The Practical Guidelines for Implementing Modular Training in Higher Education

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Abstract

The article presents comparative analysis of modular training as a teaching tool against traditional methods and techniques in educational institutions, particularly in higher education. Being one of the forms of interactive learning, modular training ensures efficient intermutual development of all members of educational process. It increases active learning and improves critical thinking, as well as problem solving skills. Based on several years of experimental research this article gives recommendations on modular training for improving knowledge in emergency first aid treatment for students of various educational institutions. It also briefly describes the algorithm of introducing elements of modular training for implementation of Health and Safety course.

Keywords: modular training, education, health and safety.

1. Introduction

The General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO), Eighteenth Session held in Paris from 17 October to 23 November 1974, encouraged the introduction of modular technology, which helped to adjust to changing production and scientific needs and local conditions. At that time the goal of modular education was set, that is to establish favorable conditions for full development of human personality through learning based on individual differences and needs of the students as well as the full mastery of the content of educational programs considering the educational background and skills of subjects of the educational process.

The modern world is characterized by a constant multiplication of natural, man-made, social and other hazards, often threatening the human health and life. In the 21st century, society has already been called a "risk society" (Vladimirov i dr., 2000).

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One of the key goals of modern higher education is to help students to build good expertise, knowledge and skills of safe behavior in different real-life situations. In addition, the level of learning outcomes should be so high that it ensures preservation of life and health not only in hazardous and emergency situations but in everyday life as well. This goal can be achieved through combination of modular and traditional education.

Technology drives our society and plays a crucial role in classrooms today. While the impact on learning has not reached its potential; educators need to explore how we go about integrating technology so that it positively impacts educational processes and learning outcomes. Michelle Norton and Casey Creghan, Kathleen Adair Creghan and Robert Maninger explored both teacher and administrator perceptions of technology integration and intended to find ways administrators can support teachers with integrating technology in the classroom in order to impact learning (Norton et al., 2017).

Some authors consider active-learning and role-playing methods as the most effective. Kelley and Liles both focus on the topic of active-learning. This method can be used to help pharmacy students develop patient education skills. The authors emphasize that patient education is an important part of the Pharmacists Patient Care Process and that active-learning strategies can also be incorporated into interprofessional education activities (Kelley, Liles, 2018).

The other author Cleveland (Cleveland, 2018) discusses digital portfolios and how they can be used to foster student reflection. In his article he presents the findings of a study into the role of formative feedback on student reflection and concludes that practitioner-preparation programs and interprofessional education activities should be encouraged to implement digital portfolios (Cleveland, 2018).

Hughes, Bradford, and Likens, present a study of how short instructional sessions can be used to encourage faculty to incorporate technology into their courses. They explored faculty perceptions of technology's impact on communication, critical thinking, and collaboration. Their findings suggest "that faculty are using technology without a good understanding of the pedagogy related to instructional design" (Hughes et al., 2018).

Being one of the forms of interactive learning, modular education ensures efficient intermutual development of all members of educational process. The teacher's role is to coordinate the student's actions, provide all necessary materials and structure the lesson in such a way that the students achieve the set goals and objectives of learning and cognitive process. This form of training develops the students' ability to independent problem-solving in various spheres of activities and promotes confidence in taking real actions in life.

2. Materials and methods

Health and Safety is one of the general subjects in higher education institutions in many countries all around the world regardless of major or educational profile. Based on several years of experimental research this article gives recommendations on modular training for improving knowledge in emergency first aid treatment for students of various educational institutions. The efficiency of introduction of modular system in the course of four years has been analyzed in comparison with traditional (control) methods and modes of study at different independent sample groups (n = 316): 150 students in control group and 166 students in experimental one.

The initial knowledge of a given topic or unit was assessed by valid tests covering all competencies for knowledge, skills, expertise and clear evaluation criteria based on T.V. Melnikova technique. The level of learning outcome on a certain unit was measured using the results of content analysis. The questions should include not only tests but cases and topic related pictures, for example:
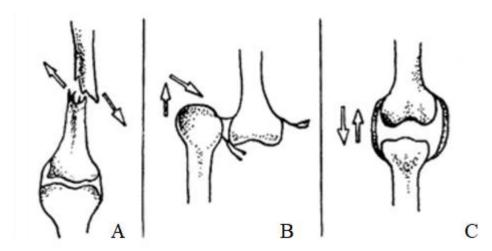
Case

You witnessed a car accident; the driver has severe arm injury. Just above his elbow joint you see a deep wound and blood flows in the form of pulsating stream. Identify the type of bleeding and administer the first aid.

