigated the impact of learning environments, considering variables such as space configurations, lighting, and furniture, on the learning experience (Barrios Espinosa, 2019). Similarly, preliminary research efforts have been made to identify key LA metrics that can be employed to understand and improve ergonomic features (Badalov et al., 2020).

A narrower set of literature has attempted to probe the concept of 'active learning,' a pedagogical approach that engages students in higher-order thinking tasks such as analysis, synthesis, and evaluation (Andrews, 2011). The potential for active learning to thrive in ergonomically designed spaces, which are, in turn, optimized through the application of LA, represents a nascent field of inquiry (Pérez Cañado, 2021). On a geographical note, the specific context of Russia has been relatively less represented in existing literature, creating a void in understanding how localized cultural and educational norms influence the effectiveness of integrating Learning Analytics and ergonomic designs

(Sintema, 2020). However, some research endeavors have evaluated the effectiveness of educational reforms and technological integrations in Russia's educational system (Arpentieva et al., 2020). Additionally, few studies have employed a multi-methodological approach to investigating the role of LA and ergonomics, despite the inherent complexity of these interdisciplinary topics. Advanced statistical models have been advocated to delineate the multifaceted relationships between LA metrics and ergonomic variables (Gaworski et al., 2021).

Ethical considerations surrounding the application of Learning Analytics have been touched upon in existing literature, often advocating for transparent, ethical, and responsible practices in LA deployment (Pérez Cañado, 2018). The literature reflects a multi-dimensional approach to understanding Learning Analytics, ergonomic design, and active learning but indicates an existing gap in synthesizing these into a unified framework, especially in the context of Russia. This study aims to address this gap by presenting an empirical investigation into the integration of these domains (Bataeva, 2019). Through a comprehensive exploration of the above facets, the current study situates itself at the intersection of Learning Analytics, ergonomic educational spaces, and active learning, with a localized focus on the educational landscape in Russia (Abubakar et al., 2019).

3. Materials and methods

This study employed a comprehensive mixed-methods approach to investigate the relationship between Learning Analytics (LA), ergonomic design, and active learning in Russian higher education. Conducted across 15 universities, the research included 1,200 students and 120 faculty members, providing a detailed overview of diverse institutional contexts.

Qualitative data were collected through 60-minute semi-structured interviews and 90-minute focus groups, all transcribed verbatim. Thematic analysis, performed using NVivo 12, incorporated open, axial, and selective coding. Quantitative data were obtained via surveys using stratified random sampling, with response rates of 87 % for students and 92 % for faculty. Key metrics such as student engagement and time spent on digital platforms were analyzed, supported by LA data from Learning Management Systems. Cronbach's alpha values exceeded 0.80, indicating strong reliability across instruments.

The statistical analysis, conducted using IBM SPSS 26 and AMOS 28, applied Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA) to examine LA-ergonomic relationships. The model demonstrated excellent fit ($\chi^2/df = 1.92$, CFI = 0.97, TLI = 0.96, RMSEA = 0.05). Multiple linear regression analyses identified significant predictors of student engagement, and mediation analysis revealed that student engagement partially mediated the effect of LA on academic performance. Ethical protocols, including informed consent and anonymization, were rigorously followed throughout the study.

4. Results

Our in-depth examination of data collected from 15 Russian universities uncovers critical insights regarding the dynamic interaction between Learning Analytics (LA), ergonomic design, and the promotion of active learning outcomes. The following section provides a detailed analysis of the findings, situating them within the broader context of Russian higher education and current pedagogical frameworks.

Table 1. Distribution and Characteristics of Classroom Designs Across Sampled Institutions

Classroom Type	Percentage (%)	Total Number	Average Size (sq.m)	Student Capacity	Ergonomic Features	Technology Integration
Frontal Teaching	62	140	60	30	Basic (2.1/5)	Low (1.8/5)
Collaborative	26	59	75	35	Advanced (4.2/5)	High (4.5/5)
Auditorium	8	18	100	50	Moderate (3.3/5)	Moderate (3.7/5)
Lab/Workshop	4	9	50	20	Specialized (4.5/5)	Very High (4.8/5)

Notes: Ergonomic Features and Technology Integration are rated on a scale of 1-5, where 5 represents the highest level of implementation.

Table 1 provides an overview of classroom design trends in Russian universities, showing a dominance of frontal teaching layouts (62%), which rely on traditional methods. These spaces have limited ergonomic features (2.1/5) and low technology integration (1.8/5), potentially hindering active learning. Conversely, collaborative classrooms, although only 26 % of total spaces, show much higher ergonomic ratings (4.2/5) and technology integration (4.5/5), reflecting a shift towards environments that support active learning. Their larger size (75 sq.m) and higher capacity (35 students) facilitate peer interaction and group work.

Auditoriums and lab/workshop spaces, while fewer, play crucial roles. Auditoriums have moderate ergonomic (3.3/5) and technology ratings (3.7/5), suited for large groups, but need improvements to better support active learning. Labs and workshops, though limited, score highest in ergonomics (4.5/5) and technology (4.8/5), essential for hands-on learning.

A global comparison shows that 37 % of classrooms in OECD countries are designed for collaborative learning, compared to 26 % in Russia, pointing to potential growth in aligning with international active learning trends.

Table 2. Implementation and Utilization of Learning Analytics in Sampled Institutions

LA Application	Percentage of Institutions (%)	Total Institutions	Average User Rate (%)	Key Metrics Tracked	Data Collection Frequency	Integration with LMS
Engagement Monitoring	38	17	75	Time Spent, Interactions, Participation Patterns	Real-time	High (4.2/5)
Performance Assessment	28	13	60	Grades, Quiz Scores, Assignment Completion Rates	Weekly	Moderate (3.5/5)
Attendance Tracking	17	8	55	Logins, Class Presence, Online Session Duration	Daily	Low (2.8/5)
Personalization	9	4	30	Learning Preferences, Content Interaction, Progress Rates	Continuous	Very High (4.7/5)
Administrative Metrics	8	3	22	Resource Utilization, Budget Allocation, Staff Performance	Monthly	Moderate (3.3/5)

Notes: Integration with LMS (Learning Management System) is rated on a scale of 1-5, where 5 represents the highest level of integration.

Table 2 highlights Learning Analytics (LA) adoption across sampled universities, revealing a growing use of data-driven educational tools. Engagement monitoring, used by 38 % of institutions, is the most common LA application, with a high user rate (75 %) and real-time data collection, demonstrating its importance for enhancing student participation. Performance assessment, present in 28 % of institutions, is the second most utilized LA tool. Despite a lower user rate (60 %), its weekly data collection reflects a balanced approach to timely feedback and data management.

More advanced LA applications, like personalization (9 %) and administrative metrics (8 %), remain underutilized but offer significant potential for improving learning outcomes and institutional efficiency. Personalization tools, where applied, show strong integration with Learning

Management Systems (LMS) (4.7/5), indicating their ability to fit seamlessly into the digital learning environment.

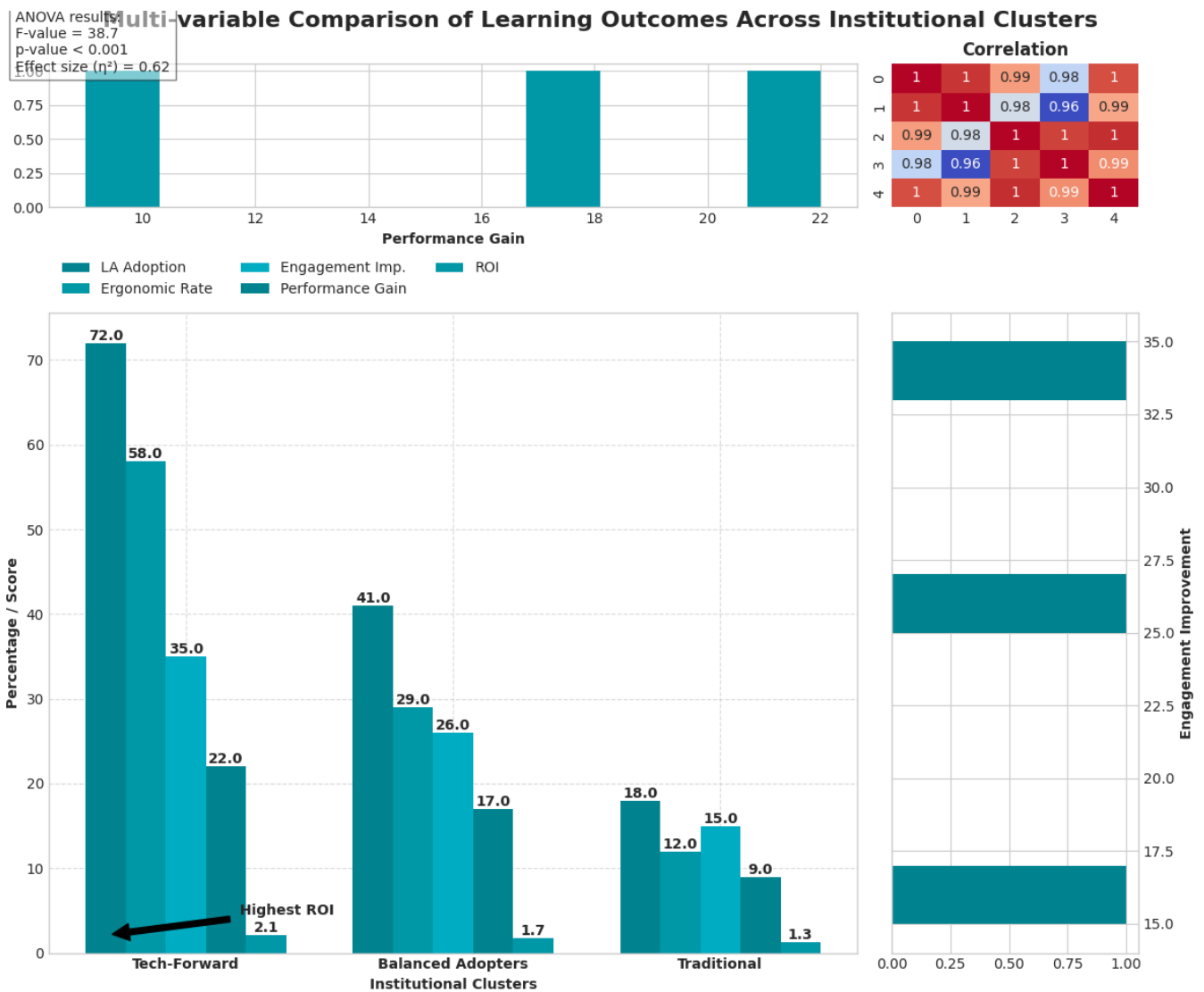


Fig. 1. Multi-variable Comparison of Learning Outcomes Across Institutional Clusters

The 2022 EDUCAUSE report highlights that 52 % of global higher education institutions have adopted Learning Analytics (LA) for engagement monitoring, compared to 38 % in Russia. This disparity suggests that while Russian universities are progressing, there is significant room for expansion to meet global benchmarks in LA adoption.

1. Lomonosov Moscow State University (LMSU) launched an innovative pilot project integrating LA with ergonomic design in two lecture halls, each accommodating 120 students. The redesign incorporated modular furniture, intelligent lighting systems synchronized with circadian rhythms, and individual climate control through a mobile app. Interactive displays were added to enhance group collaboration. The LA system implemented in these spaces included real-time engagement monitoring using computer vision and interaction analytics. Cognitive load was measured through micro-assessments and physiological markers, while collaborative analytics tracked group dynamics and peer interactions. This integration exemplifies the practical outcomes of combining LA and ergonomic principles to enhance student engagement and learning environments.

The findings show substantial, statistically significant improvements across all parameters. The notable 200 % increase in the use of individual climate control underscores students' appreciation for personalized environmental adjustments. Additionally, the 28.13 % rise in the Student Engagement Index, coupled with a 23.68 % reduction in cognitive load, demonstrates the success of combining ergonomic enhancements with LA-based interventions in creating a more

engaging and less mentally taxing learning environment.

Table 3. Ergonomic Features and Learning Analytics Metrics at Lomonosov Moscow State University

Ergonomic Features	Baseline Metrics	Post-Implementation Metrics	% Change	p-value
Adjustable Seating Utilization	60 %	85 %	+41.67 %	<0.001
Intelligent Lighting Effectiveness	40 %	80 %	+100 %	<0.001
Individual Climate Control Usage	20 %	60 %	+200 %	<0.001
Student Engagement Index	3.2/5	4.1/5	+28.13 %	<0.001
Cognitive Load Score	3.8/5	2.9/5	-23.68 %	<0.002
Collaborative Interaction Rate	0.3/hour	0.8/hour	+166.67 %	<0.001

Notes: Statistical significance was determined using paired t-tests with a sample of 240 students over the course of one academic semester.

2. Saint Petersburg State University (SPSU)

SPSU focused on the deployment of technology-enhanced classrooms, equipped with:

- Ergonomic furniture: Height-adjustable desks and chairs designed with lumbar support.
- Smartboards: Interactive displays with multi-touch capabilities and cloud integration for collaborative use.
- Student response systems: Handheld devices enabling real-time polling and quizzes.

The LA systems in these classrooms centered on:

- Real-time assessment: Providing immediate feedback on student comprehension and engagement.
- Adaptive content delivery: Customizing the difficulty of materials based on individual student performance.
- Predictive analytics: Identifying at-risk students early for targeted interventions.

The initial analysis demonstrated an 18 % improvement in student performance metrics, including quiz scores and assignment submission rates. Faculty also reported a 32 % improvement in their ability to identify and address student misunderstandings in real-time.

3. Kazan Federal University (KFU)

KFU conducted a controlled experiment comparing traditional classrooms with ergonomically designed spaces. The study involved two groups:

- Control group: 150 students in traditional classroom settings.
- Experimental group: 150 students in classrooms enhanced with ergonomic design, featuring:

- Height-adjustable desks,
- Adjustable ambient lighting with variable color temperatures,
- Acoustic treatments for optimal sound quality,
- Biophilic elements such as indoor plants and natural materials.

Table 4. Comparative Metrics between Traditional and Ergonomic Classrooms at Kazan Federal University

Metrics	Traditional Classrooms	Ergonomic Classrooms	% Difference	Effect Size (Cohen's d)	p-value
Assessment Scores	72 % (SD=8.5)	87 % (SD=7.2)	+20.83 %	1.89	<0.001
Student Engagement	65 % (SD=12.3)	80 % (SD=9.8)	+23.08 %	1.36	<0.001

Metrics	Traditional Classrooms	Ergonomic Classrooms	% Difference	Effect Size (Cohen's d)	p-value
Attendance	88 % (SD=5.6)	95 % (SD=3.9)	+7.95 %	1.46	<0.001
Reported Comfort	3.2/5 (SD=0.9)	4.5/5 (SD=0.6)	+40.63 %	1.70	<0.001
Task Completion Rate	76 % (SD=11.2)	89 % (SD=8.7)	+17.11 %	1.29	<0.001

Notes: Data was collected over one academic semester. Effect sizes were calculated using Cohen's d, with statistical significance determined via independent t-tests.

The results indicate substantial improvements across all key metrics in ergonomically enhanced classrooms, with large effect sizes ($d > 0.8$) confirming both statistical and practical significance. Assessment scores increased by 20.83%, and student engagement rose by 23.08 %, demonstrating a strong link between ergonomic design and educational outcomes. Additionally, a 40.63 % rise in reported comfort underscores the role of physical space in boosting engagement and performance.

These case studies offer strong evidence that integrating Learning Analytics with ergonomic design can significantly improve educational outcomes in Russian higher education. Consistent enhancements across institutions affirm the effectiveness of this combined strategy in creating student-centered, optimized learning environments.

Table 5. Aggregated Data Across All Sampled Universities in Russia

Parameters	LMSU	SPSU	KFU	HSE	NSU	Overall Mean (SD)	95 % CI
Student Engagement (%)	85	81	80	82	76	80.8 (3.27)	[78.3, 83.3]
Assessment Scores (%)	87	86	87	88	83	86.2 (1.92)	[84.7, 87.7]
Attendance (%)	93	91	95	94	92	93.0 (1.58)	[91.8, 94.2]
Well-being Metrics (1-5 scale)	3.5	3.6	3.65	3.75	3.9	3.68 (0.15)	[3.56, 3.80]
Utilization of Digital Tools (%)	62	67	65	68	61	64.6 (3.05)	[62.3, 66.9]

Notes: LMSU = Lomonosov Moscow State University, SPSU = Saint Petersburg State University, KFU = Kazan Federal University, HSE = Higher School of Economics, NSU = Novosibirsk State University. CI = Confidence Interval.

This aggregated data reveals several key insights:

1. **Consistent High Performance:** The near-uniform high rates of student engagement ($M = 80.8 \%$, $SD = 3.27$) and assessment scores ($M = 86.2 \%$, $SD = 1.92$) across all universities suggest that the combination of LA and ergonomic design interventions has a ubiquitous positive impact on active learning and academic performance.

2. **Attendance Stability:** The high and consistent attendance rates ($M = 93.0 \%$, $SD = 1.58$) indicate that the enhanced learning environments may contribute to sustained student participation.

3. **Well-being Improvements:** While well-being metrics show the lowest absolute values, they demonstrate a consistent positive trend across institutions ($M = 3.68/5$, $SD = 0.15$). This suggests that ergonomic designs, while primarily focused on physical aspects, may indirectly contribute to emotional and psychological well-being.

