THE IMPORTANCE OF INTRODUCING INNOVATIONS IN THE TEACHING OF INFORMATICS AND COMPUTER SCIENCE IN PRIMARY SCHOOL

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Abstract:

The paper presents the importance of introducing innovations in the teaching of informatics and computer science, which is studied in primary schools.

Given the rapid development of science and technology and the availability of these new technologies to today's new generations, there is a need to change the way we approach the students' upbringing and education. The introduction of innovations in the teaching process, primarily computers and computer technologies, encourages greater motivation and interest of students to acquire new knowledge and to study teaching materials, as well as check previously acquired knowledge.

The justification for introducing innovative methods in teaching the subject of informatics and computer science has been proven on a concrete example through the usage of the application "InfoZNANJE". This application was created with the aim of enriching and improving the teaching of the subject in which it is applied, and its functionality is reflected in solving pre-prepared interactive tests in a digital form adapted to the age of students and the class they attend.

Keywords:

Student, computer, informatics, information and communication technologies.

INTRODUCTION

At a time when real preconditions for the successful application of ICT in teaching are being created in our educational system, it is up to the school as an institution and up to a teacher as an individual to decide whether to continue working according to the traditional model or improve their work and education in general by enhancing the achievements of their students through applying innovative teaching methods [1].

In recent years, computers have begun to be widely used in schools and conditions have been created for better innovation of educational technology. And just as the goal of a modern school is to prepare students for life, one should strive for the student who leaves the educational institution to have enviable skills and abilities related to the use of computers [2].

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Using the possibilities and advantages of modern digital teaching aids, technical devices, and educational software, the teacher achieves the best effects in transferring and acquiring knowledge, making the teaching process more dynamic, attractive, and successful [3].

2. INNOVATIONS IN TEACHING

Innovation in teaching means a novelty that is implemented in pedagogical reality. The purpose of every novelty is to improve the activity in which it is introduced.

The organization of education itself must change, especially the contents and methods of work of educators. The school as we know it today, a peaceful and relatively closed oasis of knowledge, must grow into an open research station where young people will acquire and constantly innovate their knowledge. It should be a laboratory in which experiments are continuously conducted, created, discovered, and innovated. Today, innovation is a condition for the school not to lag behind the social and technological changes that occur every day [4].

Most of the work teachers did in the past has now been taken over by modern means of presenting information. Thanks to the progress and development of information and communication technologies, students and teachers can interact with databases rich in various information very far from their classroom or study [5].

2.1. MOTIVES FOR INNOVATION

Intensive development of science, technology, and engineering requires that every educator improve their skills and be up to date with innovations in the world that are of importance for their professional field and that directly affect the quality of teaching. The teacher should aim to help students form certain knowledge, skills, and abilities. School's goal is to develop the personality and individuality of every child.

Modern teaching should enable the creative freedom of students, which is reflected in selected and prepared program units. These units enable students to learn, express their abilities and form positive attitudes toward modern technical and technological creativity [6].

Continuous innovation in the teaching process intends to contribute to a more efficient and better realization of the educational process. A successful educator (teacher) does not expect someone else to demand or impose a novelty (change) on them. They must be the initiators and implementers of innovations in teaching - their preparation, programming, implementation, monitoring of the flow of innovation, and evaluation of the results obtained. Since innovations should become a way of work for teachers in schools, every teacher should be trained to perform innovations and use innovative models of work in the teaching of individual subjects [5].

Today, it is more important for students to learn how and where to find the necessary information, how to check and use it, than how to keep all the information in their heads. "Learning how to learn" has become more important than dry memorization and reproduction of knowledge.

2.2. PROFESSIONAL DEVELOPMENT OF TEACHERS

Continuous professional development and acquisition of new knowledge and skills for employees in education are extremely important because their task is of social interest. The roles and needs of teachers have changed throughout history, supplementing and adapting to the needs of time and society. The traditional approach to the educational process is still present in practice, and teachers themselves must be more open and ready for certain changes in work (active teaching, constant involvement of students in work, use of modern technologies) [7].