Specify the sequence of first aid for collapse:
a) Spray a face with cold water;
b) Raise his legs above heart level;

c) Position the injured person on his back and tilt his had slightly back;

d) Unbutton or loosen his collar and provide fresh air.

Identify the type of injury:

This technique will allow in future training to place greater focus on the topics and issues on which students made the most mistakes. It is recommended to have in average three cases, five tests, and three pictures for students to comment.

Evaluation criteria in T.V. Melnikova technique:

Each question has a score: cases – 3 points for every correct solution (9 points in total), 5 tests – 1 point for correct answer (5 point in total), tasks with pictures – 2 points for each correct comment per figure (6 points in total). The total maximum score is 20 points.

F («2») – 12 and less points;

C («3») – from 13 to 15 points,

B («4») - from16 to 18 points,

A («5») – from 19 to 20 points.

From the methodological point of view this modular approach has a very distinct feature – the students need to reflect their work at every lesson. They must assess not only their performance but the learning process of a group in general. This type of assessment promotes learning motivation not only for a given student but for the whole group and builds a cohesive team work. The reflection should be organized in three levels – "performance", "me", "we" (Table 1):

Table 1. A lesson self-assessment sheet of a student

#	Lesson activity	Assessment
1	My level of understanding of the lesson's material? ("performance")	1-5 points – little understanding, must learn it again; 6-8 points – partial understanding; 9-10 points – have solid knowledge, understood everything.
2	How was my work? Did I have any mistakes? Am I satisfied with my work? ("Me").	1-5 points – failed; 6-8 points – had some mistakes; 9-10 points – did all tasks by myself and satisfied with my work.
3	What was the group's or pair progress? ("We").	1-5 points – we worked slowly, had lots of mistakes and low interest; 6-8 points – not everyone actively participated in discussion; 9-10 points – we had a good team work and done all the tasks together.
4	Tell your opinion and some feedback about the lesson.	

To organize modular training of the Health and Safety course it is required to have the following conditions:

1. Clear structure of learning process.
2. Learning objectives and tasks for the whole module.
3. Combination of verbal and visual teaching tools and aids.
4. High involvement of students through various forms of independent work.
5. Combined assessment: written and oral answers, peer check.
6. Teacher's belief in students' abilities (Melnikova, 2013).

Modular training is an interactive type of learning. It requires involvement of teachers and students and thus provides efficient development of competencies in a subject for all participants of the educational process. Modular training is oriented at building solid knowledge and strong practical skills, which can be used in first aid treatment in emergency situations and other units of this subject, for example: Basics of Military Service, Natural and Man-made Emergencies, Health and Wellness, etc.

It is advisable to spend a considerable number of non-school hours on development of students' target practical skills. It is also recommended to organize practical training with participation of medical personnel of the school. This will improve the training structure and raise the students' motivation. The lectures of medical specialists and excursions to emergency response team's department could be useful for training and may help some students to make their career choice in future. It is also reasonable to organize special interest groups for students eager to learn first aid treatment on a deeper level.

During the lessons devoted to development of practical skills the teacher should monitor the learning process and help students in drilling exercises. To prevent students' mistakes and objectively evaluate their answers and completed tasks, the teacher should clearly show and explain the technique of first aid actions and use preparatory exercises considering the students' skills and age peculiarities of the group.

It should be noted that all teaching aids for modular learning are based on individual needs and interests of the students.
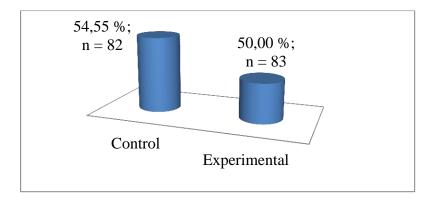
The validity of the results was evaluated using the Fisher's ratio test for independent samples, pairwise sequence comparison, with the level of statistical significance of differences $p \leq 0.01$ and considering the variance. When comparing, control was exercised over the group error probability using the Bonferroni correction, and the critical level of significance was 0.015.