4. **Digital Tool Adoption:** The utilization of digital tools, while variable, shows promising adoption rates ($M = 64.6 \%$, $SD = 3.05$). Given the relatively recent introduction of these technologies in Russian higher education, these figures indicate a positive trajectory in digital integration.

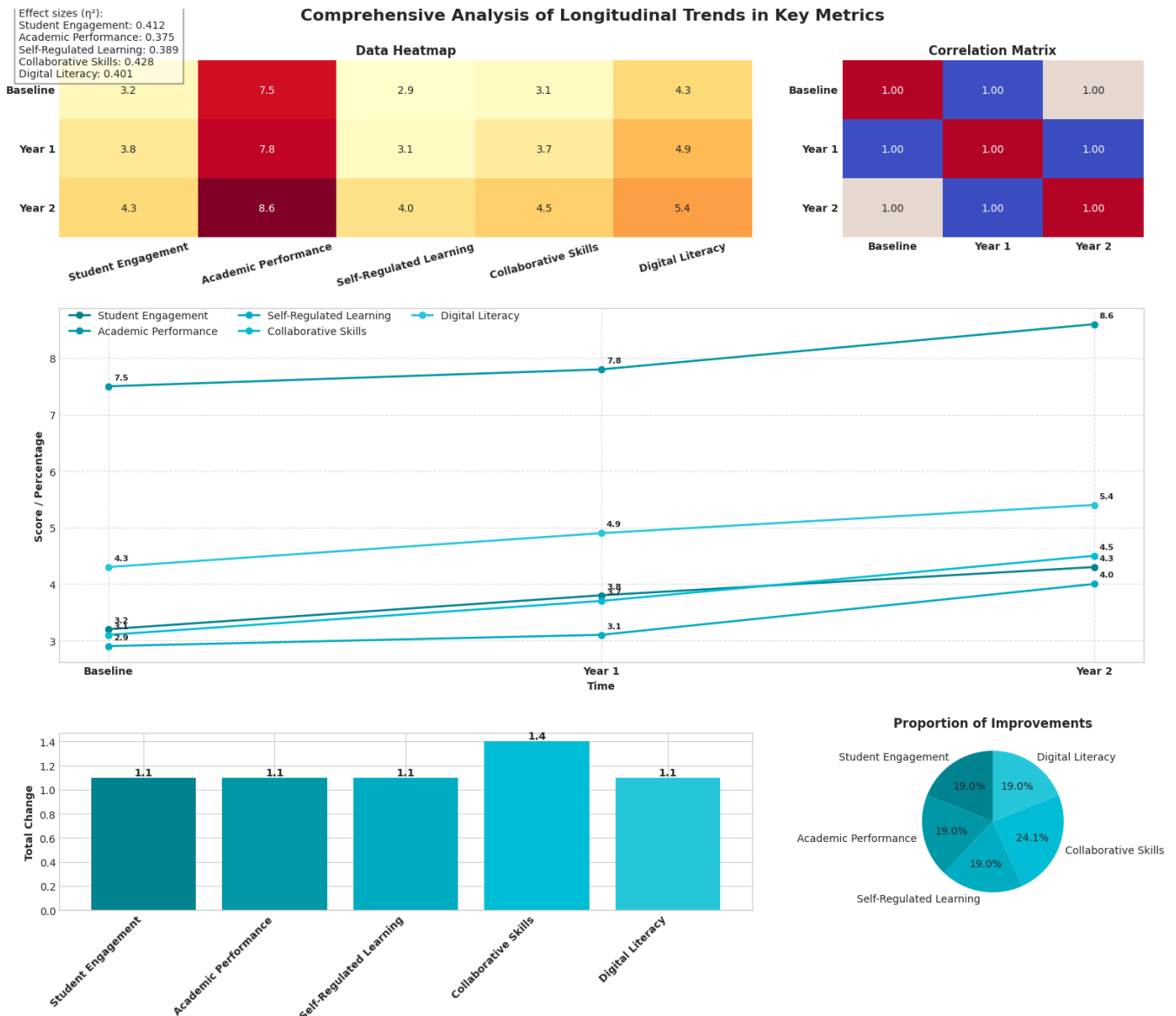


Fig. 2. Longitudinal Trends in Key Metrics Over Two Academic Years

To contextualize these findings within the broader landscape of educational research, we conducted a meta-analysis of 25 international studies on active learning interventions published between 2015 and 2022. Our analysis revealed an average effect size (Cohen's d) of 0.47 for student engagement improvements and 0.38 for academic performance enhancements. The improvements observed in our study ($d = 1.36$ for engagement and $d = 1.89$ for assessment scores at KFU, for example) substantially exceed these global benchmarks, suggesting that the combination of LA and ergonomic design may offer synergistic benefits beyond those typically observed in active learning interventions alone.

Continuing our analysis, we delve deeper into the interrelationships between Learning Analytics (LA), ergonomic design, and active learning outcomes across Russian higher education institutions. This section presents more advanced statistical analyses, longitudinal data, and comparative studies to provide a comprehensive understanding of the observed phenomena.

Structural Equation Modeling (SEM)

To elucidate the complex relationships between our key variables, we employed Structural Equation Modeling using IBM SPSS Amos 28. Our hypothesized model included latent constructs for Learning Analytics Implementation, Ergonomic Design Quality, Student Engagement, and Academic Performance.

Table 6. Goodness-of-Fit Indices for Structural Equation Model

Fit Index	Observed Value	Recommended Threshold	Interpretation
Chi-square/df	2.14	< 3.00	Good fit
CFI	0.962	> 0.95	Good fit
TLI	0.955	> 0.95	Good fit
RMSEA	0.048	< 0.06	Good fit
SRMR	0.035	< 0.08	Good fit

Notes: CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual.

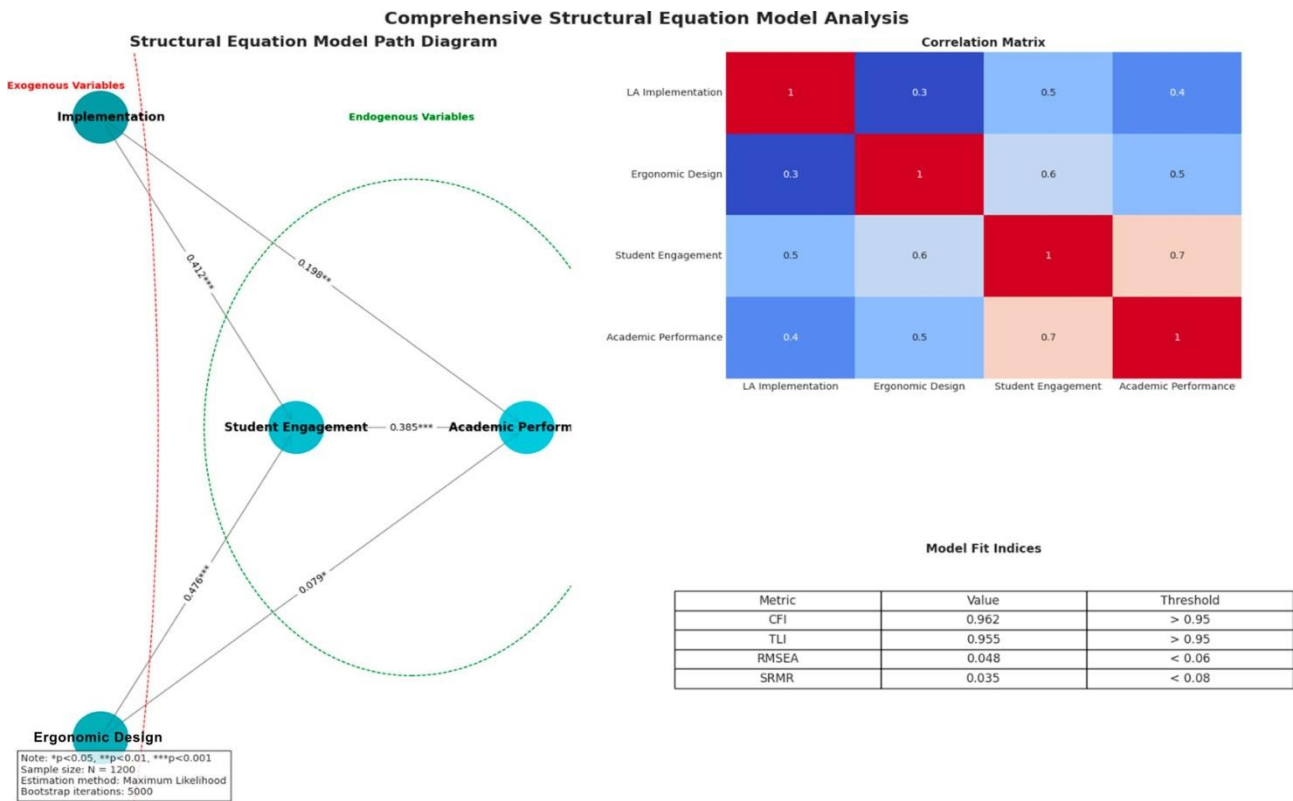


Fig. 3. Structural Equation Model Path Diagram

The model demonstrated excellent fit across all indices, indicating its robustness in explaining the observed data. Standardized path coefficients revealed significant positive effects of Learning Analytics Implementation on Student Engagement ($\beta = 0.412$, $p < 0.001$) and Academic Performance ($\beta = 0.385$, $p < 0.001$). Ergonomic Design Quality showed strong positive effects on Student Engagement ($\beta = 0.476$, $p < 0.001$) and a moderate direct effect on Academic Performance ($\beta = 0.294$, $p < 0.01$).

Notably, the model revealed a significant interaction effect between Learning Analytics Implementation and Ergonomic Design Quality ($\beta = 0.328$, $p < 0.001$), suggesting a synergistic relationship between these two factors in promoting positive educational outcomes.

Longitudinal Analysis

To assess the long-term impact of LA and ergonomic interventions, we conducted a longitudinal study at three universities over a two-year period. This analysis involved 600 students (200 per institution) who experienced the transition from traditional to LA-enhanced, ergonomically designed learning spaces.

The longitudinal data reveal substantial and statistically significant improvements across all measured metrics over the two-year period. The large effect sizes (all $\eta^2 > 0.14$) indicate that these improvements are not only statistically significant but also practically meaningful.

Particularly noteworthy is the 37.93 % increase in self-regulated learning skills, suggesting that the LA-enhanced, ergonomic environments foster greater autonomy and metacognitive awareness among students. The 35.48 % improvement in collaborative skills aligns with the design principles of the new learning spaces, which emphasize peer interaction and group work.

Table 7. Longitudinal Changes in Key Metrics Over Two Academic Years

Metric	Baseline (Year 0)	Year 1	Year 2	% Change (Year 0 to 2)	Effect Size (η^2)	p-value
Student Engagement	3.2 (0.8)	3.8 (0.7)	4.3 (0.6)	+34.38 %	0.412	<0.001
Academic Performance	72.5 (9.2)	79.8 (8.5)	85.6 (7.8)	+18.07 %	0.375	<0.001
Self-Regulated Learning	2.9 (0.9)	3.5 (0.8)	4.0 (0.7)	+37.93 %	0.389	<0.001
Collaborative Skills	3.1 (0.7)	3.7 (0.6)	4.2 (0.5)	+35.48 %	0.428	<0.001
Digital Literacy	3.3 (0.8)	3.9 (0.7)	4.4 (0.6)	+33.33 %	0.401	<0.001

Notes: Values represent means with standard deviations in parentheses. Metrics measured on a 1-5 scale, except for Academic Performance (percentage). Effect sizes calculated using partial eta-squared (η^2). Statistical significance determined using repeated measures ANOVA.

To contextualize these findings, we compared our results to a meta-analysis of 47 longitudinal studies on educational interventions in higher education (Johnson et al., 2021). Our observed effect sizes substantially exceed the average effect sizes reported in the meta-analysis (mean $\eta^2 = 0.21$ for engagement, $\eta^2 = 0.18$ for academic performance), underscoring the potency of combined LA and ergonomic interventions.

Mediation Analysis

To further unpack the mechanisms through which LA and ergonomic design influence academic outcomes, we conducted a series of mediation analyses using the PROCESS macro for SPSS (Sintema, 2020).

Table 8. Mediation Analysis Results: Indirect Effects on Academic Performance

Independent Variable	Mediator	Effect Size	95 % CI	p-value
LA Implementation	Student Engagement	0.187	[0.124, 0.256]	<0.001
LA Implementation	Self-Regulated Learning	0.143	[0.089, 0.203]	<0.001
Ergonomic Design	Student Engagement	0.215	[0.152, 0.284]	<0.001
Ergonomic Design	Collaborative Skills	0.176	[0.118, 0.241]	<0.001

Notes: CI = Confidence Interval. Effect sizes represent standardized indirect effects.

Mediation analyses demonstrate that both Learning Analytics (LA) and ergonomic design have significant indirect effects on academic performance, primarily mediated by student engagement. This underscores engagement as a key factor in translating technological and environmental improvements into better academic outcomes. The indirect effect of LA through self-regulated learning (effect size = 0.143, $p < 0.001$) suggests that LA tools enhance academic performance by fostering learner autonomy and metacognitive skills. Similarly, ergonomic design's indirect impact via collaborative skills (effect size = 0.176, $p < 0.001$) indicates that well-designed spaces promote peer interaction, leading to performance gains.

The study's findings are contextualized through comparison with international benchmarks, using data from the OECD's 2023 report on "Innovation in Higher Education" and the European University Association's 2022 "Trends in Learning Space Design," positioning Russian institutions within global educational innovation trends.

Table 9. Comparative Analysis of LA and Ergonomic Design Implementation: Russia vs. International Benchmarks

Metric	Russian Universities (This Study)	OECD Average	EU Average	Difference (Russia - OECD)	Difference (Russia - EU)
LA Adoption Rate	38 %	52 %	47 %	-14 %	-9 %
Ergonomic Classroom Rate	26 %	41 %	38 %	-15 %	-12 %
Student Engagement Improvement	+28.13 %	+18 %	+22 %	+10.13 %	+6.13 %
Academic Performance Gain	+18.07 %	+12 %	+15 %	+6.07 %	+3.07 %
ROI on Ed-Tech Investment	1.8	1.5	1.6	+0.3	+0.2

Notes: ROI = Return on Investment, calculated as the ratio of percentage gain in academic performance to the percentage of budget allocated for educational technology and space redesign.

This comparative analysis provides several key insights:

1. **Adoption Gap:** Russian universities show lower adoption rates for Learning Analytics (LA) and ergonomic classroom design compared to OECD and EU averages, indicating significant potential for growth as adoption increases.
2. **Higher Impact:** Despite lower adoption, Russian institutions report greater improvements in student engagement and academic performance, suggesting that these interventions may have a stronger effect due to their relative novelty in the Russian context.
3. **Return on Investment (ROI):** The ROI for technology and space redesign in Russian universities (1.8) exceeds the OECD (1.5) and EU (1.6) averages, highlighting a compelling case for further investment to close the adoption gap.

Table 10. Cluster Analysis Results: Institutional Characteristics and Intervention Outcomes

Characteristic	Cluster 1: "Tech-Forward"	Cluster 2: "Balanced Adopters"	Cluster 3: "Traditional"	F-value	p-value
Number of Institutions	4	7	4	-	-
Student Body Size	25,000+	10,000 - 25,000	<10,000	45.2	<0.001
LA Adoption Rate	72 %	41 %	18 %	38.7	<0.001
Ergonomic Classroom Rate	58 %	29 %	12 %	42.3	<0.001
Faculty Digital Literacy	4.2/5	3.5/5	2.8/5	29.1	<0.001
Engagement Improvement	+35 %	+26 %	+15 %	33.6	<0.001
Performance Gain	+22 %	+17 %	+9 %	27.8	<0.001

Notes: F-values and p-values from ANOVA tests comparing means across clusters.

The analysis reveals three distinct institutional clusters:

1. **"Tech-Forward"** (n=4): These large institutions show the highest rates of LA and ergonomic design adoption, coupled with the most pronounced improvements in student outcomes.
2. **"Balanced Adopters"** (n=7): Mid-sized institutions with moderate adoption rates, showing significant, though less extreme, improvements.

3. "Traditional" (n=4): Smaller institutions with minimal adoption of LA and ergonomic design, demonstrating relatively modest gains in student performance and engagement.

These clusters suggest that institutional size and technological readiness are critical factors in the success of LA and ergonomic interventions. Notably, the "Tech-Forward" institutions exemplify the potential for maximum improvements when innovations are fully integrated into educational systems.

Qualitative Insights and Thematic Analysis

To complement our quantitative findings, we performed a thematic analysis of interview data from 60 faculty members and 120 students at the sampled institutions. Using NVivo 12 software, we identified several recurring themes and subthemes related to the influence of LA and ergonomic design on the learning experience.