Without an educated teacher, their ability to accept and adapt to new developments in science as well as personal skills and motivation, educational institutions cannot be developed, educational processes cannot be improved, and students cannot be sufficiently trained and educated, which is the basic goal of education.

Continuous professional development of teachers includes monitoring, acquiring, and applying modern achievements in science and practice to achieve the goals and objectives of education and improve educational practice. Teachers improve existing knowledge, skills, and abilities and develop openness to continuous learning through individual or group forms of professional development [4].

2.3. COMPUTER AS A TEACHING TOOL

A computer is a teaching tool which can replace many other teaching aids that were represented in traditional teaching with the appropriate software, internet connection, and additional technical devices. It is physically impossible to provide one teacher for one student, but in modern society, we have the opportunity to use computers in teaching, which facilitates and improves the work. With such an approach, each student can progress according to their abilities. The use of computers in teaching aims to make lessons much more attractive to students, which encourages active learning but also greater motivation. Information should be more interesting, lessons tailored to the needs and interests of students, as well as to the pace of student work, which would contribute to better efficiency of the learning process.

Disadvantages of traditional teaching that can be avoided by using computers:

- Students are not passive in the teaching process but learn actively and sometimes independently at their own pace. The student is the subject of teaching.
- Students immediately get feedback on what is right in their answers and what is wrong and thus control themselves, which creates the possibility of learning from their own mistakes.

Computer simulation is a special type of teaching in which there is a possibility of visualizing the process. The essential feature of computer simulation is modeling using a mathematical apparatus and/or formal-logical rules. From the student's point of view, computer simulation provides two-way transmission of information because the student can independently manipulate model variables.

Virtual laboratories, experimental programs created using computers, require the integration of laboratory procedures into software solutions, the formulation of special curricula and the determination of complementary educational outcomes.

Online teaching (or web-based teaching) requires students to be connected to the Internet. This allows access to various data sources, the direct exchange of information, discussion, checking progress, etc. This type of teaching relies on previous ways of using computers in teaching. It can be an independent teaching process, but the possibilities of incorporating it into regular teaching activities are recognizable.

3. "InfoZNANJE" AS AN INNOVATIVE METHOD IN TEACHING INFORMATICS AND COMPUTING

As an innovative method in teaching the subject of informatics and computer science in the elementary school "Žika Popović" in Vladimirci, an application called "InfoZNANJE" was created by the teacher of the mentioned subject.

The project "InfoZNANJE" was designed and created to enable the students of the aforementioned school to become better acquainted with the materials of informatics and computer science in digital form and to enable them to master the most important points from each teaching unit more easily, as well as to solve tests.

The project was conducted using databases, HTML code, PHP, and CSS.

Due to technical limitations in the institution where the application was created and used, the installation of the application "InfoZNANJE" was carried out on a local server and used in the local network. The application diagram showing the key parts of the system is shown in the figure that follows (Fig.1).

