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NEW MODELS OF APPLIED MATHEMATICS

Summary: *Relying on modern pedagogical-psychological and didactic-methodical knowledge in university teaching, but also in modern innovative teaching, the application of new methods of learning, teaching and approaches in learning the content of applied mathematics with the aim of improving knowledge should achieve effects through usable knowledge. The teaching of applied mathematics should be connected with everyday experiences, but also with the creation of new models and their application.*

New models of applied mathematics should represent effective education that provides high quality knowledge and has a positive effect on general career development, thus contributing to the acquisition of applied knowledge that will contribute to the competence of the individual and ultimately the efficiency of the operations of those organizations that will employ personnel who have this knowledge. The full efficiency of the educational process, and then the fulfillment of work tasks, is achieved by acquiring applicable knowledge that maximally engages intellectual abilities.

Key words: *new learning models, effects of applied mathematics, business efficiency*

JEL classificatin: *C, C02, I2*

INTRODUCTION

The basic starting point in the educational process is knowledge that is essential for the successful inclusion of students in work, but even more so for the development of logical, critical mathematical thinking, reflection, resourcefulness, problem solving, problem situations and the efficiency of performing work tasks. A creative educator should think wisely, but at the same time be flexible and open to different alternatives. Therefore, the creative process is the process of arriving to the creative solutions, which in applied mathematics teaching can be achieved by motivating students to find a large number of solutions to a given problem. By applying new models of learning and teaching applied mathematics in the educational process of teaching, a creative, unusual and different way of learning and teaching comes to the fore. This leads to the development creative thinking of the students. The teaching process becomes more creative, and the school environment becomes a more comfortable and positive place for creative work, i.e. for the creative acquisition of knowledge, which in the future will result in efficient business.

1. NEW LEARNING MODELS

New learning models and forms represent new learning cultures. The new learning culture is aligned with the needs of the new society. New learning models are focused on action, on efficient business. They are focused on the student, on the development of their competencies, critical thinking and reflection. In the new culture of learning, the focus is more directed towards natural learning.

Today, problem-based teaching, teaching by levels of complexity, differentiated teaching, integrated teaching are generally accepted as the highest form of learning. By changing new models of learning and teaching, teaching becomes a very complex mental process in which all thought processes participate in different combinations, and because of this, students acquire knowledge in a creative way and through classes are trained for the real world that awaits them after they leave educational institutions and enter the labor market.

This kind of approach requires a greater commitment from the students. In this way, cognitive and logical actions are discovered and developed on the basis of which we make judgments about mathematical contents that are the subject of knowledge of the students' thinking and critical abilities (Maričić and Špijunović 2015, 653).

This tells us that it is necessary to apply different types of teaching, methods, forms, techniques, as well as teaching tools so that the potentials of the pupils are used as effectively and fully as possible. Previous experience and knowledge are very important, because on the basis of this knowledge, new ideas, thought processes, conclusions, problem situations and their solutions come about (Maričić and Špijunović and Lazić 2016, 30).

The student is required to be a researcher, to think logically and focus on mental work, where it is necessary to be concentrated, persistent and consistent in order to successfully solve the task (Kurnik 2002, 52). This type of learning develops creativity in the teaching of applied mathematics, a higher level of cooperation, more ideas, questioning, creating alternatives, responsibility, decision-making, critical thinking, efficient business.

According to the requirements and possibilities of new teaching models in applied mathematics teaching, the role of the teacher is changing. It becomes diverse. The teacher organizes, implements teaching content, tasks, motivates, formulates real problems and trains students for active use of various information, principles, rules, sources of knowledge, leads to critical thinking, reflection, problem solving (Anić and Pavlović Babić 2015, 40).