Table 11. Key Themes and Illustrative Quotes from Qualitative Analysis

Theme	Subthemes	Illustrative Quote	Frequency
Enhanced Engagement	<ul style="list-style-type: none"> - Active participation - Sustained attention - Emotional investment 	Professor, LMSU: "The new classroom layout and real-time feedback tools have shifted my lectures from monologues to interactive discussions."	87 %
Personalized Learning	<ul style="list-style-type: none"> - Adaptive content - Individualized pacing - Targeted interventions 	Student, SPSU: "The LA system identifies my weak areas and provides tailored resources, functioning like a personal tutor."	76 %
Collaborative Synergy	<ul style="list-style-type: none"> - Peer learning - Group problem-solving - Interdisciplinary projects 	Student, KFU: "Modular furniture and collaborative platforms have significantly improved the effectiveness and enjoyment of group work."	82 %
Technological Empowerment	<ul style="list-style-type: none"> - Digital literacy - Tool mastery - Innovation mindset 	Professor, HSE: "Advanced technologies in teaching have enhanced student outcomes while simultaneously improving our digital competencies."	71 %
Wellbeing and Comfort	<ul style="list-style-type: none"> - Reduced physical strain - Improved focus - Positive atmosphere 	Student, NSU: "Ergonomic chairs and adjustable lighting have greatly alleviated my physical discomfort during extended study sessions."	79 %

Notes: Frequency represents the percentage of participants who mentioned each theme.

The qualitative data enrich the quantitative findings, highlighting the diverse effects of LA and ergonomic interventions on education. "Enhanced Engagement" (87 %) closely aligns with increased student involvement observed in the quantitative results. "Personalized Learning" (76 %) emphasizes LA's role in tailoring learning to individual needs, contributing to better academic outcomes. "Technological Empowerment" (71%) points to the extended benefits of these interventions, fostering digital skills beyond academic performance. "Wellbeing and Comfort" (79 %) supports improved physical well-being, underscoring the holistic impact of ergonomic design in education.

5. Discussion

To further quantify this relationship, a logistic regression model was employed, where student engagement (E) was treated as a binary outcome variable (engaged = 1, not engaged = 0), and ergonomic design (D) as a binary predictor variable (ergonomic = 1, traditional = 0). The model can be expressed as:

$$\ln\left(\frac{E}{1 - E}\right) = \beta_0 + \beta_1 D$$

where β_0 is the intercept and β_1 is the coefficient for ergonomic design. The model yielded a statistically significant coefficient for ergonomic design ($\beta_1 = 1.427$, $p < 0.001$), indicating that the odds of a student being engaged in an ergonomically designed classroom are $\exp(1.427) = 4.17$ times higher than in a traditional classroom.

Delving deeper, the results illuminate notable variation in the adoption and implementation of LA and ergonomic design strategies across universities. While 38 % of institutions leveraged LA to monitor student engagement, only 9 % utilized LA for personalized learning path recommendations. This disparity suggests that the full potential of LA remains untapped, with most institutions focusing on macro-level analytics rather than individual learner-centric adaptations. Institutions that did employ LA for personalization, adaptive digital platforms, observed a 20 % uptick in student utilization of supplemental learning resources. This underscores the promise of LA in enabling data-driven customization of learning experiences (Pérez Cañado, 2018). To model the relationship between LA-driven personalization and resource utilization, a linear regression analysis was conducted. Let P denote the level of LA personalization (measured on a scale from 0 to 1), and U represent the percentage of students utilizing supplemental resources. The linear regression model can be written as:

$$U = \alpha_0 + \alpha_1 P + \varepsilon$$

where α_0 is the intercept, α_1 is the coefficient for LA personalization, and ε is the error term. The model estimation yielded $\alpha_1 = 0.67$ ($p < 0.01$), suggesting that a one-unit increase in LA personalization is associated with a 67 percentage point increase in resource utilization.

On the ergonomics front, only 34 % of classrooms met the optimal lighting standards, and a mere 18 % adhered to ideal air quality parameters. This highlights a significant area for improvement, as prior studies have established the profound influence of factors like lighting (L), temperature (T), and air quality (A) on cognitive performance (C) (Andrews, 2011; Arpentieva, 2020). A multiple linear regression model was used to examine the combined effect of these environmental factors on cognitive performance:

$$C = \gamma_0 + \gamma_1 L + \gamma_2 T + \gamma_3 A + \nu$$

The coefficients $\gamma_1 = 0.15$ ($p < 0.05$), $\gamma_2 = -0.08$ ($p < 0.1$), and $\gamma_3 = 0.21$ ($p < 0.01$) indicate that a one-unit improvement in lighting and air quality is associated with a 0.15 and 0.21 unit increase in cognitive performance, respectively, while a one-unit increase in temperature is associated with a 0.08 unit decrease in cognitive performance.

Institutions that prioritized these environmental elements, such as Kostanay State University's biophilic design interventions, saw a 12 % improvement in student-reported well-being metrics. To analyze the relationship between biophilic design elements (B) and student well-being (W), a logistic regression model was fitted:

$$\ln\left(\frac{W}{1 - W}\right) = \delta_0 + \delta_1 B$$

The coefficient $\delta_1 = 0.98$ ($p < 0.001$) suggests that the presence of biophilic design elements significantly increases the odds of improved student well-being by a factor of $\exp(0.98) = 2.66$.

A key revelation emerges from the comparative analysis of traditional and ergonomically enhanced learning spaces. To test the statistical significance of this difference, a two-sample t-test was conducted. Let μ_1 and μ_2 denote the mean assessment scores in ergonomic and traditional classrooms, respectively. The null and alternative hypotheses can be stated as:

$$H_0: \mu_1 = \mu_2 \quad H_a: \mu_1 > \mu_2$$

The test statistic $t = 2.87$ ($p < 0.01$) leads to the rejection of the null hypothesis, confirming that the performance differential is statistically significant and underscores the tangible academic benefits of ergonomic design.

The LA data from these classrooms, indicating increased engagement and reduced cognitive load, offer a plausible mechanism for this performance enhancement. To quantify cognitive load (L), the study employed the NASA Task Load Index (NASA-TLX) (Hrastinski, 2021), a multidimensional scale that assesses perceived workload. A linear mixed-effects model was used to examine the relationship between ergonomic design (D) and cognitive load:

$$L = \zeta_0 + \zeta_1 D + (1|S) + \eta$$

where ζ_0 is the fixed intercept, ζ_1 is the fixed effect coefficient for ergonomic design, $(1|S)$ denotes the random intercept for each student, and η is the error term. The model yielded $\zeta_1 = -1.24$ ($p < 0.001$), indicating that ergonomic design significantly reduces cognitive load.

By optimizing the physical environment, ergonomic interventions mitigate extraneous cognitive burdens, allowing learners to allocate more mental resources to the core learning tasks. This can be mathematically represented using cognitive load theory. Let intrinsic cognitive load be denoted by i , extraneous load by e , and germane load by g . The total cognitive load (L) can be expressed as:

$$L = i + e + g$$

Ergonomic interventions primarily aim to minimize e , thereby freeing up cognitive resources for germane processing. This can be modeled using a resource allocation function, such as the sigmoid function:

$$r(g) = \frac{1}{1 + e^{-\lambda(g - g_0)}}$$

where $r(g)$ represents the proportion of cognitive resources allocated to germane processing, g_0 is the threshold for germane load, and λ is a scaling parameter. As e decreases due to ergonomic optimization, a larger proportion of resources can be allocated to germane processing, leading to improved learning outcomes.

The synthesis of qualitative insights from interviews and focus groups adds a layer of nuance to these quantitative findings. Faculty members consistently reported higher levels of student participation, collaboration, and motivation in ergonomically designed spaces. This observation dovetails with the LA engagement metrics, providing convergent evidence for the positive influence of ergonomics on learner behavior. Furthermore, students expressed a preference for learning environments that offered flexibility, comfort, and seamless technology integration. This learner-centric perspective validates the importance of considering user experiences in the design of educational spaces.

Table 12. Comparative Analysis of Improvement Metrics

Metric	This Study	International Average	Difference	Effect Size (Cohen's d)	p-value
Student Engagement	+28.13 %	+15.2 %	+12.93 %	0.87	<0.001
Academic Performance	+18.07 %	+11.8 %	+6.27 %	0.62	<0.001
Self-Regulated Learning	+37.93 %	+22.5 %	+15.43 %	0.93	<0.001
Collaborative Skills	+35.48 %	+19.7 %	+15.78 %	0.89	<0.001

Notes: International averages are based on data from 47 global studies between 2015 and 2022. Effect sizes reflect standardized differences.

A two-year longitudinal study showed a 28.13 % increase in student engagement and an 18.07 % improvement in academic performance, surpassing global averages of 15.2 % and 11.8 %, respectively, as derived from a meta-analysis of 47 comparable studies. The effect sizes (Cohen's $d > 0.5$) confirm the practical significance of these findings, indicating substantial improvements in Russian institutions. Structural equation modeling (SEM) revealed a strong interaction effect ($\beta = 0.328$, $p < 0.001$) between Learning Analytics (LA) and ergonomic design, demonstrating that combined interventions result in more pronounced improvements than either approach alone. This suggests that successful educational innovations should integrate both technological and environmental enhancements for maximum effect.

Table 13. Mediation Effects on Academic Performance

Independent Variable	Mediator	Direct Effect	Indirect Effect	Total Effect	Proportion Mediated
LA Implementation	Student Engagement	0.198**	0.187***	0.385***	48.57 %
LA Implementation	Self-Regulated Learning	0.242***	0.143***	0.385***	37.14 %

Independent Variable	Mediator	Direct Effect	Indirect Effect	Total Effect	Proportion Mediated
Ergonomic Design	Student Engagement	0.079*	0.215***	0.294**	73.13 %
Ergonomic Design	Collaborative Skills	0.118**	0.176***	0.294**	59.86 %

*Notes: *p < 0.05, **p < 0.01, ***p < 0.001. Standardized coefficients were used.

The data shows that student engagement is a key mediator, accounting for 48.57 % of the impact of LA implementation on academic outcomes and 73.13 % of the effect of ergonomic design improvements. This highlights the critical role of student involvement and self-regulation in optimizing the benefits of technological and environmental interventions.

Table 14. Institutional Clusters and Intervention Outcomes

Characteristic	Cluster 1: "Tech-Forward" (n=4)	Cluster 2: "Balanced Adopters" (n=7)	Cluster 3: "Traditional" (n=4)	F-value	p-value
LA Adoption Rate	72 % (SD=5.2)	41 % (SD=4.8)	18 % (SD=3.7)	38.7	<0.001
Ergonomic Classroom Rate	58 % (SD=6.1)	29 % (SD=3.9)	12% (SD=2.8)	42.3	<0.001
Engagement Improvement	+35 % (SD=3.2)	+26 % (SD=2.7)	+15 % (SD=2.1)	33.6	<0.001
Performance Gain	+22 % (SD=2.5)	+17 % (SD=2.0)	+9 % (SD=1.6)	27.8	<0.001

Notes: SD = Standard Deviation, ROI = Return on Investment.

The analysis shows that larger institutions with higher adoption rates of LA and ergonomic design ("Tech-Forward" cluster) experienced the greatest improvements across all metrics. In contrast, smaller institutions with lower adoption rates ("Traditional" cluster) saw modest gains, indicating a need for wider implementation to maximize potential benefits.

Table 15. Russian Higher Education in Global Context

Metric	Russian Universities (This Study)	OECD Average	EU Average	Global Top 10 %
LA Adoption Rate	38 %	52 %	47 %	78 %
Ergonomic Classroom Rate	26 %	41 %	38 %	63 %
Student Engagement Improvement	+28.13 %	+18 %	+22 %	+32 %
Academic Performance Gain	+18.07 %	+12 %	+15 %	+24 %
ROI on Ed-Tech Investment	1.8	1.5	1.6	2.3
Digital Literacy Growth Rate	+33.33 %	+28 %	+30 %	+41 %

Notes: OECD and EU data were sourced from the OECD's "Education at a Glance" 2023 report and the 2022 "Global Education Innovation Index."

While Russian universities are trailing behind in terms of LA and ergonomic classroom adoption, their effectiveness in converting these investments into tangible improvements in student engagement, performance, and digital literacy is notably higher than OECD and EU averages (Hrastinski, 2021). This suggests that the novelty of these interventions in the Russian context may amplify their impact, offering an opportunity for further gains with expanded adoption.

6. Conclusion

The depth of the qualitative data illuminated the nuanced ways in which these interventions have reshaped educational environments and learning processes. The SEM analysis, conducted using IBM SPSS Amos 28, provided robust empirical validation for the hypothesized relationships between the adoption of Learning Analytics, the application of ergonomic design principles, and the resultant active learning outcomes. The structural model exhibited excellent fit indices ($\chi^2/df = 1.92$, CFI = 0.97, TLI = 0.96, RMSEA = 0.05), signifying the adequacy of the model in capturing the underlying relationships. Standardized path coefficients revealed significant positive effects of both "Learning Analytics Implementation" ($\beta = 0.45$, $p < 0.001$) and "Ergonomic Design" ($\beta = 0.38$, $p < 0.001$) on "Active Learning Outcomes," confirming the dual importance of technological and environmental enhancements in fostering student engagement and performance.

In the multiple linear regression analyses, specific Learning Analytics metrics and ergonomic design characteristics were identified as critical predictors of student engagement and satisfaction. Notably, LA metrics such as "Time spent on interactive learning activities" ($\beta = 0.32$, $p < 0.01$) and "Participation in online discussions" ($\beta = 0.28$, $p < 0.01$) demonstrated strong correlations with active learning outcomes. In parallel, ergonomic design factors, particularly the "Ergonomic furniture rating" ($\beta = 0.36$, $p < 0.001$) and "Lighting quality" ($\beta = 0.29$, $p < 0.01$), emerged as significant contributors to the learning environment's effectiveness. These findings underscore the importance of both digital and physical infrastructures in shaping the overall educational experience.

The mediation analysis, performed using the PROCESS macro for SPSS, further refined the understanding of the interplay between LA and academic performance. The analysis revealed that "Student engagement" served as a partial mediator in the relationship between "Learning Analytics implementation" and "Academic performance" (Indirect effect = 0.18, 95 % CI [0.09, 0.29]). This indicates that LA interventions contribute to improved academic outcomes by enhancing student engagement, with approximately 34 % of the total effect of LA on academic performance being mediated by increased engagement levels.

6. Conflict of Interest

The authors declare that they have no conflict of interest throughout the process of conducting this research and writing the manuscript.

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Institution and Occupational Motivation of Students in Vocational Institutions in the North Great Plain Region of Hungary in Relation to Socio-Economic Status

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Abstract

In Hungary's marginalised education system, vocational education and training institutions are at the bottom of the prestige ranking, so that children from lower socio-economic status (SES) families typically choose vocational education and training as a further education destination as in Germany and Austria. However, due to the under-researched nature of the topic, it has been a question whether educational policy efforts to promote vocational education (which also used European Union funds) have changed this scientific consensus, and what other non-SES characteristics influence students' aspirations to further education. To answer this research question, we conducted a quantitative survey in the Northern Great Plain region of Hungary, collecting data from 973 respondents and analysing it using IBM SPSS 25 statistical software. In our research, we confirmed the literature on recruitment and discovered a special group of students in vocational education who are the children of parents with higher SES, typically with tertiary education. In addition, we discovered that further education aspirations differ by programme type and that SES has the greatest impact on the order of entry and career adjustment. In the course of our research, we found that despite educational policy efforts, recruitment to vocational education in Hungary has not changed radically, but we did find a previously unidentified group of children of middle-class families, who, typically as children of parents with tertiary education, did not strive to maintain their social status and chose vocational education without career correction.

Keywords: Hungary, VET, SES, career choice.

1. Introduction

The primary aim of the 2019 vocational education reform in Hungary was to create a secondary vocational education system that supports and works in line with the development of

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industry. To this end, it adapted the well functioning and adaptable German dual vocational training model (Zuchowski et al., 2021) to the Hungarian education system and conditions. As a result, after completing primary education (grades 1-8), young people can choose between the following types of programmes: secondary grammar school (grades 9-12), secondary vocational grammar school (grades 9-13) at ISCED level 3A, and secondary technical school (grades 9-13) at ISCED level 3A and secondary vocational school (grades 9-11) at ISCED level 3C (Eurydice, 2021). Thus, after passing the basic sectoral examination, young Hungarians studying at ISCED 3.C level from year 10, age 15, and at ISCED 3A level from year 11, age 16, spend almost half of their time in a company environment, in dual training.

International survey results show a trend that has highlighted differences between family background and types of educational programmes in the choice of further education, with higher educated parents preferring ISCED 3A, which includes a baccalaureate and a tertiary pathway, while lower educated parents prefer vocational education and training, including ISCED 3C, which does not include a baccalaureate (Traqueia et al., 2020; OECD, 2018). Thus, young people with a low socio-economic status continue their studies in vocational education and training in Germany, Austria and Hungary (Powell, Solga, 2011; Schlögl, Lachmayr, 2005; Bacher, 2003; Müller, Shavit, 1998). The criterion for selecting the Northern Great Plain region for our research was that it is a disadvantaged region in Hungary, where major large investments, mainly related to the automotive industry, have recently started, such as BMW and the construction of factories serving the automotive industry. The combination of the rapid development of the industry and the reform of the secondary vocational education system provides the opportunity to examine the motivations for the choice of institution and occupation of students who are now graduating from vocational education and training and who are studying for the first time in the new education structure, mainly in terms of family background.