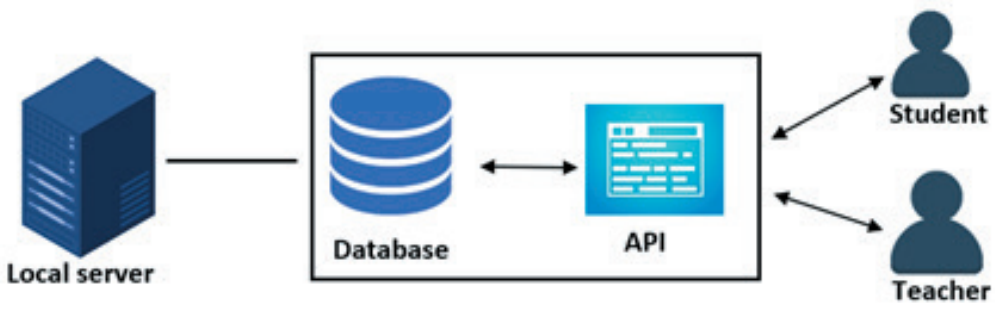

Figure 1 - Application diagram showing key parts of the system

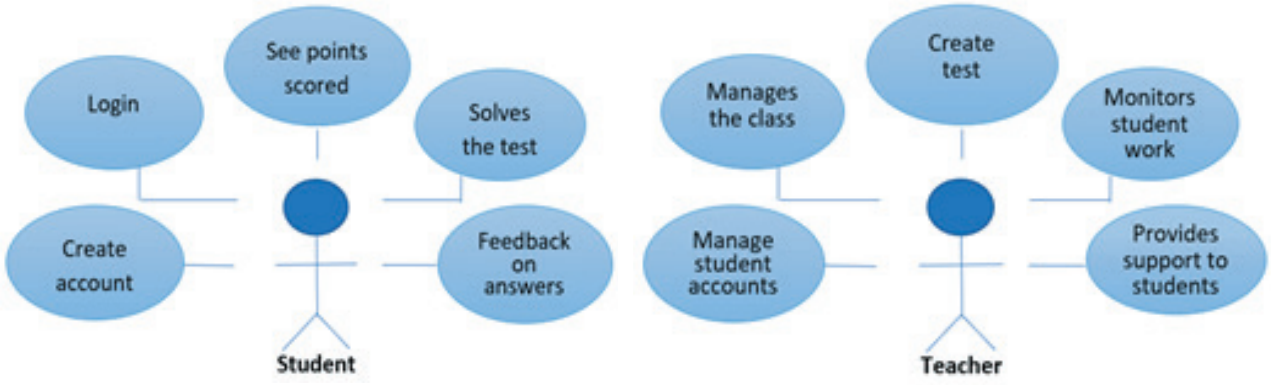

Figure 2 - Use-Case diagrams for student and teacher

This application consists of a user (student) part and an administrator (teacher) part. Each user in the application has their own role and certain privileges that are shown in the Use-Case diagram (Fig.2).

3.1. APPEARANCE AND FUNCTIONALITY OF THE APPLICATION

When accessing the application (Fig. 3) there is a home page that contains basic information about the project, an e-mail that students can contact if they have questions or suggestions, a special section for login students who already have an account or if they use the application for the first time, they will be redirected to a page to create their own account.

When creating a new student account, they need to enter their unique ID and password, which they will use every time they log in to the application. Students will also be required to enter other information such as name, surname, e-mail address, and the grade they are attending. Based on the ID data, the application monitors the work of that student, their activities, and the results they record in the database.

After login, students have the opportunity to review their previous results or choose a new test (Figure 4) with pre-defined knowledge test questions.

Figure 3 - Appearance of the "InfoZNANJE" application page.

Figure 4 - The appearance of the test question.

Depending on the class they attend, students can choose the unit from which they want to solve tasks or to master the previous material and achieve better results; they are allowed the option of retaking already completed tasks, where the application will record the number of attempts to fill test and record each result. Each test consists of several questions that are selected as the most important for a given teaching unit and which are in accordance with the curriculum of the class the student belongs to.

The administrative (teaching) part (Fig. 5) allows teachers to log in to their account and to add tests and questions after the topic, which students will be able to solve later. There is also the possibility of adding new teaching units and new classes. The teacher in the application can check the success of individual students, their interests, and activities in the application.

3.2. SUBJECT OF RESEARCH

The main research question of this paper refers to the positive impact of the innovative applied method in teaching informatics and computer science in the elementary school "Zika Popovic" in Vladimirci through the active usage of the application "InfoZNANJE" by students and teachers of this subject.