Below are the averaged results of a four-year study of the Health and Safety knowledge and skills ("First Aid" unit) of high school students obtained during traditional and modular modes of training.

3. Results

Results of a comparative analysis of traditional and modular lessons. Innovative technologies allow combining standard and interactive teaching methods. Often a teacher who mainly uses traditional forms of education does not dare to switch completely to another mode of training, for example, to modular one. However, some sections of the Health and Safety course are very convenient for introducing innovative techniques. For example, the use of modular training for studying "First Aid" unit engages students on a greater level and they show higher enthusiasm to learn important topics independently and without detriment to the learning process.

The initial ascertaining experiment identifies the level of learning outcome of the target unit in the control (other lessons of Health and Safety course will be taught only with traditional teaching methods) and experimental groups (other lessons of Health and Safety course will be taught using modular training). The review of "First Aid Provision" unit consists of two options, each contains test tasks, three cases and three topic related pictures to determine the type of injury. According to the results of initial testing, as a rule, the results in the groups do not differ significantly: the control group – 82 students (54.55 % from n = 150); experimental – 83 students (50 % from n = 166) (Figure 1).

Fig. 1. Percentage of students with low level of knowledge and skills in "First Aid Provision" unit based on the results of initial tests (average data for 2014-2017; n = 316; $\varphi^*_e = 2.45 > \varphi^*_c = 2,31$, p ≤ 0.01)

Based on the criteria for knowledge assessment, it can be concluded that students in both groups have an average level of knowledge on the topics of the target section.

The teaching experiment involves the development of didactic material for the target unit for both groups and teaching classes using these materials.

Based on the test results for the control group, the didactic material was developed according to the traditional method, based mainly on the explanatory-illustrative teaching method. The didactic material included presentations, as well as lessons notes on the topics of the unit.
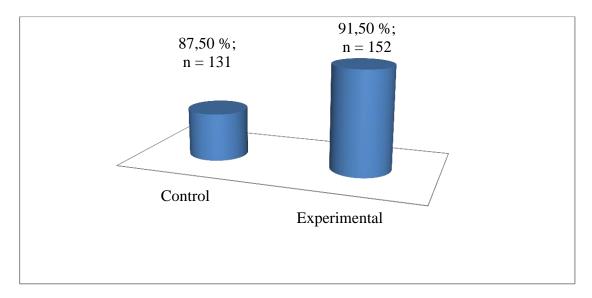
Based on the results of initial testing and questionnaire analysis for the experimental group, the didactic material was developed, including the following:

- Modules structure layout;
- Modules on first aid provision in emergency cases;
- Lessons notes for each module;
- Presentations;
- Video materials for the following topics: "Imposition of pressure bandage", "First aid for arterial bleeding", "Basic cardiopulmonary resuscitation", "How to apply a splint to a fractured limb".

The same topics of the "First Aid" unit during the school year are taught by a teacher in both groups in accordance with the program of the experiment, i.e. in the control group - using traditional teaching methods, in the experimental group – using modular training.
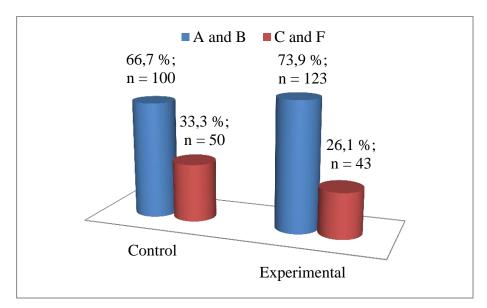
After studying a half of the material for each topic, the knowledge and skills in both groups are monitored to identify and evaluate the effectiveness of the developed modules in comparison with traditional training.

As a rule, the test results show the following: the statistical processing of data does not reveal significant differences between the groups, i.e. based on the obtained data, it can be concluded that with 99 % confidence the level of knowledge and skills of students in both groups is the same (the control group – 131 students; experimental – 152 students) – a medium when mastering half of the required material (Figure 2):

Fig. 2. Percentage of students with medium level of knowledge and skills in "First Aid Provision" unit after studying a half of the topics (average data for 2014-2017; n = 316; φ^{*}_{e} = 2.39 > φ^{*}_{c} = 2.31, p ≤ 0.01)

However, it should be noted that upon completion of the study of all the material in the "First Aid" unit, the level of knowledge and skills of students in both groups increased from medium to high, which indicates the effectiveness of both traditional and modular methods without any significant differences, i.e. methods bearing no significant differences on effectiveness (Figure 3).