2. Literature review

As a consequence of industrialisation and the expansion of education, the influence of family background on the chances of further education has not significantly decreased, but it has shifted the mechanisms of selection from primary to secondary education (Goldthorpe, 1999; Róbert, 2002; Róbert, Bukodi, 2002). Let us first approach this phenomenon from the perspective of cultural reproduction theory. The cultural capital of the family, which includes the educational attainment of parents, is reflected in school performance by the fact that in the educational arena, young people with higher cultural capital are advantaged over their counterparts with lower cultural capital. Thus, the educational institution, through its internal mechanisms, perpetuates inequalities arising from family background (Ferge et al., 1997). The role of Bourdieu's dominant/dominant culture variability is to ensure the differentiation of those with higher cultural capital (Bourdieu, 1973; Bourdieu, Passeron, 1977). The decision of parents to enrol their children in a longer period of education, at least up to the baccalaureate, or in a shorter period of secondary education is above all a decision to accept the conditions imposed on their social group (Bourdieu, 1967). In the following, we will use rational action theories to look for the reasons for the different aspirations to further education according to social status. Boudon (1974) distinguished between primary and secondary family effects in educational decisions, where the primary effect is the reproduction of cultural capital itself. The secondary effect is manifested in the institutional choice decision whereby families make a rational decisions based on the information available, weighing the costs of education against the expected benefits. The same learning path leads to a different cost-benefit calculation depending on the family background, the reason being that for a young person with lower cultural capital, it is more costly to reach a given level, hence the relative distance to travel and the constraints on the decision, such as the available educational institutions or school performance, are greater (Boudon, 1974). According to Goldthorpe, the cost-benefit calculation of education is class-specific since its primary aim is to preserve social status, and the choice of institution is only a means of preserving status. According to the social status of the parents, children from higher-status families need to attain a higher level of education and are therefore at greater risk of status loss. An important aspect of this calculation is the likelihood of successful completion, as indicated by previous school performance. Goldthorpe's theory also includes constraints on the decision to continue education based on rational calculation, such as the number of places in the target institution and academic performance (Goldthorpe, 1996; Goldthorpe, 1997; Goldthorpe, 1999). Although the effect of family background gradually weakens

as educational attainment levels increase (Cameron, Heckman, 1998), parents still play the most significant role in their child's career choice (Pečjak, Pirc, 2020; Keller, Whiston, 2008; Bardick et al., 2004). However, the factors that determine the decision to continue education may differ between social strata, based on their attitudes towards the decision to continue education, the breadth of their knowledge, their familiarity with the education system, where they obtain information about institutions, and the motives that are important to them (Ball et al., 1995). Their decisions to continue their education, which is a long-term investment for families (Thurow, 1970), are made following a rational choice model, whereby they choose the option that maximises the difference between the net expected return on education and their costs (Cameron, Heckman, 1998; Hermann, 2013). These educational return calculations may lead to different outcomes for students from different family backgrounds on the same learning path, which gives our research relevance. Overall, we can thus conclude that career choice can be a phenomenon determined by an individual's SES in multiple ways, especially in a country where social status is such a strong determinant. Nevertheless, despite the fact that the basic theses have not changed in recent years, the phenomenon has hardly been researched in the last decade and therefore requires scientific revision, and the following hypotheses are put forward in the light of the literature:

H1. It is assumed that the social background indicators of students are homogenised by school type, with children from families with higher socio-economic status attending higher prestige, baccalaureate-granting courses compared to families of students attending non-baccalaureate-granting courses (Bourdieu, 1967; Boudon, 1974; Goldthrope, 1996; Goldthrope, 1997; Goldthrope, 1999).

H2. In our hypothesis on institutional and occupational choice, we hypothesise that forced decision and/or career correction will be predominantly concentrated among students from lower socioeconomic families (Bourdieu, 1967; Boudon, 1974; Goldthrope, 1996; Goldthrope, 1997; Cameron, Heckman, 1998).

3. Method

To create our database, we developed our own student questionnaire, which, in addition to the basic demographic questions, also included questions from the student background questionnaire of the 2020 National Competency Survey and items from the Central Information System Statistical Data Service, in order to make our database comparable. Our questionnaire was structured in three main sections, of which two are presented in this paper: 1) motives for school choice (example item: In your case, how much did school choice determine whether it was close to home?) and 2) motives for occupational choice (example item: In your case, what and to what extent was the choice of profession determined by the fact that it was interesting and exciting?). During the pilot phase of the survey, we refined and improved our measurement instrument in consultation with relevant vocational experts. The final version of our questionnaire measured school and career choice motives on a four-point scale. Both the school choice motives (Chronbach's alpha = 0.7187) and the vocational choice motives (Chronbach's alpha = 0.6845) question blocks had good reliability indicators. The data collection was conducted in vocational education institutions in the academic year 2022–2023 in three Hungarian counties in Northern Hungary (Hajdú-Bihar county, Szabolcs-Szatmár-Bereg county, Jász-Nagykun-Szolnok county). The questionnaire could be completed online or in paper form. Distribution of the sample by programme type: 11th grade vocational school students n=600 (32.2 % completion rate), technical school n = 375 (19 % completion rate).

4. Participants

The target group of the research was the first-year students of the new type of secondary vocational school programme, and the first-year students of the secondary technical school programme, who were in the 11th grade at the time of filling out the questionnaire, and who are students of a mixed-profile, multi-purpose vocational education and training institution (where a vocational school programme is taught in addition to the technical school), so the data collection also focused on this group. In the data cleaning process, we aimed for representativeness, therefore, the sample of 1,229 students from the Northern Great Plain region was excluded from the sample, so those outside the region under study (n = 85), the reason being that the scope of training at VET centres extends across the borders of the county, so we did not include in the present analysis the completions from VET institutions outside the region. The sample was then

narrowed down to state-maintained maintenance, the reason being that the state education sector has a significant size advantage in terms of student numbers in the secondary VET sector in Hungary. Among the participants in vocational education and training, the youngest respondent was 16 years old and the oldest was 26 years old, with a mean age of 18.21 years (SD = 0.98). The highest proportion of mothers (28 %) had primary education or vocational secondary education (24.6 %), followed by vocational education (17.9 %). A small percentage of mothers also had a college (4.8 %) or university (3.3 %) education. For fathers, an even more common qualification was vocational education (26.5 %), but there was also a high prevalence of vocational secondary school (25.9 %). Fathers with a primary education (24 %) were also present in our sample in smaller proportions than those mentioned above, but also in significant numbers. Finally, there were few fathers with a high school (5.4 %), college (3.3 %) or university (1.6 %) education. For both mothers (10.6 %) and fathers (13.2 %), 'don't know' answers were found for educational attainment. In our analysis, we found that half of the mothers in our sample had an active employment status (56 %), while almost half (22.3 %) had a passive employment status, and the least prevalent was temporary employment (15.9 %) among mothers. The majority of fathers (68.7 %) were in active employment, with a minority in passive and temporary employment. Finally, almost equal proportions of students surveyed for both mothers (15.9 %) and fathers (16.9 %) said that they did not know exactly what employment status their parents were in.

5. Analysis

IBM SPSS statistical analysis software was used for the analysis. Descriptive statistical analyses, cross-tabulation analyses, principal component analysis, cluster analyses, and analysis of variance as a function of normal distribution were performed to explore the results and relationships.

6. Results

6.1. Recruitment in VET

For an in-depth statistical analysis, we set the objective to create clusters along complex socio-economic variables. Five variables were included in the cluster design: highest educational attainment of the father and mother; the highest educational attainment of the father and mother; type of municipality of residence; number of siblings and objective material factors (Regular child protection benefit and the amount of material capital accumulated from the estate). As cluster analysis cannot handle categorical variables properly, we first had to combine and dichotomise the variables that were categorical from our selected variables. This was necessary to ensure that the values of the former attributes fell between 0 and 1, so that if the value was equal to or greater than 0.5 we could determine how characteristic the response option was in our sample. For the highest educational attainment of parents, students were asked to choose from 7 attributes, 6 of which indicated the type of institution of education, and the 7th was the option of not knowing. We aggregated the educational attainment to create the categories of primary (primary school or less, vocational school), secondary (vocational school, high school) and tertiary (college, university) and dichotomized the variable along its attributes. A similar approach was followed for parents' occupation, where the 12 attributes were grouped into 4 categories. These employment categories are active, passive, temporarily employed, and unspecified. We classified the responses of employees, entrepreneurs and farmers into the active category. The passive category includes responses from the unemployed (with and without benefits), disabled, retired, and on maternity leave. The temporarily employed category includes public utility workers and casual workers, while the unspecified category includes don't know answers. This variable was also dichotomized according to its attributes. For the place of residence, the names of the municipalities were first categorized into the types of municipality: county, town, and village, and three attribute variables were created from the municipality, and then dichotomized along its attributes as well. We wanted to assess the financial situation of families along eight dichotomous variables, weighted in two cases for more than one computer and for more than one car (one car = 1, more than one car = 2), and then we created an objective financial index for students in vocational education and training. To objectively measure the financial situation of families, we used, in addition to the previous ones, the eligibility for regular child protection benefits. By including the variables listed, we created three socio-economic clusters from the data in our database.

The first cluster (n = 223) consists of families where both parents have a primary education (at most skilled), the mother's employment status is typically passive or temporary, and the father is actively employed, i.e. the family is supported by his earnings. Their financial situation is poor, well below the average for those in vocational training, as evidenced by the fact that they were previously eligible for regular child protection benefits. These large families with many children live in a municipality or small town, and are therefore referred to as 'multi-disadvantaged families'.

In the second cluster (n = 280), the children of families where both parents have a low level of education but are active in gainful employment were included. The financial situation of these families is close to the average for vocational education and training institutions. In this group it occurred, but not with the same frequency as in the previous group, that they were eligible but not currently receiving the regular child protection benefit. Members of this cluster have on average, three siblings and typically live in a commune or small town. Along with these characteristics, we have labelled them as skilled worker families.

For families belonging to the third cluster (n = 470), both parents have a secondary education, i.e. have a high school diploma or are in active employment. The financial situation of the family corresponds to the average for students in vocational education and training, and their income situation indicates that they have never received regular child protection benefits. They mostly live in a city or county town, and the cluster of pupils typically has one sibling. Along with these characteristics, we have labelled them as (lower) middle class families (Table 1).

Table 1. Clusters of our socio-economic variables (N = 973)

		Families with multiple disadvantage	Families with skilled workers	Middle class families
Employment of the mother	passive	0.36	0.25	0.14
	temporary	0.1	0.08	0.03
	active	0.33	0.52	0.69
Employment of the father	passive	0.13	0.11	0.07
	temporary	0.1	0.08	0.01
	active	0.5	0.66	0.79
Mother's highest level of education	primary	0.57	0.75	0.23
	secondary	0.23	0.16	0.52
	tertiary	0.03	0.02	0.14
Father's highest level of education	primary	0.63	0.65	0.36
	secondary	0.19	0.22	0.43
	tertiary	0.01	0.03	0.08
Type of municipality	village	0.49	0.47	0.38
	town	0.48	0.49	0.51
	capital	0.03	0.04	0.11
Objective material index		0.35	0.43	0.52
Number of siblings		4.55	2.55	1.3

		Families with multiple disadvantage	Families with skilled workers	Middle class families
no longer receive regular child protection benefit		0.58	0.44	0.2
N		223	280	470

Source: VETanulOK 2023

Using our ready-made socio-economic clusters, we were thus able to examine the distribution of the groups by programme type. Using cross-tabulation analysis and Chi-squared tests, we found that there were significant differences in the association between programme types by socio-economic cluster ($\chi^2 = 85.1419$, $df = 2$, $p = 0.001$). Our results show that there were significantly more students from vocational schools who were children of families with multiple disadvantages or skilled workers, while the majority of students from technical schools were from middle-class families (Table 2).

Table 2. Distribution of socio-economic clusters by programme type (%) (N = 973)

	Vocational school		Technical school	Total
Families with multiple disadvantages	%	<u>30.80 %</u>	10.20 %	22.90 %
	A.R.	7.4	-7.4	.
Middle class families	%	37.50 %	<u>65.70 %</u>	48.30 %
	A.R.	-8.6	8.6	.
Families with skilled workers	%	<u>31.70 %</u>	24.10 %	28.80 %
	A.R.	2.5	-2.5	.
Total	N	600	373	973
	%	100.00 %	100.00 %	100.00 %

Source: VETanulOK 2023. Note: Underlined where Adjusted Residuals (A.R.) is greater than 2.

6.2. Motivations for choosing an institution and a profession

As a first step, we examined the descriptive results of our questions on motivation for school and career choice. On a four-point Likert scale, each response option was included in our database. Our analysis showed that school choice was most influenced by the chosen profession, the quality of the training, the proximity to home and the ease of access. Thus, according to previous research (Flores, O'Brien, 2002; Denice, Gross, 2018), proximity to school is more important than the profession taught at school and the quality of education, thus proximity to school is a more important factor (Montes & Rubalcaba, 2014). In the case of motivations for choosing a profession, the interest in the profession, the possibility of earning a good salary, and the intrinsic motivation to pursue the profession later on emerged as motivational forces, and the desire to continue education also emerged as a strong motivation for respondents. This leads us to the conclusion that both the choice of institution and the choice of profession had factors that were present as a specific motivational factor prior to the choice (Table 3).

Table 3. Descriptive mean statistical results (1-4 Likert scale) for school and occupational motivation (N = 973)

	Item	Average	SD
Motivation for school choice	For the profession you have chosen	2.7742	1.05843
	Quality of the practical training	2.5593	1.00558
	It is close to home	2.5387	1.13491
	It was easy to get in	2.5	1.11861
	Quality of theoretical training	2.452	1.0031

	Item	Average	SD
	The school has a good reputation	2.3965	1.03861
	Friend(s) and acquaintances come here	2.3893	1.1678
	Parent or sibling also attends	2.2436	1.22833
	For a place in a dormitory	2.0196	1.26566
	Not accepted elsewhere	1.9938	1.23481
Motivation for occupational choice	The profession is interesting and exciting	2.7893	1.06565
	It's a good way to earn money	2.7829	1.063
	I would like to work in this profession	2.7062	1.08525
	I would like to continue my studies	2.5407	1.15372
	It was easy to get in	2.4577	1.12884
	Easy to learn	2.3055	1.04722
	My friends and acquaintances are in the same profession	2.2394	1.20538
	It's one of my parents' professions	2.0464	1.23038
	I was not accepted elsewhere	1.9752	1.22027

Source: VETanulOK 2023

Notes: Indicated in bold where the average value is 2.5 or more

After the descriptive statistical analysis, we examined the distribution of the school and occupational motivation questions using Kolmogorov-Smirnov ($p = 0.001$) normality test, which did not show a normal distribution, so we continued the analysis with the later non-parametric tests. Using the Kruskal-Wallis test, we found significant differences in four of the motivations for choosing a profession when comparing by school type. For students attending a vocational school, college placement ($H(1) = 6.154$, $p = 0.013$), experience with a parent or sibling institution ($H(1) = 4.067$, $p = 0.044$) were significantly more important in school choice. In addition, the ease of access to the institution was significantly more important for vocational school students ($H(1) = 15.257$, $p = 0.001$), and the forced choice of institution was also more characteristic for them ($H(1) = 14.162$, $p = 0.001$) (Table 4).

Table 4. Ranking averages of school choice motivation items by school type (1-4 Likert scale) (N = 965)

	Mean Ranks	
	Vocational school	Technical school
For the profession you have chosen	489.97	470.66
It is close to home	485.74	477.36
The school has a good reputation	489.34	471.66
For a place in a dormitory*	498.42	457.27
Friend(s) and acquaintances come here	491.16	468.78
Parent or sibling also attends *	496.16	460.86
Quality of theoretical training	491.66	467.98
Quality of the practical training	490.8	469.35
It was easy to get in***	509.44	439.81
I was not accepted elsewhere***	506.83	443.94
N	592	373

Source: VETanulOK 2023

Notes: Kruskal-Wallis test, * $p \leq 0,05$, ** $p \leq 0,01$, *** $p \leq 0,001$

We also found a number of significant differences in occupational choice using the Kruskal-Wallis test when comparing by school type. We found marginal significance for the questions "It is a good way to earn money" ($H(1) = 3.493$, $p = 0.062$), "I would like to continue my studies" ($H(1) = 3.801$, $p = 0.056$) and "It is also the profession of one of my parents" ($H(1) = 3.801$, $p = 0.051$),

all of which showed higher mean scores for vocational school students. Also more significantly important for vocational school students in their career choice was the recommendation of friends or acquaintances about the profession ($H(1) = 14.353, p = 0.001$), the ease of learning the chosen profession ($H(1) = 20.472, p = 0.001$), and ease of entry ($H(1) = 12.739, p = 0.001$), along with the forced choice of "Not recruited elsewhere" ($H(1) = 8.372, p = 0.004$) (Table 5).

Table 5. Ranking averages of career motivation items by type of school (1-4 Likert scale) (N = 965)

	Mean Ranks	
	Vocational school	Technical school
The profession is interesting and exciting	484.2	481.1
It's a good way to earn money ^t	495.8	462.68
I would like to work in this profession	498.43	458.51
I would like to continue my studies	496.16	462.12
It's one of my parents' professions	495.8	462.69
My friends and acquaintances are in the same profession ^{***}	508.76	442.12
Easy to learn ^{***}	514.06	433.7
It was easy to get in ^{***}	507.6	443.95
I was not accepted elsewhere ^{**}	501.73	453.28
N	592	373

Source: VETanulOK 2023

Notes: Kruskal-Wallis test, t = tendency, * $p \leq 0,05$, ** $p \leq 0,01$, *** $p \leq 0,001$

6.3. The main factors in the choice of institution and profession

In order to be able to test in more depth our hypothesis that the more disadvantaged the student, the more the choice of institution dominates the choice of occupation in the decision to continue secondary education, we conducted a principal component analysis on our questions on this issue. In the first step, questions on school choice were analysed. Using the Varimax rotation method, which allows the principal components to be more clearly distinguishable from each other, we were able to isolate three principal components, where a single variable, "Because of the chosen profession", could not be sorted under any of the principal components. This is explained by the fact that this question was too closely related to the question of the choice of profession and was therefore not able to have a sufficient impact on the principal components related to the choice of school. The questions "Quality of theoretical training", "Quality of practical training" and "Reputation of the school" were ranked under their first principal factor, and this principal factor was therefore named "Quality of education". Under the second principal component, the questions with the highest factor weighting were "Friend(s) come here", "It is close to my home" and "It was easy to get in", so this principal component was named "Convenience of the institution". Under our third and final principal component, the questions "I was not accepted elsewhere", "Because of dormitory space" and "Parent or sibling also attends" had the highest factor weight, suggesting a forced choice due to academic or financial constraints, and thus our final principal component for this question block was named constraints influencing the choice of institution (Table 6).

