UNIVERSITY OF NOVI SAD
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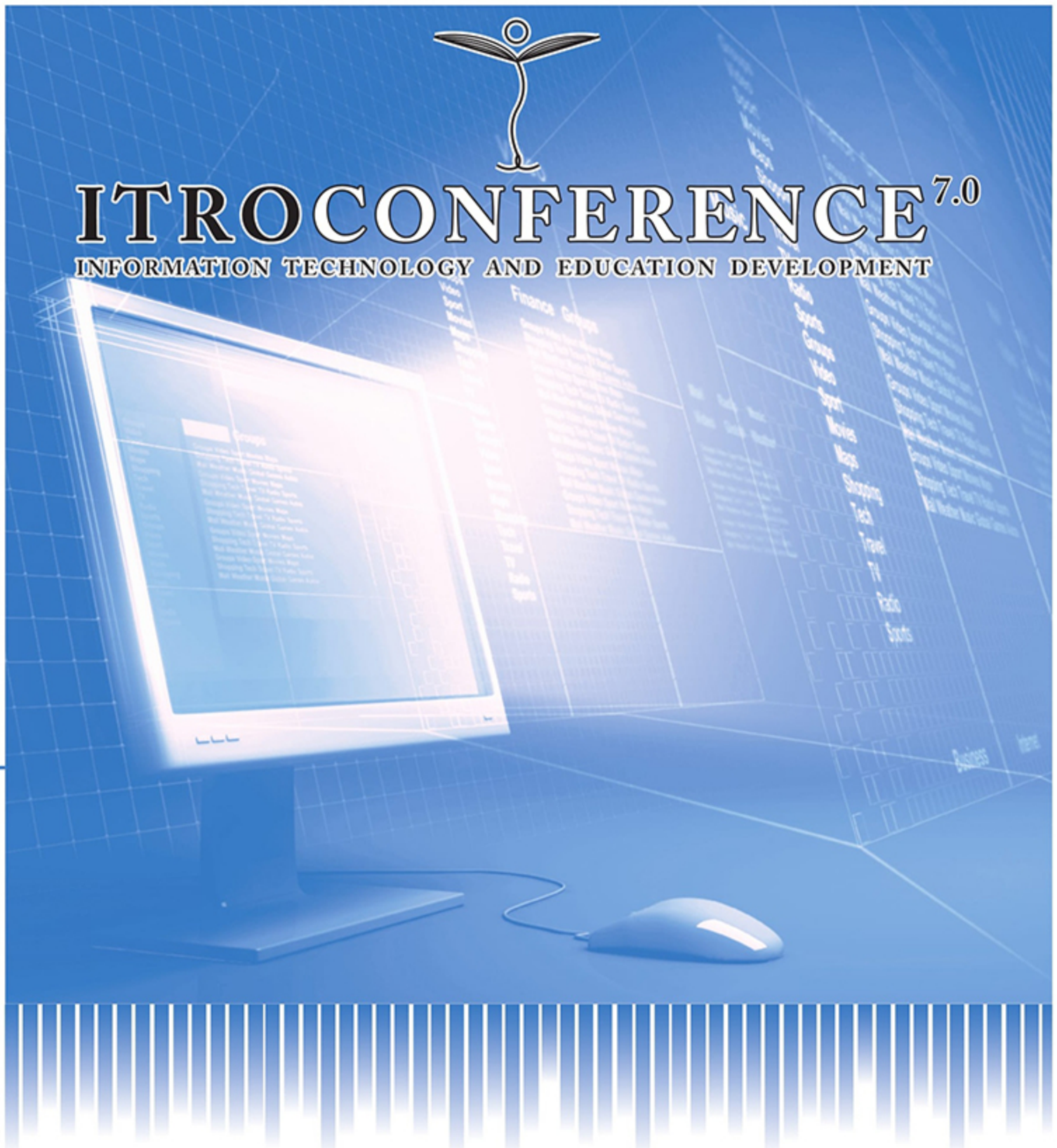
INFORMATION TECHNOLOGY AND EDUCATION DEVELOPMENT



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PROCEEDINGS

ZRENJANIN, June 2016

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TECHNICAL FACULTY "MIHAJLO PUPIN"
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With this publication, the CD with all papers from the International Conference on Information Technology and Development of Education, ITRO 2016 is also published.

INTRODUCTION

This Proceedings of papers consists from full papers from the International conference "Information technology and development of education" - ITRO 2016, that was held at the Technical Faculty "Mihajlo Pupin" in Zrenjanin on June 10th 2016.

The International conference on Information technology and development of education has had a goal to contribute to the development of education in Serbia and the Region, as well as, to gather experts from natural and technical sciences' teaching fields.

The expected scientific-skilled analysis of the accomplishment in the field of the contemporary information and communication technologies, as well as analysis of state, needs and tendencies in education all around the world and in our country has been realized.

The authors and the participants of the Conference have dealt with the following thematic areas:

- Theoretical and methodological questions of contemporary pedagogy
- Personalization and learning styles
- Social networks and their influence on education
- Children security and safety on the Internet
- Curriculum of contemporary teaching
- Methodical questions of natural and technical sciences subject teaching
- Lifelong learning and teachers' professional training
- E-learning
- Education management
- Development and influence of IT on teaching
- Information communication infrastructure in teaching process

All submitted papers have been reviewed by at least two independent members of the Science Committee.

There were total of 163 authors that took part at the Conference from 15 countries, 4 continents: 96 from the Republic of Serbia and 67 from foreign countries such as: Macedonia, Bulgaria, Slovakia, Russia, Montenegro, Albania, Hungary, