Educational material in a form of digital classes used as an innovative approach in the teaching process of mathematics

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Abstract: Continuous development of the information technologies arouses interests among the educators and researchers to form educational softwares which are used in the teaching process. Information technologies are of key importance in the modern educational era. Indeed, computer usage and usage of the interactive material for learning and working in the students' friendly environment can contribute to the development of students' motivation, research spirit and wish for learning. In the paper, few digital teaching units will be represented with the aim of forming the interactivity among teaching material and students, all for the purpose of improving the quality of education.

Key words: digital classes, interactivity, information technologies, GeoGebra.

INTRODUCTION

Nowadays, information technologies are considered to be the core of the further society advancement, whilst education is the foundation of the contemporary society and the key factor when it comes to nation development and the country advancement. For a long time, information technologies are the present, not the future. Together with reading, writing and calculating, knowing information technologies is the part of the elementary literacy. In order to form successful educational system, the system should follow the contemporary trends and it should apply a contemporary technology.

Based on the international researches which measure the accomplishments of the students, like OECD/ PISA i TIMSS testings, we learn that the students from Serbia, when it comes to the knowledge application, are in the unenviable position compared to their fellow students form abroad[1]. Serbia took part in the PISA testing in 2003, 2006, and 2009. Average students'result was 437 points and in 2009, 442 points. Regardless of the improvement, our students are still far away from the international avarage score which is 500 points. Considering the fact that one year of education brings in average 40 points on the achievement scale, it is evident that our students fall behind more than just one year compared to their fellow students. Results of this kind clearly indicates that the teaching process should be adjusted according to the needs and interests of a modern student[2].

Looking at the a teaching unit is presented in an average Serbain school, today, it is concluded that the way of presentation does not greatly differ from the way it was twenty years ago. The teaching process in Serbia is based on the traditional grounds, it is linked to blackboard and the frontal way of presentation. Despite the aspirations to place the student in the center of the education, the pillar of that center is still mostly the teacher himself/herself. As one more drawback of this teaching process, the one-way communication should be emphsised. If we, for instance, observe students, thier environment, way of life, aspirations, interests, a huge difference is noticed between the students of today and the students of twenty years ago. Students are overloaded with information and their attention is directed to various contents. In that surrounding it is necessary to improve and innovate classes, so as the teaching process becomes more interesting, useful and understanable to students.

The last decade of the twentieth century has been characterised by significant changes in all spheres of the society, thus the qualitative changes have also been expected in the sphere of the education. Certain countries have witnessed the advantage of the information technologies which formed a ground for the further changes ragarding the position of the teachers and the students. The changes tackled the important issues, such as revealing the teacher of the routine activities connected to memorising numerous facts, way of presentation and assessment, with the increase of the students activities and

constant interaction among teachers and students. It is expected that a student will become the pillar of education and that he will gain information from different resources; that he will acquire new knowledge with the pace which suits his abilities and foreknowledges, so he will master the teaching content thoroughly and with understanding.[3]. Dominant role of the teacher has been replaced with the role of the strategist[5] and advicer. The education of the information era, with the usage of the new technologies, considers also the changes in the work organisation, teaching forms and methods, in order to surpassthe is advantages of the traditional teaching process and to place the education process onto the level of a higher quality.

Information technologies should be introduced in the education system through the process of application and integration, by educating the teachers, which will have positive impact on other spheres of children development, placing all segments of educational work onto a higher level and develop media culture among children. In accordance with this, in this paper, one of the ways of the improvement of the teaching process will be presented, so as the interactive teaching materials for units "Operation in the set of natural numbers" and " and "The sum of the interior angles of triangle and triangle types depending on angles size". For the presentation of the content web technologies HTML,PHP and JavaScript are used. Mathematical text is displayed through MathJax functions, and the dynamism of the education material is accomplished by using GeoGebra applet. Material is designed for teachers and pupils of the fifth and sixth grade of the primary school.

OPERATION IN THE SET OF NATURAL NUMBERS

Aims of the material which will be presented are determination and widening the accomplished knowledge regarding the computer operations and their application on the real problems, development of the students' motivation and research spirit. Teaching materials which is the base for the class of this teaching unit is available on the internet page http://www.alas.matf.bg.ac.rs/~ml06095/dc3/index.html and follows the educational standards. Exercises for the basic level are placed in the green frames, for the second-intermediate level are in the blue frames and exercises for advanced level are placed in the red frames.

A digital class starts with the students running the internet application http://www.alas.matf.bg.ac.rs/~ml06095/dc3/index.html.The assignment of the teacher is to briefly introduce the students with the teaching unit which is to be learnt (what is written in the materials, explain and define of the given problematic situation, what is the task of the student) Afterwards, when students "meet" Petar and Marcus with who they will "be friends", lesson and their learning can begin.

The first assignment does not demand the application of the specific mathematical concept, but its aim is to encourage those students who have negative attitude towards the mathematics to solve the problem and to engage them into the process of finding the solution.

Beside this, so called motivation task, group from this basic, consists of other two tasks (level reading and writing numbers, finding the smallest and the biggest number). These tasks provide the students with the possibility to check the correctness of their answers by clicking on the button "Check the results". If a student answered correctly, given answer will become green, vice versa given answer will become red. Beside this, student can choose option- "Show the correct answer", which enables student to see correct answers. In this part, information technologies are proved to be of a great importance, a student immediately gets the information showing how many examples he or she managed to solve. This all improves the quality of learning.

Furthermore, there is a group of assignments for the intermediate level. By doing these assignments student should first read the information which are shown on the simple graph, then he should write them in the table and after that he should represent them on the number ray or vice versa. They should also read this information from the given table

and to represent them on the graph. The aim of these tasks is to enable the students to be familiar with the graphical representation, so as to learn how to read them. In these tasks, GeoGebra applets are created, they enable the interaction between students and the teaching material.[6]. Given applets contribute to the creation the interactivity or in another words a student is an active reader of the material[5]. The usage of computers is very significant and in this task has a purpose to facilitate the work of the students and to make it more understandable and interesting.

Giving the fact that one real situation is used here, situation which circle the whole picture of Petar and Marcus, it is expected that students will be motivated for solving these tasks. Also, given problem should affect the development of the students' motivation, so as to help them to see how mathematical knowledge is important in the real daily situations.

In this assignment, it is expected of a student to notice all possible ways of connecting places A with B. It is also expected of students to read information from the auto card and consider various numbers of possibilities. Also, following these information from the card, a student must chose the cheapest and the shortest way. It is expected of a student to calculate the sum of money needed for building a road. Here is necessary to apply addition of natural numbers. While the student in the future task apply multiplication, addition and subtraction of full numbers, he must good understand a problem, create a new way for solution and in the end apply an adequate mathematical concept, which represent steps in the realisation of the problem.

The class ends with giving a homework. At the end of the internet page http://www.alas.matf.bg.ac.rs/~ml06095/dc3/index.html (where is the lesson) there is a button – link Homework. By clicking on this button, the page with homework is opened. This homework is created to be done in pairs.

At the beginning of the page there is an empty space where a student pair put their personal information: names, e-mail addresses, and the e-mail of the teacher. After writing this information, homework is to be done. Homework is done in pairs. The idea is that students choose three cities which they would like to visit and then to explore the distance between those cities, the ways how they come to those cities, the amount of money they need for the ticket and similar things. At the end of the page with the homework there are empty boxes where students can write their comments, questions, complaints,…and at the end of the page there is a button "Send". By clicking on this button homework is sent to the teachers' mail which is written at the beginning. This kind of homework represents a kind of research assignment which demands usage of information technologies. Reason for solving in pairs is accomplishment of a better cooperation between students and creationof a team spirit. It is expected that the students will find this kind of homework interesting, regarding the fact that they have been given a freedom to choose and to send their answers interactively.

It is recommended to do the evaluation also, which means that students should fill in the survey giving their impressions from the previous class, in order to create a picture about the students' attitude when it comes to conducting these classes by usage of the information technologies.