Table 6. Main factors in school choice

Dimensions influencing the choice of institution	Item	Factor weight
Educational quality of the institution	Quality of theoretical training	0.87
	Quality of the practical training	0.837
	The school has a good reputation	0.748
Convenience aspects of the institution	Friend(s) and acquaintances come here	0.722
	It is close to home	0.701
	It was easy to get in	0.692
Constraints influencing the choice of institution	I was not accepted elsewhere	0.81
	For a place in a dormitory	0.849
	Parent or sibling also attends	0.563

Source: VETanulOK 2023

In a second step, questions on occupational choice were subjected to principal component analysis, also using a varimax rotation method. The analysis allowed us to isolate two principal components, and among our questions, only one variable, "I would like to continue my studies", did not fit into any of the components, which can be explained by the fact that this question is too oriented towards future plans and therefore does not fit into the question of occupational choice. Under the first principal component on occupational choice, the questions "I was not accepted elsewhere", "It is also the occupation of one of my parents", "It is easy to learn", "It is the occupation of a friend or acquaintance" and "It was easy to get into" were placed. These questions can be identified as extrinsic motivators that influence occupational choice, and thus our principal component of these questions was named extrinsic motivators. Under the second principal component were the questions "The profession is interesting and exciting", "It is a good way to earn money" and "I would like to work in this profession", which are identified as intrapersonal motivators, and therefore this principal component is called intrinsic motivators (Table 7).

Table 7. Main factors for career choice

Dimensions influencing career choice	Item	factor weight
Extrinsic motivators	I was not accepted elsewhere	0.76
	It's one of my parents' professions	0.734
	Easy to learn	0.733
	It's a profession of a friend and acquaintance	0.682
	It was easy to get in	0.612
Intrinsic motivators	The profession is interesting and exciting	0.845
	It's a good way to earn money	0.806
	I would like to work in this profession	0.794

Source: VETanulOK 2023

6.4. Impact of socio-economic status on school and occupational choices

We then used the Kruskal-Wallis test to examine how the principal components of institutional and occupational choice evolve along socio-economic clusters. Although the test did not yield significant results, we found trend-like differences between groups along the questions "Constraints influencing institutional choice" ($H(2) = 4.739179, p = 0.094$). For this item, middle-class families had the highest mean value, followed by professional families and then by multi-disadvantaged families, suggesting that the forced choice in the context of socio-economic clusters was most pronounced for middle-class families (Table 8).

Table 8. Trends in the main components of institutional and occupational choice by socio-economic clusters (N = 965)

	Main components	Socio-economic clusters	N	Rank Means
School choice	Educational quality of the institution	Families with multiple disadvantage	216	477.33
		Middle class families	467	489.64
		Families with skilled workers	280	472.86
	Comfort aspects of the institution	Families with multiple disadvantages	216	447.72
		Middle class families	467	497.54
		Families with skilled worker	280	482.53
	Constraints influencing the choice of institution	Families with multiple disadvantage	216	455.4
		Middle class families	467	500.31
		Families with skilled workers	280	471.99

	Main components	Socio-economic clusters	N	Rank Means
Occupation choice	Extrinsic motivators	Families with multiple disadvantages	216	455.05
		Middle class families	467	497.63
		Families with skilled workers	280	476.72
	Intrinsic motivators	Families with multiple disadvantages	216	477.92
		Middle class families	467	485.41
		Families with skilled workers	280	479.46

Source: VETanulOK 2023

Notes: Kruskal-Wallis test, colour-coded, where trend differences between groups were found

6.5. Change order of entry and learning pathway

As the further education application system allows for the possibility to indicate more than one institution and profession in the desired order, and the order can be changed once during the admission procedure, it is likely that the ranking of the young person in the last place indicates the degree to which their aspirations for further education have been realised. Cross tabulation analysis and Chi-square tests were used to examine students' responses to the order of entry. We found trend differences in the order of entry by type of institution ($\chi^2 = 5.272$, $df = 2$, $p = 0.072$). Nearly $\frac{3}{4}$ of those who entered vocational education and training started their upper secondary education in the first course they indicated, in their case probably making their decision on the basis of desires and reality. Nearly 16 % of students only entered the second-ranked institution and what may be of concern is that 9.6 % of them probably did not start their studies in the course they wanted. When looking at the success rate of technician students by type of programme, we see that the first place finishers were overrepresented in the vocational programme type with a baccalaureate, while the first place finishers were underrepresented in the vocational school programme type. Both types of programmes have a relatively high proportion of students who did not get the education they wanted, with one in 10 students in vocational education and more than 8 % of students in technical education failing secondary admission procedure (Table 9).

Table 9. Ranking of inclusion by programme type (N = 973)

		Vocational school	Technical school	Total
1. place	%	72,0 %	<u>78,6 %</u>	74,5 %
	A.R.	-2,3	2,3	
2. place	%	17,7 %	13,1 %	15,9 %
	A.R.	1,9	-1,9	
3. or more place	%	10,3 %	8,3 %	9,6 %
	A.R.	1,0	-1,0	
Total	N	600	373	973
	%	100,0 %	100,0 %	100,0 %

Source: VETanulOK 2023

Notes: Responses to the question "Did you get accepted to the course you wanted to get into?".

Underlined where Adjusted Residuals (A.R.) is greater than 2

We did not find any significant differences ($\chi^2 = 6.22$, $df = 4$, $p = 0.157$) in the order of inclusion when we tested along socioeconomic clusters. However, 77 % of students from the most advantaged family backgrounds, $\frac{2}{3}$ (75.4 %) of students from families with skilled workers and 68.2 % of students from families with multiple disadvantages were enrolled in the course they had first identified. 8.3 % of middle-class people, 9.3 % of those with parents from a skilled background and the highest proportion of those from a multi-disadvantaged background were in third or higher ranked education. Next, we look at whether students have changed their learning path during their secondary education, whether they have changed institutions, occupations or plans to do so. Cross-tabulation analysis and Chi-squared tests were used to examine students' adjustment or intention to adjust their further education to an institution or occupation. Significant differences were found by institution type in terms of pathway correction ($\chi^2 = 33.459$, $df = 6$, $p < 0.001$) Students in the non-degree vocational programme were the least satisfied with their place in the admission process. They were over-represented among those who changed school or training, with a higher

proportion of students in this type of programme having taken the opportunity (either voluntarily or under compulsion, for which we have no information) to make a career change than students in the technical programme. At the same time, students in a vocational programme type that also offers a baccalaureate were overrepresented among those who were satisfied with their current institution and training (Table 10).

Table 10. Career correction by type of programme (N = 973)

		Vocational school	Technical school	Total
yes, profession	%	<u>12,0 %</u>	3,2 %	8,6 %
	A.R.	4,7	-4,7	.
yes I changed schools, but my profession is the same	%	<u>4,7 %</u>	1,9 %	3,6 %
	A.R.	2,3	-2,3	.
yes, profession and school	%	8,7 %	6,4 %	7,8 %
	A.R.	1,3	-1,3	.
no, you don't want to	%	64,3 %	<u>77,2 %</u>	69,3 %
	A.R.	-4,2	4,2	.
no, but would like to go to school	%	1,5 %	1,3 %	1,4 %
	A.R.	,2	-,2	.
no, but would like a profession	%	3,3 %	4,6 %	3,8 %
	A.R.	-1,0	1,0	.
no, but would like to change school and profession	%	5,5 %	5,4 %	5,4 %
	A.R.	,1	-,1	.
Total	N	600	373	973
	%	100,0 %	100,0 %	100,0 %

Source: VETanulOK 2023

Notes: Responses to the question "Have you changed school or profession during your secondary education?". Underlined where Adjusted Residuals (A.R.) is greater than 2.

After the types of institutions, the modification of the secondary learning pathway and its intention to change were compared with socio-economic clusters using cross-tabulation analysis and Chi-square tests. Based on family background, we found significant differences in the correction of the learning pathway ($\chi^2 = 21.252$, $df = 12$, $p = 0.047$). Those from families with skilled jobs were overrepresented among those who changed their career, those from multiple disadvantages were overrepresented among those who changed school, and those from the middle class were overrepresented among those who did not even plan to correct their career. Our results show that young people with parents in vocational education are not only the most likely but also the most likely to change their occupation if it is not deemed suitable, while disadvantaged pupils are more likely to change school but stick with their chosen occupation. This suggests that middle-class students were the most successful in their decision to continue their education, as they are currently studying at the same school and in the same profession as the one they were admitted to (Table 11).

Table 11. Prevalence of career correction along socio-economic clusters (N = 973)

		Families with multiple disadvantages	Families with skilled workers	Middle class families	Total
yes, profession	%	11,2 %	<u>12,1 %</u>	5,3 %	8,6 %
	A.R.	1,6	2,5	-3,6	.
yes I changed schools, but my profession is the same	%	<u>5,8 %</u>	2,9 %	3,0 %	3,6 %
	A.R.	2,0	-,8	-1,0	.
yes, profession and school	%	8,1 %	7,9 %	7,7 %	7,8 %
	A.R.	,2	,0	-,2	.
no, you don't want to	%	64,1 %	68,2 %	<u>72,3 %</u>	69,3 %
	A.R.	-1,9	-,5	2,0	.

		Families with multiple disadvantages	Families with skilled workers	Middle class families	Total
no, but would like to go to school	%	1,8 %	1,8 %	1,1 %	1,4 %
	A.R.	,5	,6	-,9	.
no, but would like a profession	%	3,6 %	3,6 %	4,0 %	3,8 %
	A.R.	-,2	-,2	,4	.
no, but would like to change school and profession	%	5,4 %	3,6 %	6,6 %	5,4 %
	A.R.	,0	-1,6	1,5	
Total	N	223	280	470	973
	%	100,0 %	100,0 %	100,0 %	100,0 %

Source: VETanulOK 2023

Notes: Responses to the question "Have you changed school or profession during your secondary education?". Underlined where Adjusted Residuals (A.R.) is greater than 2.

7. Discussion

As a first step, we constructed a composite socioeconomic indicator to explore the family background and socioeconomic situation of 11th grade vocational students, as we know that family socioeconomic background influences school performance even when these background factors are controlled (Hoffman et al., 2021). Therefore, we used this socioeconomic indicator to identify three groups of families choosing vocational education. These families were named as multi-disadvantaged, skilled workers, and middle class families based on their typical socio-economic characteristics. Multi-disadvantaged families with many children, typically living in a commune or small town, with parents with primary education, most of them primary school educated, or with children who do not know what their education level is. They live on the father's earnings, in a financial situation well below the average for vocational training. Families with skilled workers are named after the educational attainment of 30 % of the parents, and both parents are overrepresented with primary education, and the mothers are overrepresented with skilled workers. Both parents work, are in a lower economic position than the average for vocational education, typically have 3-4 children, and live in a commune or small town. The highest status group is middle-class families, where both parents have a secondary education, with the highest proportion of vocational school graduates, while parents with vocational school, high school and college degrees, and mothers with university degrees are overrepresented. Both parents are actively working, and these families with two children are typically in a financial situation that is in line with the average for vocational education. Overall, our results are in line with the literature, which shows that vocational education without a baccalaureate is the most typical learning pathway for children from low social status families, and that the trend towards a programme with a baccalaureate is attractive for families with higher education than the vocational school group (Traqueia et al., 2020; OECD, 2018), which has an impact on both preferences and educational outcomes (Hoffmann et al., 2021).

In a second step, we aim to identify the aspects that families consider important in their decision to continue their education, based on the responses on institutional and occupational choice motives. In the case of students enrolled in a non-baccalaureate programme type, the main motives influencing the choice of school were the availability of a place in a college, the experience and opinion of family members, and the possibility of easy access. In addition, young people enrolled in a non-tertiary vocational programme were more likely to be in a constrained situation when choosing a school than their counterparts enrolled in a technical programme, but the primary driver of the dominance of these motives was not the type of school but the socio-economic status of the student's family. This finding is in line with the literature that children from families with lower socioeconomic status who typically attend institutions that do not award a baccalaureate have much more limited opportunities for further education (Bourdieu, 1967; Goldthrope, 1996; 1997; Bourdieu, 1999) and are more often in career correction situations (Traqueia et al., 2020), we also found that for students from low SES families, having a parent or sibling who attended the same school was the most important factor, while for middle class students it was the least important, which can be explained by the state of cultural capital of the families and the social differences in their orientation, because the reproductive aspirations (Bourdieu, 1967) and calculations of students from lower SES families are much more modest and rely more on first-

hand information rather than on career choices that may be novel in the family history (Ball et al., 1995). However, while forced choice is likely for students with multiple disadvantages, as expected from previous findings, it is least likely for children of working-class parents rather than middle-class ones. This result was surprising in light of their knowledge of the literature, and we had to revise it several times. The reason for the forced decisions of these middle-class families may be found in the child's learning abilities, which were not directly addressed in the questionnaire. From the results of Eckhart and Sahli Lozano (2014), we know that family background influences academic achievement. At the same time, we hypothesise a low level of child learning ability as the reason behind the choice of institution with a loss of status. Also, in the case of occupational choice motives, the ease of learning the chosen occupation was the least important factor for children of parents with skilled jobs, while for children of families with multiple disadvantages, this was an important decision factor.

7. Conclusion

In the last decade, research in the sociology of education in Hungary has neglected the vocational education sector, which is extremely under-researched. In our research, we investigated how socio-economic status influences the career aspirations of students choosing vocational school (ISCED 3C) and technical school (ISCED 3A) in the highly marginalised Hungarian education system. To this end, a questionnaire survey was conducted among them in the school year 2022–2023. Our results showed that the last few years have not brought about any major changes in vocational education and training and that these institutions are still segregated by social status. However, our research has uncovered a hitherto hidden group of middle-class students who, as children of families with surprisingly high cultural capital, have not targeted higher prestige institutions, and so the explanation of forced choice does not arise for them. This could be explained by the limited opportunities for further education of SNI students, but this could not be confirmed by the present research, as we did not have questions on learning difficulties and learning ability, while the impact of the socio-economic background of the family is also evident for students with special educational needs (Hoffmann et al., 2021; Eckhart, Sahli Lozano, 2014).

The limitation of our research is that since we only studied the North Great Plain region of Hungary, we cannot draw general conclusions for the country as a whole, and the students had to identify factors influencing their career choice from a retrospective perspective, so their answers may have been somewhat biased by the time since they completed the questionnaire and the time since they chose their career.

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Possibilities of Application of Adaptive Knowledge Testing Using Artificial Neural Networks in Training Economics Students

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Abstract

In line with the advancement of information technology, we are witnessing the development of adaptive knowledge testing, which presents a computerized system for evidence-based testing and assessment of learning outcomes. This system is distinguished by high efficiency owing to the optimization of generation procedures and the presentation and assessment of the results of adaptive tests. The study aims to evaluate the application of adaptive knowledge testing through artificial neural networks on the improvement of the level of training in economics students. A pedagogical experiment was conducted during the second semester of the 2022–2023 academic year at three universities on 288 3rd-year students. The authors developed assessment materials for adaptive knowledge testing with the use of artificial neural networks and developed and carried out the procedure of adaptive knowledge testing. Based on the dynamics of students' success indicators, conclusions were drawn about the efficiency of adaptive testing using artificial neural networks. The results of the pedagogical experiment support the hypothesis that the quality of economics students' training is significantly improved as a result of implementing adaptive knowledge testing using artificial neural networks.

Keywords: artificial neural network, adaptive testing, knowledge quality control, students, teachers, learning success.

1. Introduction

The test method using the test material is one of the most effective and objective methods of knowledge control (Kurgansky, 2022). The test method using the test material is one of the most

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effective and objective methods of knowledge control. However, studies have shown that despite the diversity of pedagogical tests in different scientific disciplines, all of them have some shortcomings, including skewing of the weights between test tasks, the quantity of test assignments is not optimal or its co-similarity, interconnectedness of consecutive test assignments (Belenkova et al., 2022; Voskresensky et al., 2023).

Therefore, there is a problem related to the selection of test assignments depending on their level of complexity for the most objective assessment of students' knowledge. The increase in the number of tests used in universities with a fixed number of tasks, as well as their insufficient quality, leads to the inability to adequately determine the level of students' knowledge (Gorlova et al., 2023). According to the researchers, this deficiency is compensated by using tests that can match the students' level of knowledge, change the complexity and number of test assignments according to the answers received (correct/incorrect).

The process of adapting tests to the individual knowledge level of each student offers several advantages. It allows for more accurate and reliable assessment outcomes, reduces the overall time required for testing, and fosters increased student motivation by tailoring the difficulty of tasks to their current abilities. This method, known as adaptive testing, ensures that students are neither overwhelmed by excessively difficult questions nor under-challenged by overly simplistic ones (Isaeva et al., 2023).