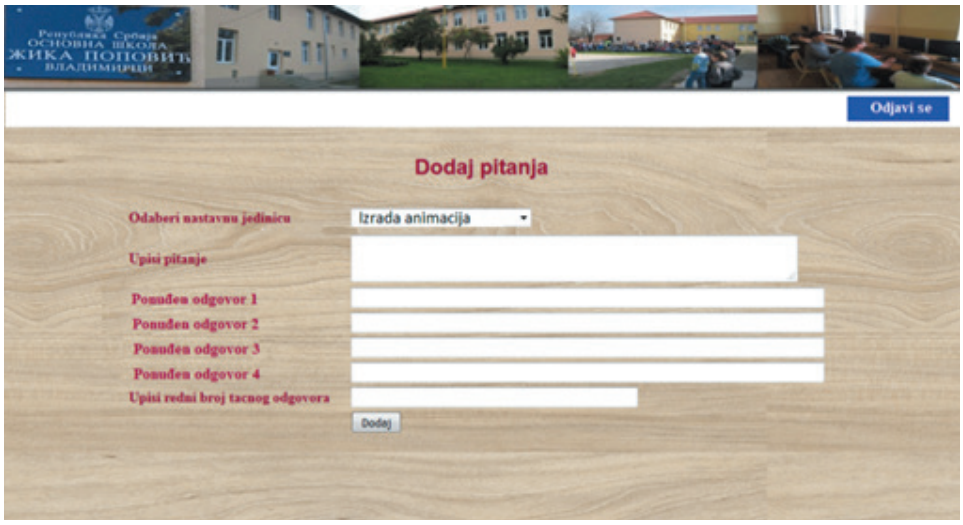

Figure 5 - Administrator account..

The research starts from the general hypothesis, which reads:

The application of innovative methods in teaching the subject of informatics and computing has a positive impact on the increase in the efficiency of teaching in primary school.

3.3. THE GOAL AND TASKS OF THE RESEARCH

The research aims to form a picture of the application of innovative methods in the teaching process of the subject of informatics and computer science, as well as the attitudes and opinions of students about it. The aim is to point out the statistically significant possibility of raising the overall level and quality of the educational process by using information and communication technologies in teaching, based on the use of innovative methods in the education of primary school students. Students are expected to express a desire to make greater use of modern teaching aids.

Research tasks:

- To determine whether students use an innovative method in teaching the subject of technique and technology presented through the program "InfoZNANJE"
- To determine whether the mentioned innovative method has contributed to easier mastering of teaching materials;
- Review their interest in continuing this form of teaching and processing new material through the subject;
- Examine their desire to introduce innovative methods like this into other subjects

3.4. RESEARCH METHODS, TECHNIQUES, AND INSTRUMENTS

In the research process, the method of anonymous type survey was used, i.e. the survey questionnaire instrument. The questionnaire is designed to contain five questions and an explanation of how to answer the questions. They are set in writing, and answers are also given in writing. Each question is answered, and students should mark one of the offered. The survey was used only for statistical purposes for this paper.

The questions are designed to provide an overview of students' opinions and attitudes on the application of innovative methods in teaching, and specifically on the usage of the application "InfoZNANJE" in the teaching of informatics and computer science.

3.5. SAMPLE AND PLACE OF RESEARCH

A deliberate sample was taken for research purposes. The examined group consists of 178 students of the fifth, sixth, seventh, and eighth grades of the elementary school "Zika Popovic" in Vladimirci, who have the subject of informatics and computer science as obligatory during their schooling.

3.6. RESEARCH RESULTS

Based on the research (Fig. 6) in which 178 students of the fifth, sixth, seventh, and eighth grade of the elementary school "Zika Popovic" in Vladimirci participated, very positive results were obtained which speak of the justification of applying innovative methods in teaching computer science.

To the first question (question no.1): "Do you use the InfoZNANJE application regularly?", 81% of students answered YES, 7% NO, and 12% answered OCCASIONALLY.

To the second question (question no.2): "Did the InfoZNANJE application contribute to easier mastering of materials from the subject of informatics and computer science?", 92% of students answered YES, and only 8% NO.