2. EFFECTS OF APPLIED MATHEMATICS

Education and upbringing are interconnected processes. We can direct their effect towards achieving the positive effects of applied mathematics. Within the framework of applied mathematics, there are numerous opportunities to carry out educational activities on pupils. By upbringing-educational effects, all personality changes that occurred under the influence of upbringing and education. It should be clarified that the term effect is of Latin origin (lat. *efficere, effectus*), and means "action, effect, success". When we talk about the effects of education, we mean the results, outcomes, effects of the educational process, which can represent knowledge, a system of values, skills and habits. Thus, the effectiveness of education refers to the success of achieving the goals and tasks of education. Of the numerous factors that influence the effectiveness of the educational process, two are the most important: the nature of the educational process itself and the subject of education, that is, its role and position in the educational process. Effective education is education that provides high quality knowledge and has a positive effect on the general development of the student's personality. The full efficiency of the educational process is achieved by acquiring knowledge based on critical reasoning, which maximally engages intellectual abilities. The effectiveness of the educational process is also determined by the extent to which the acquired knowledge has become the permanent property of the person and whether it can be practically used in new life situations, and in this

case in the business world. The educational effects of education refer to the results and effects achieved in the process of education, i.e. effects in the intellectual, moral, emotional, work, physical and aesthetic education of the students' personalities, as well as on their behavior and actions in this process. The effectiveness of the educational process means "the degree of success of each pedagogical measure undertaken in the process of education." The criteria for evaluating efficiency can be different, such as the amount of acquired knowledge, skills and habits, their quality, intensity and impact on positive changes in the behavior of pupils, etc.

The aspect of education in the teaching of applied mathematics emphasizes the alternative of acquiring general and specific knowledge, considering that they are acquired in a different way than it was the case in education until now.

The idea of education as the transmission of ready-made information and the building of certain precisions has been overcome. It creates the impression that everything must be taught in a strict logical order and that the production and recognition of quality is a matter of adopting a deductive thought system based on abstract concepts, in which mathematics plays a predominant role (Iniri Hapsari 2019, 110).

The ultimate goal is for the student to acquire knowledge through his/her own efforts, because the educational process should be oriented toward creative work. That is why this paper is the result of research aimed at finding answers to the question of how the application of new learning and teaching models affect the learning and teaching outcomes of students and later on the application of these findings in the workplace.

3. RESEARCH METHODOLOGY

The aim of this paper is to answer the question whether the application of new models in the teaching of applied mathematics becomes interesting, that is, to examine how both the teacher and the pupils think, to what extent the application of new models of learning, teaching and problem solving in the teaching of applied mathematics makes the teaching of mathematics interesting for the pupils and both from the point of view of the teacher and from the point of view of the students, and what kind of final effects such teaching achieves.

The research problem is to examine how the teacher and student think, to what extent the application of new models in the teaching of applied mathematics becomes interesting.

The subject of the research is the views of teachers and students on the application of new models in the teaching of applied mathematics.

The sample included 200 preschoolers, 200 teachers from the Banja Luka region.

The methods used in this research are methods of theoretical analysis and synthesis, descriptive methods or survey methods, static quantitative methods. The scaling-estimation technique was used in the research.

The assumption is that by applying new models in the teaching of applied mathematics, the teaching of mathematics becomes interesting, the solution of tasks is reached in a creative way through critical thinking and reflection, and therefore business in applied mathematics is more effective.

Several statistical procedures were applied, all of them in one way or another dealt with the consideration of pupils and teachers.

The application of new models of learning and teaching requires, in addition to mutual interaction, great responsibility for one's own work, mutual communication, interactive relationships, research, critical thinking, reflection, as well as respect for each member of the group and supporting their ideas and thoughts. The role of the student changes by solving problem tasks and situations, the student investigates, asks questions, collects new evidence, expresses his/her opinion using arguments, takes into account other perspectives, understands causes and consequences, uses independent and self-directed thinking, i.e. comes up with new innovative idea, makes decisions based on evidence, concludes, solves the problem as evidenced by this research.

Firstly, an analysis of the measures of descriptive statistics was carried out in order to establish the tendencies within which the obtained results move. After that, the deviation of the obtained distributions in relation to the normal was checked. After that, the degree of agreement between the students and their teachers regarding the assessment of the quality of applied mathematics teaching using new teaching models was discussed and an answer was given based on all these data.