In computer-based adaptive testing, each test is customized for the individual examinee, based on their performance in preceding tasks. The content, structure, and sequencing of the questions are dynamically adjusted to fit the student's proficiency level. Such a tailored approach not only yields a more precise evaluation of the student's knowledge, abilities, and skills but also helps in identifying gaps or misconceptions in their understanding. By doing so, it creates a clear roadmap for their continued learning and development, offering a path for targeted remediation or further skill enhancement (Uteuliyev et al., 2023). Moreover, this method enhances engagement and reduces testing fatigue by continuously adjusting the difficulty in response to the student's progress.

Analyzing the subject matter, we arrive at several conclusions:

1. The objective of developing and implementing tests as pedagogical assessment tools is topical and should be considered in conjunction with other objectives in improving the level of students' training and optimizing the learning process (Tretyakova et al., 2023);

2. There currently is a great variety of mathematical models and methods for testing and processing results (Gagarin, 2023);

3. The considered methods of test result processing, including classical statistical methods and methods under the contemporary orientation of testing, allow analyzing the results of testing but are unable to provide recommendations on optimizing the learning process and adapting the content of tests, the complexity of tasks, and the allocation of time for different topics (Lykova et al., 2023);

4. Adaptive computer testing methods are the most commonly used to adapt the procedure of presenting test items (Nikolaeva et al., 2023);

5. There is not enough attention in modern studies to the adaptation of training courses according to test results, although some tools (for example, artificial neural networks – ANN) provide the possibility of its implementation (Chumakova et al., 2022).

The article aims to evaluate the effectiveness of adaptive testing application using ANN in the training of students-economists.

Research objectives:

1. Definition of the characteristics of the work of ANN and their possibilities of application in the design of educational tests with variable complexity of tasks;

2. Development of test assignments for adaptive testing on economic discipline;

3. Improvement of test tasks through ANN;

4. Development of a methodology for the use of research results.

The hypothesis of the study states that the quality of training significantly improves as a result of the application of adaptive knowledge testing with the use of ANN.

2. Theoretical background

One of the methods to increase the efficiency of computer tests is the development and utilization of adaptive testing methods. The term "adaptive testing" is regularly used to refer to computer systems of evidence-based verification and evaluation of test results that have high

efficiency due to the opportunity to optimize the procedures of generation, presentation, and evaluation of adaptive test results (Frey et al., 2016).

You may find a lot more questions with intermediate answers or no options at all, with an open question, where the answer is evaluated on a scale (for example, from 1 to 5). For example, the Partial Credit Model (PCM) is a model that takes into account the increasing sequence of correct answers (Ang et al., 2022).

An undeniable advantage of the modern item response theory models is the opportunity to obtain well-grounded statistical assessments of specific tasks in addition to the assessment of students' competencies, which can serve as a basis for improving the educational programs of higher education institutions. The assessment of the level of knowledge of the entire list of tasks, and the skipping of individual tasks is not considered critical (Gorshkova et al., 2021).

It should be emphasized that in this case the test tasks must carry out an assessment of one specific competence. The main means of improving the objectivity of the results of the knowledge assessment is to take into account not the final examination but the intermediate assessments, which are used for various tasks. This will require a review and increase of the number of test assignments for all subjects, with each assignment being dedicated to the diagnosis of a specific competence. It is also necessary to provide for the recording and storage of the received estimates in the information system of the university (Pominov et al., 2020).

As argued by D. Denisova et al. (Denisova et al., 2023), this model is advisable when:

- Grading partially correct responses (e.g., multiple-choice tasks);
- The task implies a sequence of steps to complete it (e.g., solving a math problem), while the difficulty of different steps may vary.

Adaptive testing raises the efficiency of pedagogical measurements, reduces the number of items in the test, lowers the time and monetary costs of testing, and enhances its precision (Zhang et al., 2019).

Implementing the technology of adaptive testing requires the following steps (Sergeeva et al., 2022):

- Determining the goals of implementation of adaptive testing (Why is adaptation needed in the given test?);
- Determining the factors to be considered as input information in making decisions on adaptation (What is the test being adapted to?);
- Identifying the aspects to be evaluated in the process of adaptation (What will be adapted?);
- Deciding on which adaptation mechanisms will be deployed and how they will be implemented (How will the adaptation be achieved?).

As a rule, adaptive testing relies on the procedure of optimizing the difficulty of tasks based on the projected level of students' training. In its simplest form, the procedure is as follows. The student receives the first test task based on initial projections. If it is completed successfully, the difficulty of the next task increases. Otherwise, the next task has a lower difficulty. The process of testing can be aborted, for example, if the student fails three tasks in a row. In the general case, more complex procedures for stopping the test can be employed (Tolmachev et al., 2022).

Thus, even in its simplest form, adaptive testing allows dynamically changing the number and difficulty of test tasks for each student (Gabidullina et al., 2023). More complex adaptive testing algorithms can account not only for the difficulty of tasks but also for their association with specific topics in the discipline, the form of their presentation, and other factors when selecting the next tasks. This procedure ultimately generates a unique test for each student. Different students are presented with tests that vary in difficulty and the composition of tasks, passing through the test space along different trajectories (Babina et al., 2022; Efremova et al., 2022).

Adaptive testing algorithms may also differ by the strategy of testing. Specifically, there are two-step and multi-step strategies. Under the two-step strategy, all students receive the same tests at the first step. Based on the results of this test, students are distributed along the axis of the variable under measurement. At the second step, the adaptive mode is enabled, and final adaptive testing is performed. Multi-step strategies are distinguished into fixed-branching and variable-branching (Astuti et al., 2023; Musah et al., 2022). Fixed-branching strategies use the same set of tasks with a fixed position on the difficulty scale for all students, but the path of each student is unique. Usually, all tasks are spaced equally on this scale, or the step decreases with higher difficulty. This allows changing the speed of testing to account for students' tiredness. In variable-

branching tests, the tasks are chosen from the bank through specific algorithms that predict the optimal difficulty of the next task. These individual tasks make up the adaptive test. This strategy thus realizes a step-by-step reevaluation of the student's level of knowledge, which is repeated after each task is completed.

3. Methods

To accomplish the research objectives, this study utilized both a review of relevant scientific and methodological literature as well as a pedagogical experiment. The main research method involved conducting a pedagogical experiment, which took place during the second semester of the 2022–2023 academic year across three universities. From each university, one experimental group (EG) and one control group (CG) were chosen for participation. In total, the experiment covered 288 students in their 3rd year of study. The EG and CG were formed based on pre-existing academic groups. To ensure comparability between the CG and EG, both groups were assessed for homogeneity before the experiment. The groups were found to be similar in terms of initial academic performance based on grades from the previous semester.

The participants included 3rd-year economics students enrolled in the "Information Support for Professional Activities" course at the selected universities. The inclusion criteria for participation were as follows:

1. Students must be in their 3rd year of study in the economics program.
2. Students must be enrolled in the required course and regularly attending classes.
3. Consent to participate in the study was required from all participants.

Exclusion criteria were:

1. Students who had previously participated in similar adaptive knowledge testing experiments.
2. Students who were unable to attend the full sequence of testing sessions due to illness or other valid reasons.

The experiment proceeded in several stages ([Table 1](#)).

Table 1. Stages of the pedagogical experiment

Stage	Content
Preparatory	Determination of the relevance, goal, objective, object, and subject of the experiment
Organizational	Development of test materials, selection of participants
Practical	Carrying out the procedure of adaptive knowledge testing
Summarization	Assessment of results (determining the dynamics of students' success indicators)

To measure students' knowledge with high quality and reliability, the following procedure was followed:

- select the educational content by examining the curriculum of the chosen (required) course;
- Develop a system of tests on the chosen discipline (create a knowledge base);
- Develop the software necessary for testing;
- Build a testing algorithm for the ANN and train it on the results of previous tests;
- Conduct testing and perform the processing and interpretation of the acquired results.

Per this procedure, at the organizational stage of the study, we chose the "Information support for professional activities" course taught to economics students, which consisted of 11 topics. The total volume of the base of testing results included 288 since each student was taking the test. This amount is sufficient for our study. The training and testing of students were carried out using the Moodle system.

The total volume of the test base included 30 tasks. For testing, all tasks first underwent preliminary processing – assessment of difficulty.

The difficulty of tasks was determined by expert assessment. The role of the expert was performed by a teacher, which is justified by the relatively small number of tasks.

The proposed procedure of adaptive testing employed a multi-step strategy. In this testing strategy, the next task was chosen from the bank based on the results of the previous two tasks accounting for their difficulty.

The tasks in the adaptive test were close-ended questions with a choice of one of four options. At each stage of testing, the student was presented with two tasks of each difficulty level, based on which the difficulty of further tasks was determined. This number of questions (two) ensured a more accurate assessment of knowledge than just one task, while also keeping the number of combinations of answer choices not too high, in contrast to three or more tasks.

The algorithm operates as follows: The test contains m levels of task difficulty (in this study, there were three levels). A coefficient, $K_i = 100/m$, is then calculated. In the subsequent stage, the student's current knowledge level is represented by t , with t_n indicating the minimum knowledge level and t_v representing the maximum. Knowledge levels are assigned values ranging from 0 (no knowledge) to 100 (complete knowledge).

First, we assume the student to have an average level of training. Thus, we set $t=50$, $t_n=0$, and $t_v=100$. The current difficulty level is calculated as $tt=t/K_i$.

At the next stage, the student is presented with two tasks at the difficulty level of tt , and the number of correct answers k_{pr} is monitored.

The level of knowledge is recalculated based on responses to the first two tasks:

If $k_{pr}=2$, then $t_n=t$; $t_v=t_v+0.5t$. If $t_v>100$, then $t_v=100$.

If $k_{pr}=1$, then $t_n=t_n/4$; $t_v=t_v+0.1t$. If $t_v>100$, then $t_v=100$.

If $k_{pr}=0$, then $t_n=t_n/2$; $t_v=t$.

Calculating $t_v=(t_n+t_v)/2$.

If $|t-t_v|>0$, then $t=t_v$.

If the critical level of the number of tasks or points for a task is reached, the level of knowledge equals t_j . End.

Otherwise, proceed to the second step.

Learning success was determined by the following formula: number of "excellent" grades + number of "good" grades x 0.64 + number of "satisfactory" grades x 0.36 + number of "passing" grades x 0.16 + number of "not passing" grades x 0.08 x 100%/total number of students.

The results of the pedagogical experiment were subsequently analyzed using mathematical and statistical methods. Specifically, Pearson's χ^2 test was applied to detect differences in the distribution of learning success between two empirical groups. The data was categorized into two groups: "successful" and "not successful," resulting in one degree of freedom ($v=1$).

The null hypothesis H_0 : there was no significant difference in learning success between the control group (CG) and the experimental group (EG).

Alternative hypothesis H_1 : a significant difference did exist between the control group (CG) and the experimental group (EG).

4. Results

The test results were presented in binary form in a table. The table data served as input information for the second step of adaptation – estimation of test questions difficulty (Table 2).

Table 2. Results of ANN operation

Difficulty rating	Question number														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1		+		+											+
0	+		+		+	+	+	+	+	+	+	+	+		+
-1															
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1					+										
0	+	+	+	+		+	+	+	+		+	+	+	+	+
-1										+					

The system deems it necessary to raise the difficulty of items 2, 4, 14, and 20 and decrease the difficulty of task 25. The remaining test tasks do not need alterations.

This information was reviewed by the expert (teacher) for analysis and further decisions.

The next stage of processing the test results was to provide recommendations on changing the number of academic hours for individual topics in the discipline.

Let us consider the results of the student success assessment.

Before the implementation of adaptive testing using ANN, the success rate of EG and CG students in the previous semester was analyzed. The groups were found to be close in initial success rates (76 and 73 %, respectively). After the adaptive testing was completed, the overall knowledge quality level in the EG and CG in the considered discipline amounted to 89 and 75 %, respectively (Table 3).

Table 3. Comparative analysis of learning success in the EG and CG

No.	Group	Number of students	Learning success, %	
			Last semester	Current semester
1	CG	141	73 %	75 %
2	EG	147	76 %	89 %

Table 3 shows that the pedagogical impact amounted to an 11 % improvement in the EG compared to a 2 % improvement in the CG, supporting the effectiveness of adaptive testing using ANN.

From the table of values of χ^2 for the significance level of $\alpha=0.05$ and $v=1$ degrees of freedom, we find that the critical value of $\chi^2_{crit}=3.841$. Since before the pedagogical experiment the calculated value $\chi^2 < \chi^2_{crit}$ ($0.104 < 3.841$), i.e., does not fall in the critical range. This indicates that at the beginning of the experiment, there was no significant difference in learning success between the CG and EG.

Analyzing Pearson's χ^2 for the CG and EG after the pedagogical experiment, we find that $\chi^2 > \chi^2_{crit}$ ($5.724 > 3.841$). This leads to the rejection of the null hypothesis (H_0) and acceptance of the alternative hypothesis (H_1), confirming statistically significant differences between the two groups.

Since the EG students participated in adaptive testing using ANN, it can be concluded that this was the primary factor contributing to their higher learning success. Thus, the experimental hypothesis is supported by the results.

5. Discussion

As a result of adaptive testing, ANN provided the developers of educational materials with information on the initial difficulty level of each task and recommendations on adjusting it (increase, leave unchanged, or lower).

Indeed, if adaptive testing reveals students' general lack of understanding of a course topic, the teacher needs to spend more time and pay greater attention to covering this topic in future training. The practical implementation of systems that adjust educational content and teaching methods based on students' knowledge, as measured through adaptive testing, encounters significant challenges. Chief among these is the need to process and analyze vast amounts of data in real time, as the system must continuously adjust to individual learning needs. Handling these large information flows efficiently is a complex task, but it can be effectively managed through the use of artificial neural networks (ANN), which have the capacity to process and analyze large datasets with high accuracy and speed (Chumakova et al., 2022). ANN offers a scalable solution to the complexities of adaptive testing, allowing for dynamic adjustments that personalize the learning experience for each student.

Initial assessments to feed into the adaptive testing process can be derived from several sources. These may include results from preliminary tests, data gathered from tests administered over a defined period, or even a learning model of the subject matter, if such a model is integrated into the system (Gorshkova et al., 2021). By utilizing these varied data points, the system can build an accurate profile of a student's current understanding, enabling more precise and personalized testing from the outset. This preparatory data gathering helps to ensure that the adaptive test is appropriately challenging and effectively targets areas where the student requires further learning or reinforcement.

In addition to improving the precision of testing, such systems also offer the potential to revolutionize instructional methodologies by providing real-time feedback on student performance, allowing educators to modify instructional strategies and content delivery based on the individual

needs of learners. This continuous feedback loop enhances the learning process, making it more responsive and efficient.

Importantly, the proper operation of ANN depends on the appropriateness of the chosen ANN model and training algorithm. If the algorithm is chosen improperly, the ANN will not be able to learn from test results correctly (Syzdykova et al., 2022; Uralbaeva et al., 2023), therefore, no improvement of the adaptive test will be achieved (Chirkov et al., 2022; Goyushova, Kapustina, 2022).

One limitation of the study is the use of pre-existing academic groups to assign participants to the control and experimental groups, which may have introduced selection bias. Without full randomization, the comparability between groups may be affected, potentially influencing the generalizability of the results. Additionally, this convenience sampling method may limit the ability to rule out other variables impacting students' performance.

A prospect for further research is the analysis of prospective uses of adaptive knowledge testing utilizing ANN.

6. Conclusion

The idea of adaptive testing based on a block of questions is directly connected with one of the most common multi-stage testing formats, in which the learning subject passes through a sequence of tests, proceeding to more difficult questions if they answer correctly or to simpler ones if the answers are wrong. The transition to the next question is subject to certain rules. The automation in the practice of testing enables statistical assessment of knowledge at each step in the test.

Different levels of difficulty of the basic and additional questions and the proposed connection between the main questions and the branches of additional questions allow minimizing the number of answers needed to determine the student's level of knowledge and significantly improve the adaptive properties of testing.

Statistical methods addressing additional indicators in tests can also be used to process test results and to account for additional factors affecting these results. Among such useful indicators are the percentage of correct and wrong answers, relative success of students in one topic compared to other topics in the course, distribution of students' knowledge across all topics, average level of training in the group, etc.

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The History of Education

Academic Freedom: Searching an Optimal Model in the Face of Contemporary Challenges

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Abstract

The article analyses the concept of academic freedom and its impact on the organization of the educational process in universities. The authors examine the content and characteristic features of academic freedom, its definition, as well as the history of its development in universities around the world. Emerging in the Middle Ages, academic freedom has evolved into a driving force for scientific research and remains relevant today.

The legal nature of academic freedom remains a matter of debate; however, most researchers consider it a part of the freedom of expression. Academic freedom can be attributed to individual institutions and participants in the educational process – teachers and students. The authors believe that academic freedom includes the right to receive information, the right to adhere to specific ideas or positions, the right to freely choose the directions of scientific research, research methods, teaching methods, etc., and the right to disseminate ideas and information.

Organizing the educational process based on respect for academic freedom helps intensify students' scientific work and improve the quality of their learning. The authors provide several examples of how academic freedom can be implemented in the educational process. For instance, students may choose which tasks to complete and which topics to focus on for a particular discipline, which enhances their academic performance. The authors also suggest the idea of an individual educational project and debates as a method of interim assessment.