Fig. 3. Percentage of students with high level of knowledge and skills in "First Aid Provision" unit after studying all material (average data for 2014-2017; n = 316; φ^{*}_{e} = 3.01 > φ^{*}_{c} = 2.31, p ≤ 0.01)

The obtained results allow us to conclude that the developed modules are effective and contribute to improving the knowledge of students and can also be used in teaching the first aid in emergency situations along with traditional methods. The traditional teaching method was just as effective, the study did not reveal any significant differences between the results in both groups, the level of knowledge increased from medium to high, which proves the feasibility and effectiveness of introducing the developed modules into the educational process along with the traditional teaching methods.

Recommendations for development of algorithm for modular training implementation. First aid is a set of simple actions for saving human's life. First aid provision is the civic duty of every

person, regardless of religion, race and political convictions. Below is a list of conditions when the first aid is needed (Ob utverzhdenyi perechnya…, 2012; Pogodin i dr., 2014; Golub i dr., 2007):

1. Collapse.
2. Respiratory and circulatory arrest.
3. External bleeding.
4. Upper respiratory airway foreign body.
5. Injuries of different body areas.
6. Burns, heat strokes.
7. Freezing injuries and other impacts of low temperatures.
8. Intoxication.

The experience of teachers all around the world showed that the essence of modular training is to develop skills for self-education of students (partial or full) based on individual program containing all elements for achieving teaching goals: lesson plans, information database, teaching materials, handouts, etc. The educational process is structured around conscious learning, the teacher acts as a counselor and coordinates, monitors and guides the learning process, and his key role is preserved but he can interact with every student during a lesson. Many years of experience revealed the number of shortcomings of modular training:

- large number of students' individual work;
- the teacher spends considerable time on development of training modules, handouts, teaching recommendations;
- development of specific practical skills against general ones;
- difficulty to maintain the required level of motivation for self-learning and self-development.

The modular training has important features: it involves algorithmization of educational process, clear structuring of teaching materials, consistent presentation and study of theoretical material; it assumes variability of training and possibility to introduce certain components of a given module into the educational programs; it also suggests adjustment of training process to an individual pace of a student's learning-cognitive activity (Blokhin, 2012; Borisova, Kozlov, 2010).

The fundamental difference between modular and traditional training is that material is divided into separate modules (blocks), each module is not a source of information but a tool for its assimilation. Another important distinctive feature is that each module is characterized by completeness of training process with further reflection and assessment of gained knowledge, the traditional training involves systematic study of logically connected topics and final assessment of knowledge of all course units.

A module, as a rule, consists if submodules and smaller units – training elements (TE). Training element is a separate teaching brochure, which is a step towards achieving the set goal; gradually learning the material of these elements a student achieves integration goals and tasks of a module in general.

Each training element must include a goal, certain theoretical knowledge and practical skills, interdisciplinary connections, teaching information, reflection and evaluation of material retention. It is recommended to have not less than seven training elements (Table 2).

Table 2. Required training elements (TE)

TE-0	Setting of integrating goal for achieving the learning outcomes;
TE-1	Tasks for evaluating the level of knowledge previous material/new topic (checking home task or independent work, etc.)
TE-2 and other TEs	Drilling of teaching material: explanation (individual, pair, group work), learning and initial consolidation of new material
Final TE	Knowledge assessment, summary, home task, reflection.

A larger (thematic) item is a modular block, uniting elements close in their content. Modular block ends with practical qualification task, according to which a student can be assessed on a professional scale. The whole modular course ends with final qualification test. The course must

have the multi-level assessment system but at the same time a student can plan his individual training process.

Modular training program is a system of logically completed elements of a given academic course – training modules. The teacher should develop the modular program including regular assessment of knowledge, skills and expertise, which helps to manage the educational process.

If there is a need to choose between modular and traditional system for teaching any given subject it is recommended to conduct a pedagogical experiment including the following stages:

1. Carry out the summative pedagogical research to determine the students' knowledge on a given unit/topic by means of tests. This will allow not only to identify the main knowledge gaps but to build the relevant modules, lesson plans and pay greater attention to problem areas.