To the third question (question no.3): "If you had the opportunity to choose, would you always choose to work in the application instead of other ways of testing knowledge?" 79% of students answered YES, 6% NO, and 15% of students answered OCCASIONALLY.

To the fourth question (question no.4): "Would you like InfoZNANJE to continue to follow your teaching in informatics and computer science?", 93% of students answered YES, 2% NO, and 5% of students answered OCCASIONALLY. This speaks to the desire of students to learn through play.

To the fifth and last question (question no.5): "Would you like to have similar applications for other subjects" 96% of students answered YES, and 4% NO. This information should influence the motivation of teachers to introduce innovative and modern methods in their organization of classes.

The results of statistical data analysis presented in Table 1 and obtained by comparing the responses of students of all grades confirm the hypothesis and the expectation of positive results. Statistical analysis was performed in the SPSS program.

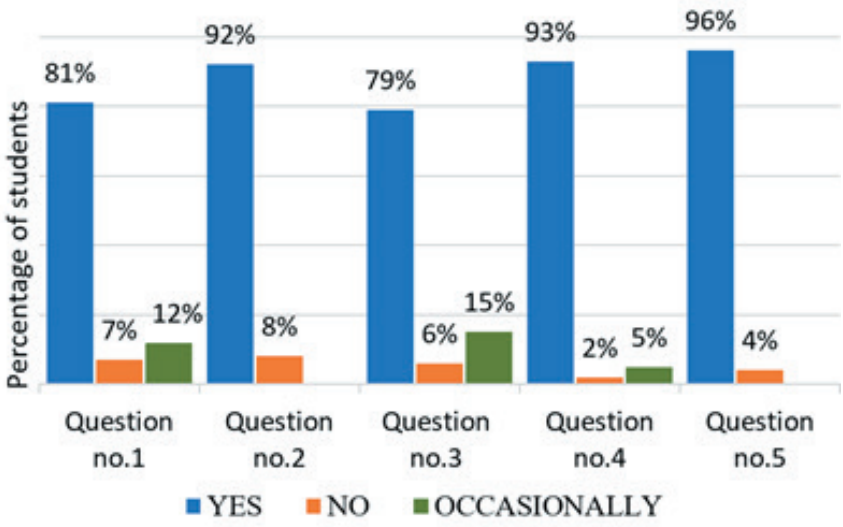

Figure 6 - Graphic presentation of research results.

4. CONCLUSION

The research in this paper has shown and proved that there is a great justification and need for the introduction of innovative methods in the teaching process in school because that is what today's generations need for the successful acquisition of teaching materials.

Science and technology are evolving at a rapid pace, and the school itself, teachers, and students are in a significantly different environment than a few years ago and perhaps a decade ago.

In such circumstances, the school cannot remain in the traditional way of working, where the teacher, textbook, and accompanying teaching literature are the only source of information and the students themselves are passive receptors of the material.

Much of the work that was once done only by teachers is now being taken over by modern teaching aids, and the approach to students is becoming different.

Due to all of the above, it is necessary for teachers to embark on modern teaching trends and apply innovative forms of work in the classroom without waiting for the changes to come of their own accord or for someone else to impose those changes on them.

Question	Correlation	Sum of Squares	df	Mean Square	F	Sig.
Question no.1	Between grade	,110	3	,037	,192	,902
	Within grade	33,328	174	,192		
	Total	33,438	177			
Question no.2	Between grade	,124	3	,041	,564	,640
	Within grade	12,775	174	,073		
	Total	12,899	177			
Question no.3	Between grade	,341	3	,114	,558	,643
	Within grade	35,395	174	,203		
	Total	35,736	177			
Question no.4	Between grade	,021	3	,007	,095	,963
	Within grade	12,838	174	,074		
	Total	12,860	177			
Question no.5	Between grade	,075	3	,025	,655	,581
	Within grade	6,650	174	,038		
	Total	6,725	177	,037	,192	,902

Table 1 - Statistical analysis results.

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