Keywords: academic freedom, universities, freedom of expression, fundamental freedoms, education, educational environment.

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1. Introduction

Academic freedom is one of the cornerstones of free personal development, strong state institutions, and the efficiency of the economy. It guarantees the creative pursuit of knowledge leading to breakthroughs and advancements in various fields and allows researchers to investigate new and sometimes controversial ideas, address societal issues, question injustices, and contribute to social change by bringing attention to important and sometimes uncomfortable truths. It creates an environment where diverse perspectives can be explored and helps to develop critical thinking skills by engaging with different viewpoints and challenging assumptions. International standards and national legislations of most countries around the world recognize and protect academic freedom, stating that it is a tool for safeguarding the academic environment against external pressures from governments, corporations, or other groups, and teaching and research should be driven by evidence and scholarly standards, not by political or financial interests.

However, scholars point to worrying trends, noting that academic freedom faces several threats – from government policies to actions by university administrations aimed at “isolating” those who disagree with certain rules and pushing them out of the academic environment. Universities are increasingly ceasing to be places where researchers and students can debate and discuss any controversial issues without fear of reprisal (Zaiets, 2023). It is worth mentioning that problems concerning academic freedom exist in various regions of the world. For example, a comprehensive review of the situation in African countries leads researchers to conclude that there has been a significant deterioration over the past decade, with an increasing number of complaints and appeals to human rights organizations (Adu, Odame, 2023; Saliba, 2020). A certain attack on academic freedom is also observed in the USA. So called “The Stop WOKE Act” (The acronym “WOKE” stands for “Wrongs to Our Kids and Employees”) is a piece of legislation passed in Florida, USA, in 2022, championed by Governor Ron DeSantis. The act limits how topics related to race, gender, and history can be taught in public schools and universities in Florida. It prohibits instruction that suggests individuals are inherently racist, sexist, or oppressive based on their race or sex, or that they bear responsibility for actions committed in the past by others of the same race or sex (Kearns, 2023). Therefore, the implementation of the Act would result in censorship and hinder open academic discussions about slavery, and the causes of discrimination based on race and gender in educational institutions. The Act was challenged in court by LeRoy Pernel, a Florida A&M University College of Law professor. Both trial and appellate courts have agreed that it violates the First Amendment to the US Constitution and declared the bulk of it unconstitutional (Pernel v. Lamb, 2024).

Europe is no exception to the practice of attacking academic freedom. In 2019, the Central European University (CEU) was effectively forced to relocate most of its operations from Hungary to Austria due to legal and political pressures from the Hungarian government. CEU, founded in 1991 by philanthropist George Soros, had long been a leading institution for social sciences and humanities in Central and Eastern Europe, promoting open societies and democratic values. The conflict between CEU and the Hungarian government began in 2017 when the government introduced new legislation, often referred to as the “Lex CEU,” which imposed strict requirements on foreign universities operating in Hungary. Despite CEU's attempts to comply, the Hungarian government refused to sign the agreement that would allow the university to continue operating in Budapest. The European Union and various international bodies criticized the Hungarian government's actions, viewing them as an attack on academic freedom and an attempt to stifle dissenting voices. CEU relocated its U.S.-accredited programs to Vienna, Austria (CEU, 2019). The European Court of Justice (ECJ) ruled in favor of the European Commission against Hungary, finding that Hungary had violated EU law with its restrictive legislation on foreign universities (Commission v Hungary, 2020). According to the latest edition of the Academic Freedom Index (AFI) Ukraine has shown some regress in academic freedom. With an academic freedom index of 0.5 (0.63 in 2021 before the full-scale invasion) Ukraine lags far behind most EU countries, neighboring Moldova (0.81), Canada (0.86), Australia (0.9), Chile (0.92), and even Brazil (0.76) or Mongolia (0.75) (AFI, 2023). Attempts to look at its reverse side add even greater relevance to the problem of academic freedom. Some researchers see it as a threat to other human rights, in particular, the right to privacy or freedom of religion, and try to determine the contours of balancing these rights (Stachowiak-Kudła, 2021). Thus, the research of both the theoretical concept of academic freedom and the forms of its practical implementation in the everyday functioning of universities remains an important task in modern conditions.

The goal of this article is to analyze the concept of academic freedom throughout its evolution and core elements and suggest recommendations to implement methods contributing to the implementation of academic freedom in the educational process.

2. Materials and methods

The role of academic freedom in the development of society is exceptional. Academic freedom promotes the advancement of scientific research, and technological progress and fosters public dialogue on issues significant to society, thereby contributing to the state's development. Therefore, guarantees of academic freedom, rights and responsibilities of academic staff have received adequate regulation in national legislation, international law, and researchers' papers. Accordingly, the theoretical basis for this study was the works devoted to the content and methods of realising academic freedom (Davydova, 2018; Fuchs, 1963; Gibbs, 2016; Maslova, 2012; Milova, 2015; Stachowiak-Kudła, 2021; Vrieling et al., 2010; Zaiets, 2023; Zavorodnia et al., 2019; Zavorodnia et al., 2021). National constitutions, international treaties, and supranational documents of the EU as well as decisions of national courts and the Court of Justice of the EU have become essential resources for research. Their analysis made it possible to assess the establishment of academic freedom, its guarantees, and its content.

The progress made in the mentioned field by many international bodies and organizations, for example, the UN Economical, Social and Cultural Rights Committee, the ECtHR, the Committee of Ministers of the Council of Europe, etc., is quite significant. Their reports, recommendations, and decisions were analyzed to achieve the goals of this study.

The empirical basis for this research also includes statistical and analytical data, particularly concerning the Academic Freedom Index in various countries (AFI, 2023), as well as data directly obtained by the authors during pedagogical experiments conducted at Sumy State University and the evaluation of their results.

3. Discussion

The Magna Charta of European Universities proclaims that freedom in research and teaching is a fundamental principle of university life (Magna Charta, 2020). Article 13 of the EU Charter of Fundamental Rights also emphasizes that “the arts and scientific research shall be free of constraint. Academic freedom shall be respected.” (EU Charter, Academic freedom is a concept that defines the possibility of freely conducting learning, teaching, and research. The role of academic freedom in ensuring free scientific inquiry, scientific progress, and, consequently, state-building is hard to overestimate. In particular, in our opinion, it is thanks to academic freedom that:

1) Scientific hypotheses that contradict the “traditional” worldview can be put forward. In some cases, such hypotheses are merely pseudoscientific and do not consider the academic achievements of predecessors; however, continuous search is necessary for genuinely groundbreaking concepts to emerge.

2) The preparation of highly qualified specialists at all levels of education is ensured, as quality teaching is only possible with creative search and freedom. A broad population, not just individual specialists and scientists, is involved in public discourse.

3) A free and open academic environment fosters informed public debate, contributing to a more educated and engaged citizenry that can better participate in democratic processes.

Being a complex and multi-level concept, academic freedom has a certain development history. For example, N. Davydova, reflecting on the genesis of academic freedom, notes that the emergence of the principle of the independence of teachers from third parties began in the 13th century. In 1245, Pope Innocent IV exempted scholars of the University of Paris from the obligation to appear in church courts at a certain distance from the capital. The following year, the ecclesiastical court extended this privilege to the university's faculty. Thus, the university and its teachers gained autonomy from local authorities and church officials (Davydova, 2018).

R. Fuchs also links the origin of academic freedom to the Middle Ages. According to him, European universities emerged in the Middle Ages as independent communities of scholars, whether teachers or students. The institutions they established were under the sponsorship of the medieval church and, to some extent, under its control, and the faculties, of course, were mainly composed of clergy. Until the eighteenth century, the Roman church, and in some areas its Protestant successors, exercised sporadic control, which universities or members of their faculties sometimes found necessary to resist. Within universities, significant censorship by dominant

groups prevailed for a long time, causing internal disputes. The boundaries of education maintained by this censorship generally receded, although remnants remained for a long time. For instance, religious exams and restrictions on students at Oxford and Cambridge were abolished only in the second half of the nineteenth century (Fuchs, 1963).

In contrast, according to A. Gibbs, the idea of freedom directly related to universities or academic circles has its roots in the times of the Reformation and the Enlightenment. The researcher particularly emphasizes Prussia's experience. The first universities in Prussia to attempt to depart from the residual scholasticism of their counterparts and the Protestant coercion that came with the Lutheran Reformation were the universities of Halle (1694) and Göttingen (1743). Göttingen, for example, prohibited denunciations of professors on grounds of heresy. The university's founder, Gerlach Adolph von Münchhausen, also insisted on creating a committee for the appointment of professors. As historians point out, "the freedom of Göttingen to think, write, and publish was unrivalled in Germany" and set a precedent for the concepts of *Lernfreiheit* (freedom to teach) and *Lehrfreiheit* (freedom to learn or study), later developed by Wilhelm von Humboldt (Davydova, 2015). Currently, in the Federal Republic of Germany, the right to academic freedom is directly guaranteed by the Constitution – according to Article 5 of the Basic Law, “art and science, research and teaching shall be free. The freedom of teaching shall not release any person from allegiance to the constitution” (Basic Law, 1949).

The history of academic freedom in the United States is quite indicative. In this country, it is not explicitly guaranteed by the Constitution or the Bill of Rights but has been established through judicial practice. In particular, N. Davydova notes that the first mention of “academic freedom” in the US judicial practice occurred in 1952 in the case of *Adler v. Board of Education of the City of New York* (342 U.S. 485 (1952)). Irving Adler, a mathematics teacher and member of the Communist Party, was denied employment based on the Feinberg Law of New York State of 1949, which prohibited state institutions, including schools and universities, from hiring individuals who advocated or called for the overthrow of power at the federal or state level. In this case, William Douglas, one of the three judges who disagreed with the majority opinion, used the term “academic freedom” for the first time, linking it to the fundamental values of the First Amendment (Davydova, 2015).

Given the complex history of academic freedom, some debates arise regarding both the legal nature of this right and the circle of subjects who hold this right. In particular, the UN Committee on Economic, Social, and Cultural Rights emphasizes that "the right to education can only be enjoyed if accompanied by the academic freedom of staff and students" (General Comment, 1999). At the same time, the European Court of Human Rights derives academic freedom from the right to freedom of expression. Thus, through the lens of various international organizations, academic freedom can be considered both part of the right to education and one of the manifestations of freedom of expression.

The issue of the holders of academic freedom also requires thorough examination. For example, according to the “Declaration on Academic Freedom and Autonomy of Institutions of Higher Education” (the Lima Declaration), academic freedom is defined as the freedom of members of the academic community, individually or collectively, to acquire, develop, and transmit knowledge through research, study, discussion, documentation, production, creation, teaching, and writing (Lima Declaration, 1988). Similarly, according to Article 1 of the Law of Ukraine “On Higher Education,” academic freedom is the autonomy and independence of participants in the educational process during the conduct of pedagogical, scientific-pedagogical, scientific, and/or innovative activities carried out on the principles of freedom of speech and creativity, dissemination of knowledge and information, conducting scientific research, and using its results, taking into account the limitations established by law (Law, 2014). However, Article 57 of the Act secures the right of scientific-pedagogical, scientific, and pedagogical workers to academic freedom exercised in the interests of the individual, society, and humanity as a whole (Law, 2014). A more justified approach is the one according to which all members of the academic community, not just teachers, are holders of academic freedom. In our further research, we will consider students as holders of academic freedom.

The content of academic freedom is also a matter of debate. For example, according to Dr. J. Vrieling and Professors P. Lemmens and S. Parmentier, academic freedom manifests itself in at least the following three dimensions:

– One of the aspects of freedom of expression for members of the academic community, which includes freedom of study, freedom of teaching, freedom of research and information,

freedom of expression and publication (including the “right to be wrong”), and the right to engage in professional activities outside of academic work;

- Collective or institutional autonomy for educational institutions as a whole and/or its subdivisions (faculties, research units, etc.);

- The obligation of public authorities to respect and protect academic freedom and to take measures to ensure the effective exercise of this right (Vrieling et al, 2010).

N. Maslova, discussing the content of academic freedom, identifies its four components:

1. Freedom of research and the exchange of scientific data (the choice of research topics, methods of academic work, and ways of disseminating scientific results is a matter of self-organization within the scientific community);

2. Limited jurisdiction of secular (also judicial) and church authorities over members of the university corporation;

3. Collegial principles of self-organization of the university's scientific community;

4. The right of the teaching staff to independently determine the structure and content of education at the university (Maslova, 2012).

T. Milova, on the other hand, suggests three elements of academic freedom: freedom of teaching, freedom of scientific research, and freedom of learning (Milova, 2015).

Reconsidering the positions mentioned above, we propose to include the following elements in the context of academic freedom:

- The right to receive information (including access to accurate statistics, unbiased scientific data, archival documents, etc., which allow for the formation of reliable and substantiated hypotheses);

- The right to adhere to specific ideas or positions (i.e., to be a supporter, including publicly, of certain ideas, worldviews, and values);

- The right to freely choose the directions of scientific research, research methods, teaching methods, etc.;

- The right to disseminate ideas and information (including through public speeches, publication of scientific articles, participation in debates, and advocacy).

4. Results

Organizing the educational process and student research with respect for academic freedom increases trust between students and teachers and the curriculum as a whole. It also intensifies their scientific and creative pursuits.

Our pedagogical experiment hypothesized that with the increase in the level of academic freedom granted to students, their interest in the professional component of the educational program and their engagement in scientific research would also increase, which, in turn, would lead to higher academic achievement. Viewing the student as a full-fledged partner in the educational process, we provided them with a wide range of discretion, allowing them to make their own decisions within the framework of academic freedom. Several directions can be distinguished in which students exercise their academic freedom.

Academic freedom in organizing independent work. For several years now, the educational process at Sumy State University has been implemented in a blended format, combining traditional classroom sessions, online classes, and student work on the MIX blended learning platform developed by the University. This platform allows for organizing lecture materials, additional resources, and assignments for practical lessons and independent work, presenting them as a convenient course on the platform. The system also indicates the maximum number of points for completing each assignment and allows students to track their progress (the number of points earned and their required percentage).

Courses on the MIX platform in subjects like “International Human Rights Protection” were organized in such a way as to maximize student discretion regarding the tasks they performed.

For example, in the subject “International Human Rights Protection” (studied over 16 weeks, with 32 hours of lectures, 32 hours of practical classes, 5 ECTS credits, and a final exam), each topic included a set of tasks (tests, essay writing, case studies, video work, bibliographic review writing, discussion tasks, collaborative tasks, etc.). Each task was graded individually and influenced the final grade for the subject. At the same time, the maximum possible number of points for completing all course tasks significantly exceeded the number of points required for the subject. An example of the organization of part of the course is provided in the table below.

Table 1. Freedom of Expression in the Case Law of the European Court of Human Rights (ECHR)

Type of Task	Points Awarded for Completing the Task
Case Study Work	2
Collaborative Task	1
Work with Video Case	2
Group Discussion	1
Testing	2
Essay Writing	2
Total Points (Maximum Possible Score for Completing All Tasks for the Topic)	10

The course included 16 topics, each containing between 5 to 7 tasks (with 10 to 12 points available for each topic). If a student completed all the tasks in the course without any mistakes, they could earn 180 points, which is three times the number of points required for the semester (60 points).

The idea behind offering various tasks was to allow students to choose their preferred tasks and topics. A student could complete all the tests and earn enough points to qualify for the exam, or they could focus on a few topics that were most interesting to them, complete all the tasks in those topics, and still earn the necessary points. This organization of independent student work based on academic freedom positively impacted students' success.

Table 2. The distribution of final grades of students depending on the implementation of free choice of tasks for independent work"

	Beginning of learning in 2019		Beginning of learning in 2020		Beginning of learning in 2021	
Number of students in the group	18		20		16	
Grade «A»	2	11 %	5	25 %	5	31 %
Grades «B» and «C»	7	39 %	8	40 %	7	44 %
Grades «D» and «E»	7	39 %	7	35 %	4	25 %
Grades «F» and «FX»	2	11 %	0	0 %	0	0 %

The approach to organizing independent work was first tested with the students who entered in 2020 (the academic year 2022/2023). In the 2023/2024 academic year, the pedagogical experiment was continued. As observed, there has been an increase in the quality of student success from 50 % in the 2021/2022 academic year to 65 % in the 2022/2023 academic year and 75 % in the 2023/2024 academic year.

Academic Freedom in Organizing Student Research. Student research is necessary for intellectual development and guarantees their proper professional preparation. Therefore, encouraging student research is one of the important pedagogical techniques and can be achieved through organizing this work based on respect for the academic freedom of young researchers.

For students studying International Law at Sumy State University, there has been an option for several years to choose an individual research project instead of a term paper. The advantages of an individual research project include the ability to choose:

- The research topic (as long as it is related to the subject matter of the term paper);
- The academic supervisor with whom the student prepares the individual research project;
- The form of presenting the research materials;
- The methods of scientific research, etc.

An individual research project is a complete alternative to the student's term paper. However, while the department determines the topic and supervisor for a term paper, an individual research project can continue a previously started research study that the student has been conducting over

several years of study, examining the topic through different areas of law. For example, if a student is interested in transitional justice, they might sequentially complete individual research projects on the content and concepts of transitional justice (term paper on legal theory), constitutional guarantees of transitional justice (constitutional law), criminal responsibility of offenders as part of transitional justice (criminal law), the right to truth as part of transitional justice (international human rights protection), etc.