It is recommended to evaluate students' knowledge on the following scale:

• High level – a student mastered successfully more than 70 % of the content of the educational program;

• Middle level – a student mastered successfully from 40 % to 70 % of the content of the educational program;

• Low level – a student mastered successfully less than 40 % of the content of the educational program.

2. Preparation and development of main teaching material.

3. Carrying out of forming and control experiment.

4. Mathematical-statistical processing of results.

For example, an ascertaining test can have five theoretical questions, three cases and three pictures for students to identify the type of the injury. Each task has its own score: questions - 1 point, cases – 3 point for each case, picture tasks – 2 point for each task. The maximum possible score is 20 points. The evaluation criteria could be the following:

• F ("unsatisfactory") – 12 points and less;

• C ("satisfactory") – from 13 to 16 points,

• B ("good") – from 17 to 18 points,

• A ("excellent") – from 19 to 20 points.

Based on the testing results it is recommended to conduct a forming experiment based on developed teaching material corresponding to modular training algorithm, namely:

• build modules structure (Table 3) for first aid provision in emergency cases;

• write lesson plans for each module;

• create presentations for lessons;

• select video materials for topics: "Imposition of a pressure bandage", "First aid for arterial bleeding", "Basic cardiopulmonary resuscitation", "Broken limb splintage" (Bubnov, Petrov, 2006; Golub, 2007; Diamant, 2013). (Table 3)

Table 3. Modules structure

Block: "First aid for emergency cases"	
#	Module title
M 1	General rules for first aid.
M 2	First aid for bleeding
M 3	Structure and function of cardiac and pulmonary activity. Signs of clinical and biological death.
	First aid for respiratory and cardiac arrest. Cardiopulmonary resuscitation.
M 4	First aid for fractures, bruises and dislocations
M 5	First aid for thermal injuries

Listed below are the main principles on the basis of which the didactic materials and the algorithm of all modular training are constructed: the principle of fragmentation and isolation of discipline elements; the principle of structuring of all elements and modules; the principle of dynamism; the principle of relevance, systemic and interdisciplinary integration of knowledge; the

principle of the flexibility of interaction between the teacher and the student; principle of perspective and applied value of knowledge, skills and expertise (Bukalova, 2009; Melnikova, 2013).

The most difficult in modular training is the selection of evaluation criteria for each module (topic). To check the building of knowledge, skills and expertise for each module it is required to conduct control testing, its results will help to make conclusions on the efficiency of modular training in comparison to traditional methods for mastering given competencies (Vakhitove, 2011).

As a rule, the developed modules are expedient and efficient for building competence for a certain topic or some subject in general.

4. Conclusion

Conclusions and recommendations for compilation of modules for ensuring their successful inclusion in educational process alongside with traditional techniques:

1. The modules should be introduced in educational process gradually. On the initial stage only elements of modular training can be used. The first few modules should be small but concise as the students are not familiar with this type of learning and training.

2. The modules should be interesting, informative, memorable and built according to age and individual peculiarities of students. The material, examples and tasks should be selected considering needs and life experience of students and current situation in the country and the world.

3. It is necessary to clearly mark the time for each task, because the enthusiasm of students with independent work can interfere with the lesson plan and effectiveness of the educational process.

4. It is necessary to ensure constant assessment of knowledge after each module or several training elements. This will promote consolidation and repetition of the material and reduce the possibility of cheating.

5. The tasks and questions should be structured in such a way that the student's answer is clear and concise, this helps to perform a self-check.

6. At all stages of modular training the teacher should act as a counselor and coordinate, monitor and guide the education process and he still has a leading role in communication with each student.

7. The development of modules should be based on basic principles of modular training: the structuring of the content of learning for isolated elements, dynamism, relevance, systemic and interdisciplinary integration of knowledge, flexibility and mutual understanding of the teacher and the student, parity and versatile methodological counseling.

8. One of the main features of modular training is the reflection of students at the end of each lesson. At the same time, it is necessary to evaluate not only their work, but also the educational process in the group, which contributes to the motivation of the training and cohesion of team work.

So, the gradual assimilation of theoretical material in modules, the consistency, completeness and coherence of learning activity, the possibility to select the pace of work – all this provides the opportunity for successful self-education and professional orientation in the future.

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