Table 1. Verification of the significance of the differences in the teacher-teacher assessment by the students and teachers using the T test (Authors)

A variable	N	M	SD	t	p
evaluation by students	200	43,44	4,24	6,69	0,00
evaluation by the teacher	200	45,37	3,45		

N – sample

M – arithmetic mean

SD – standard deviation

W – variance

t – t test for dependent samples

df – degree of freedom

p – level of statistical significance

A comparison of the results related to the assessment by the pupil - teacher, obtained by the pupil and the teacher, show that there are statistically significant differences between them. Namely, teachers statistically significantly (at the level of statistical significance 0.01) evaluate the application of new models in the teaching process, which makes teaching and business very high quality and rich.

Although the obtained values of this assessment by the preschoolers are also high, the teachers still statistically significantly evaluate them as higher.

In the simplest terms, teachers evaluate the application of new models in the teaching process more highly than their students. By doing so, they probably in some way increase their role in education and upbringing, considering that they are also the creators of the educational process.

Table 2. Correlation of teacher-teacher assessment by students and teachers (Authors)

A variable	evaluation of teachers by teachers
evaluation of teachers by students	0,236**

** - statistically significant at the new 0.01

The correlation of teacher-teacher assessments by teachers shows that the connection between them (0.236) is statistically significant at the 0.01 level. This should mean that students evaluate the application of new models in the teaching process as very rich and high-quality.

Data related to the evaluation of the application of new models in applied mathematics teaching, the teaching of applied mathematics becomes interesting, which shows very high results, regardless of whether it is an assessment of the students themselves or the teachers. All variables are statistically significant at the 0.01 level.

Bearing this in mind, we can clearly conclude that it is a very high-quality and frequent evaluation and by applying new models in the teaching of applied mathematics, the teaching of mathematics, business and solving tasks becomes very interesting for preschoolers.

In other words, we could say that the responses and evaluations by the students and teachers based on the results obtained with this type of teaching and learning of applied mathematics are rich.

This type of teaching requires constantly preparation of the teacher, both theoretically and practically, because according to the individual, mental abilities of his/her students, the teacher needs to determine what are the differences between them in abilities and knowledge, and based on that he/she has to design tasks.

By applying and creating tasks with new types of teaching and new ways of working, good results are achieved, teaching becomes more interesting, and students think critically, reflect, evaluate and come up with solutions to tasks in a creative and very interesting way. By encouraging such learning and reflection, students are motivated to think the same way later when they are involved in business processes, to be more creative, to think critically, to be able to apply what they have learned in work, which will ultimately contribute to a higher level of their satisfaction and their competences, and this will ultimately affect the efficiency of the business. By applying new models, certain laws or new learning theories and the acquisition of applied knowledge are achieved.

New models and types of teaching must be well designed and functionally used with other types of teaching, forms and methods of learning and teaching (Ningsih 2014, 85).

Knowing how to solve a mathematical problem represents the best characteristic of the mathematical thinking of preschoolers and their mathematical education (Puji Ati and Setiawan 2020, 297).

CONCLUSION

By applying new models in the teaching of applied mathematics, the teaching of mathematics to preschoolers becomes interesting, viewed from the point of view of the teacher and the preschooler. It can be concluded that, according to the assessment of students and teachers, the application of new models of applied mathematics teaching in the teaching process is a very important educational resource, because by applying new models in the teaching of applied mathematics, it is very important to empower students to solve tasks, problems, situations individually or within a group. In this way, the pupils are motivated and learn to solve problems in the same way later in the work team because this model becomes acceptable for them. The student's motivation, his/her engagement, faith in himself/herself and faith in his/her ideas, which can lead to the solution of tasks, are very important. The application of new models in the teaching of applied mathematics brings to the fore the ability of the students to search for adequate content in the textbooks related to the given problem, and later to look for solutions for business challenges, and to spend their time in a quality way and to try to apply the learned material later, they successfully apply it to new tasks and situations, which is the main feature of the new approach in applied mathematics teaching.

The ability to solve a mathematical problem represents the best characteristic of the mathematical thinking of preschoolers and their mathematical education, which can be applied to various life situations.

In this way, knowledge is acquired through independent work, researching and searching for specific data, solving tasks and thus practically creating new knowledge, and the teacher's role is to prepare appropriate tasks and situations, motivate students, encourage their engagement, critical thinking, reflection when solving tasks, and states that they apply the acquired knowledge in further learning and modern business.

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