SUM OF THE INTERNAL ANGLES OF THE TRIANGLE. TYPES OF TRIANGLES DEPENDING ON THE SIZE OF THE ANGLES

By realizing these digital classes it is planned that a student learn a certain teaching unit. Sum of the internal angles of the triangle and types of triangles depending on the size of the angles by using the interactive material (each student needs a personal computer). Materials are available on the page http://alas.matf.bg.ac.rs/~ml06125/digitalnicas/index.html. The teacher is presented all the time as a help and support, he or she gives directions, additional explanations and instructions. At the end of the class students will get a printed version of the material which they will keep in their notebooks.

Class starts with the interactive material introduction, which is available on the page http://alas.matf.bg.ac.rs/~ml06125/digitalnicas/index.html. The first part of the material is dedicated to repeating the information that they learnt in the previous class. In this part a student will briefly repeat the term collinear points, then he or she will repeaton the interactive applet triangles marking.

Student is an active reader of the material and the advantage of this usage of information technologies is that every student can adjust his or her pace with their capabilities. Teacher is presented all the time, as a help and support to students while they work.

In the medium part of the class students experimentally discover sum of the angles in the triangle, by using applets on the interactive web page. In this part students are given an opportunity to change types of triangles very easily and to determine the sum of angles of that triangle. After that a theorem is explained to students, so as the importance of theorem and its proves. Then they are presented with a proof (using the material for learning) step by step, by interaction with the picture which helps student to understand the proof. It is expected of students to consider all examples step by step and then assignments follow. In these assignments students should check if they have understood the presented content. Also, a student has an opportunity to check if he or she has correctly completed the assignment by using the specific button on the page. This kind of representation of the mathematical content is convenient because it reveals students of the routine transcription of the content from the table and make them to actively read mathematical text and follow the content which is presented on the screen.

The next part refers to the types of triangles regarding their internal angles. Before the classification, a student should experimentally determine, by using GeoGebra applet, the fact that the triangle can have only one right, i.e. obtuse angle. This heuristic approach to the students contributes to a clearer and longer understanding of the teaching material. A student is not presented with information, but he should on his own come to the conclusion by conducting a research.

For the last part of the class it is planned to complete the interactive quiz which has a purpose of evaluation. The quiz consists of nine questions with the given answers. Created questions refer to the already presented content of the material. At the end of the quiz a student receives a feedbackshowing the number of assignments he solved correctly and mistakes he made, also it shows correct answers.

CONCLUSION

The education system in our country is still based on the traditional way of teaching which is grounded on the plenarylectures. Students are mostly just passive readers of the teaching material, and in most cases blackboard and a chalk represent the only teaching equipment. Heuristic teaching is rare, so as the usage of the information technologies in the teaching process. The idea is to place students into the center of education and to enables them to become active consumers of the teaching content. The aim is to adjust classes according to the needs of the modern society and top resent it in an adequate way. Also, one of the aims is to make teaching material available and interesting, in order to form a wish among the students to learn, explore and experiment.

In this paper, one part of the functionality of the pogramme package GeoGebra and possibilities which it possess, is represented. It is represented in an interactive educational material which consists of the following teaching units: "Operation in the set of the natural numbers" and "The sum of he internal angles of a triangle depending on the size of a triangle". This is orginises by using a plan and a programme for elementary schools. The way and the possibility of the usage of the discussed material are described: for interactive learning, practising of the assignments, checking the knowledge and developing the research spirit among students. This approach of creation of the education content can be applied on the other mathematical units, so as on the other subjects. By using the

information technologies teachers can present an apstract mathematical terms to students and place them in the virtual surrounding which is closed to the students of today. In this way a place where students used to play can become the place where they will discover new things and learn.

Interactive clases need a lot of strain, effort, work and proficiency, so as the number of other conditions which makes innovations to become slowlyan inseparable part of the teaching process. The aim is to create interactive material of a great purpose which will publically available. It is needed to create materils of a high quality which fullfill basic matodological criteria, which will furthermore have a positive effect on the creation of the students competation. Of course, a spoken word of a teacher can not be omitted, while the interactive material will represent one new approach, which will contribute to understanding of the students motivation and the research spirit.

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The paper is reviewed.