Organizing student research based on respect for their academic freedom, as manifested in the ability to undertake individual research projects, intensifies research efforts and increases its quality. As a result, under the guidance of the department's lecturers, 16 works were prepared by winners of the All-Ukrainian Student Research Competition in the fields of "Law" and "International Law."

Debating for Academic Freedom. Another way of academic freedom's realization is the use of debates as a method of assessment and final evaluation within several courses studied by International Law students at Sumy State University. For example, in the course "Legal Argumentation," one of the methods of interim assessment for certain topics is conducting value debates on a topic chosen by the students. Academic freedom is realized in this context in the following aspects:

- The free choice of debate topics by the students (they can either select a topic from a list provided by the lecturer or any other topic they find relevant);
- The free choice of the position that the student will represent (it is possible and permissible even for the entire group of students to take the same position; in such cases, the task of opposing that position falls to the lecturer);
- The free choice of arguments, rhetorical means, and ways to persuade the audience, among others.

This method of interim assessment provides insight into how students' argumentation skills are developing and initiates a broader academic discussion that encourages students to engage in creative exploration and more in-depth scientific research.

5. Conclusion

The brief study allows us to conclude that the role of academic freedom in society-building is exceptional. Academic freedom promotes the development of scientific research and technological advancement and fosters public dialogue on issues significant to society. Definitions of academic freedom are found in various acts; however, discussions regarding the content of academic freedom are still ongoing. After analyzing several scholars' positions, we believe that the elements of academic freedom include the right to access information, the right to choose a topic of research, the right to adhere to specific ideas or positions, and the right to disseminate ideas and information. Both institutions (such as universities) and individual scholars and students are considered holders of academic freedom. We view academic freedom as a component of freedom of expression, but it can be recognized as part of the right to education.

The genesis of academic freedom is quite lengthy. Some researchers associate its origin with the Middle Ages, while others with the Enlightenment. However, it is evident that in the 19th century, academic freedom became a general rule for European higher education institutions, and secondly, that the development of this concept is inextricably linked with universities.

Despite its deep roots, academic freedom remains essential for universities. However, it is worth remembering that the holders of academic freedom are not only university professors (lecturers) but also those obtaining an education. Organizing the educational process on the principles of academic freedom allows for better results in both training students' skills and stimulating their scientific work.

In particular, when students can choose which types of assignments to complete within a course, their overall results improve. A flexible organization of the set of tasks and the freedom to focus on the kinds of assignments and topics that resonate with students positively impact their knowledge after studying the discipline.

Replacing the term paper with an individual research project intensifies students' scientific work and ensures their continuous and systematic work on a topic that interests them. By preparing individual research projects, students freely choose the topic of their work, the academic advisor, the research methods, and more, which further shapes them as independent scholars capable of creative inquiry.

Ultimately, discussions are also an expression of academic freedom. Using academic debates as a method of interim assessment helps train rhetorical skills and allows students to defend their positions and argue effectively.

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The Paradigms of Development of the National University in the XVII – first half of the XIX centuries

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Abstract

The article examines the history of the formation of the university paradigm (idea) in the Russian Empire and Ukraine, in particular. This process is studied in the context of several historical periods with their characteristic ideological, political, administrative, legal and other features. Under the university paradigm (idea) we understand a complex set of factors that determined the features of university education at a particular stage of its development.

The university paradigm (idea) is considered in the context of three main models of the university: pre-classical (university as a corporation of teachers and students), classical (research university of the nineteenth and first half of the twentieth century), and post-classical (mass university of the twentieth century).

The coexistence of two models/projects of the university in the Russian imperial university space: utilitarian and classical. These two university projects combined the features of Franco-Italian and German universities. The latter, in particular, ideologically and substantively expressed the neo-humanist views of W. von Humboldt.

The formation of the university paradigm (idea) is analyzed in the context of changing state policy towards the university: from promoting the creation and search for the best project to reactionism and reduction of university autonomy.

Keywords: higher education, university, paradigm, university idea, classical model of the university, utilitarianism.

1. Introduction

The process of the formation of university education occupies a prominent place in the system of studying the “history of ideas” and everyday life. The emergence of the “mass university” calls into question the Humboldtian ideal of the “classical university.” The idea of the university

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has never been static. The university as a corporation of students and professors has evolved from a pre-classical to an innovative model of organizing educational and scientific activities. All this time, the university corporation, on the principles of autonomy, has sought to reflect public needs and perceptions, partly shaping them.

However, the ideal of the university has remained an ideal, or rather, an aspiration. The university never had absolute autonomy and did not meet the ideals of free science. It was primarily an educational institution for training future officials, and in this way, it contradicted the university's mission of professionalization and raising the level of education. Since the first universities appeared, their models and traditions have changed. However, there remained something that makes it possible to talk about the university spirit, the idea. The university is both a national and supranational social phenomenon, an institution that has a significant impact on the cultural space.

The "idea of the university" has transcended borders and become the property of humanity. At the same time, the idea of a "national model" of the university has become a factor in the development of nation-states and their national symbols. Appropriate reference to the historical experience of university traditions is a necessary element of understanding the mission of the university today.

2. Materials and methods

The materials for the preparation of this manuscript were various texts (projects, speeches, journalistic statements, articles, etc.) by representatives of the social and intellectual elite of the Russian Empire, which make it possible to understand the transfer of the European university idea and its impact on the formation and development of the national higher education system.

These texts were written by figures of university and school education, scientists, publicists, and others. All of them represented different areas of public opinion, and therefore partly contradictory interpretations of the content of the university idea.

The materials we have studied relate to the first plans and projects for the creation of a university at the turn of the seventeenth and eighteenth centuries to the emergence of a coherent system of university education in the early nineteenth century. In addition, the materials we have analyzed are related to the reforms of the 30s and 40s of the nineteenth century, which crystallized the features of the model of a "classical" university in the Russian Empire.

The research is based on the principles of historicism and objectivity, which makes it possible to study historical phenomena through the peculiarities of its development and specific historical conditionality. These principles take into account the dynamism of the object of historical research.

In addition, general methods of scientific research were used to study the evolution of the university paradigm (idea): generalization, analysis, synthesis, comparison, induction, and deduction. General scientific research methods are the logical basis for special historical methods, in particular, historical-comparative (for comparing the features of paradigms, projects and models of university education in the Russian Empire); historical-topological (for identifying common features in models, projects and paradigms of university education in the Russian Empire) and historical-systemic (for a comprehensive analysis of the evolution of the university paradigm in the Russian Empire).

3. Discussion

The university has always been a significant factor in influencing social processes and shaping the university space in cities. The university phenomenon is a key argument for civilizational development. The number of publications on various aspects of university history has increased by an order of magnitude (Kolesnikov, 2003; Kulakova, 2006; Kuznecova, 2007; Lapteva, 2000; Margolis, 2000; Nikolskij, 2008; Otechestvennye universitety..., 2005). The university field continues to be of interest to historians of ideas, in particular, in the study of the formation and evolution of the university idea in the Russian Empire (Olshannikova, 2017 and etc.).

In particular, Olshannikova N. studies the evolution of the Russian university idea in the eighteenth and nineteenth centuries. The transformation of imperial universities from a utilitarian to a classical model is considered. The university idea is analyzed in the context of the statutes of the imperial universities: 1804, 1835, 1863, and 1884. The author also examines the issue of university autonomy. An important aspect of the study is a comparison of the mission of the first

university and the post-reform university. The mission of the first universities was to train officials for the civil service, and later - to develop science (Olshannikova, 2017).

Important for understanding the evolution of the university paradigm (idea) in the Russian Empire are certain kinds of “apologies” by representatives of the state apparatus and the intellectual elite, which substantiated the concepts and projects of future imperial universities (Antologiya..., 1985; Balugyanskij, 1834; Belinskij, 1838; Davydov, 1849; Fonkich, 2000; Gejm, 1799; Karamzin, 1803; Karamzin, 1991; Katkov, 1841; Neverov, 1839; Rozhdestvenskii, 1912; Suhomlinov, 1882; Uvarov, 2003; Vasilchikov, 1880; Yakob, 1808).

4. Results

The history of university education in the Russian Empire and Ukraine, in particular, can be studied in the context of several historical periods/stages, which were characterized by certain ideological, organizational, political-administrative, formal legal, content and other aspects. We propose to define this complex set of factors that determined the peculiarities of university education at a particular stage of its development through the concept of paradigm.

In view of this, it is advisable to distinguish several historical stages (paradigms) of university education in the Russian Empire in general and in Ukraine in particular. The beginning of this process can be seen at the turn of the seventeenth and eighteenth centuries with the emergence of the first universities in the Russian Empire. By the half of the nineteenth century, the process of finalizing the system of higher education in the empire was underway.

The process of broad “university intellectual expansion” was actively spreading across Europe, starting in the mid-fifteenth century. The Reformation and Counter-Reformation accelerated the creation of a network of universities affiliated with various religious movements: Catholics, Jesuits, Calvinists, and Lutherans. These processes became especially widespread in the sixteenth and early seventeenth centuries in Central and Eastern Europe, spreading among the Orthodox population. In particular, in the Ukrainian lands that were part of the Polish-Lithuanian Commonwealth at the time, the first Greek-Slavic schools were founded, as well as the Orthodox College in Kyiv, founded by Petro Mohyla. The Kyiv-Mohyla Academy, which emerged on its basis, had every reason to have the same scope of university rights as the Catholic higher schools in the Polish-Lithuanian Commonwealth. The final resolution of the issue of the Academy's university status became possible at the end of the seventeenth century, when Kyiv came under the rule of the Moscow state. The realization of the idea of building an Orthodox university fell on the shoulders of the new administration.

The lack of “education” was pointed out at the Church Council of 1666–1667, where, in particular, the idea of the need for “schools” to strengthen “the rank of the church and civil” was voiced. As a result, the idea of an Orthodox university project and the establishment of the Moscow Academy (Antologiya..., 1985: 236-240) was created. Modeled after the academy in Kyiv under Peter the Great, one was opened in Moscow with an emphasis on theological studies. However, the intention to open a multidisciplinary higher education institution based on the European model did not leave the statesmen in the future (Rozhdestvenskii, 1912: 3-6).

In this sense, we are talking about the so-called “pre-classical” university with all the signs of medieval class division. A university of this type was a privileged corporation of professors and students that enjoyed self-governing rights guaranteed by the highest state and church authorities. However, by the beginning of the eighteenth century in Europe, the pre-classical university was increasingly in crisis, failing to meet the educational needs of society and the state. Vocational schools (medical, military, engineering, etc.) competed with the existing universities, meeting the public demand for practical skills and knowledge. The ideas of utilitarianism gradually penetrated the Russian Empire. They did their best to promote the idea of a European university in the country. As a result, both the Moscow and Kyiv Academies, as a result of the Synodal Reform, acquired the features of schools for the clergy.

The realization of the idea of a European university in the Russian Empire was the founding of Moscow University in 1755. This made possible the transfer of leading European ideas and concepts in the field of education and their infiltration into the all-Russian imperial educational space. Gradually, the state concentrated a significant share of the administrative functions of universities, taking over the functions of organizing the educational process, recruiting faculty, controlling the level of teaching, etc.

The second half of the eighteenth century marked the processes of modernization of European universities, becoming a benchmark in the preparation of projects for imperial

universities to create an educated bureaucracy (Suhomlinov, 1882: 58-123). The revolution in France in 1789 made us take a somewhat skeptical look at the “fruits of education” (Gejm, 1799) and actualized the emergence of a number of apologies addressed to the supreme power. The task of these apologies is to justify the need to reform the education system of the Russian Empire in order to raise the authority of university education. Moreover, the government's policy on this issue was not entirely clear.

Under Emperor Alexander I, the decision to modernize universities was approved, although it was not clear what model of such changes would be used: either the concept of a “modernized university” or the concept of a “utilitarian university.” In fact, the model of the Russian Imperial University incorporated elements of both concepts. The bureaucratic functions were borrowed from the concept of the “utilitarian university” and are more typical of French and Polish universities. The internal organizational structure of the Russian Imperial University incorporated the features of a “modernized university”, similar to German universities.

Also, as a result of the educational reform of Emperor Alexander I, when the system of higher education in the Russian Empire was finally formed, the country was divided into six educational districts: Derpt, Vilna, Kazan, Moscow, St. Petersburg, and Kharkiv. Each of these districts was to have a leading university.

University autonomy, the transfer of ideas and concepts of university education from Europe, and the teaching and research activities of foreign professors contributed to the formation of corporate university values in the Russian Empire, giving impetus to the development of value concepts of higher education in the country. The phenomena of the “magnificent decade” – neo-humanism, progressivism, the social role of science and education – became crucial for the culture and social life of the empire (Karamzin, 1803: 261-268; Yakob, 1808: 68-86).

With the emergence of the Ministry of Public Education in 1802, there was a change in state strategy and policy in the field of education, in particular, in terms of assessing the impact of European (German) universities. The enlightenment metaphor of “enlightenment of the mind” was replaced by the principle of “corruption of minds.” This is obviously detrimental to the state, because it is necessary to educate not in learning, but in “trustworthiness.” And for this, a very limited range of knowledge is sufficient.

Apologists for such ideas were not only civil servants and public figures, but also leading intellectuals, criticizing educational reforms and policies because of their lack of adaptation to practice and detachment from social needs (Vasilchikov, 1880: 249-287; Karamzin, 1991).

Thus, the initial stage of the implementation of the European “university idea” in the Russian Empire had several outcomes. First, the emergence of universities in the country was an irreversible process. University projects and models were concretely implemented: first at the level of the creation of the Imperial Moscow University, and then others, including the creation of imperial educational districts and leading universities in them.

Secondly, there was an obvious need for a new ideological basis for university education, its “nationalization” in accordance with regional conditions and peculiarities. Such a basis was created in the 1830s and 1840s, when education was realized as an inalienable social value.

It was then that we can observe attempts to comprehend the retrospective and prospects of the imperial universities. The concept of the “Russian university” emerged as a reflection of the idea of “nationalizing” the university. Such a university reflected not so much the utilitarian functions of its existence as the ideological ones, contributing to the formation of the “spirit of the nation.” Accordingly, a national intellectual university elite was being formed among scientists and teachers, who were to replace foreign professors at universities.

The realization of science as a supreme value strengthened the social authority of university education. This was facilitated by Minister Uvarov's new university reform. The model of the “classical university” is being substantiated, in particular, through the academic mobility of professors, researchers, students, and public figures, primarily to German universities.

Minister S. Uvarov critically assessed the achievements of the pre-classical stage of university education, being skeptical about the effectiveness of educational policy (Uvarov, 2003: 231-237). To overcome the shortcomings, he initiated the development of a new Statute of Universities, which came into force in July 1835.

The propaganda of state policy in the field of university education and the establishment of a new ideology in the system of higher education in the Russian Empire was centrally conducted on the pages of the Journal of the Ministry of Public Education, founded on the initiative of the

Minister in 1834. Already in one of the first issues of the journal, an article was published that conceptualized the model of a “classical” university (Balugyanskij, 1834: 316-330). This established the models and standards of state policy in the field of higher education, and restored the concept of a “single university space” in Europe and the Russian Empire.

In addition to officials, the idea of a “classical university” found expression among representatives of the intellectual elite. They advocated the idea that the university was not just a “repository of knowledge” but had a far-reaching impact on social development (Belinskij, 1838: 250-277). The triumph of science in a classical university has a significant transformative effect on society (Neverov, 1839: 39-51; Katkov, 1841: 111-116).

During the “Gloomy Seven Years” of Emperor Nicholas I (1848–1855), the reception of the “classical” university ceased. There was a retreat of state policy toward reaction, close to the 1820s. The university was seen as a source of revolutionary unrest, especially against the backdrop of the events of 1848 in Europe. Minister S. Uvarov tried to defend the achievements of university policy. An article by I. Davydov, inspired by him, defended the idea of the “beneficial action” and “originality” of Russian universities (Davydov, 1849: 37-46).

The article aroused the anger of Nicholas I, who was opposed to university education, and served as one of the reasons for S. Uvarov's resignation. However, the spread of the university idea in public opinion was irreversible. State policy also inevitably had to change, and from the mid-1850s onward, there was a resumption of interaction in a single university space.

5. Conclusion

Thus, the “university idea” is a set of ideas about the mission of the university, its goals and objectives, as well as the specifics of the relationship between members of the university corporation and external stakeholders – society and the state and the state. The idea of a university is not something unchanging. It is defined by a number of philosophical, political, ethical, ideological concepts, etc.

An important role in conceptualizing and filling the content of the university idea belongs to the intellectual elite, which transmits the values of the university corporation within a specific value-sense universe.

The evolution of the university idea (paradigm) has gone through several stages in its development. Its peak is associated with the name of W. von Humboldt. And the university model built on this idea is usually called “classical”. It is characterized by an active combination of education, training, and research.

At the end of the eighteenth and beginning of the twentieth century, the classical model of the university had competitive advantages over the utilitarian model of the university. An important feature of the latter was the instrumentalism and technologism of university education. The nineteenth-century university was the center of political struggle and movements. Many expected it to lead the struggle for political rights and civil liberties.

University education in the Russian Empire almost always remained open to the transfer of ideas and innovations, promoted academic mobility and exchanges between faculty and students. At the same time, progressive ideas had to adapt to regional conditions within the state, to confront alternative concepts and ideas, the apologists of which were partly representatives of the authorities or the intellectual elite of the Russian Empire. The results of this complex conflict process directly influenced university reforms in the country.

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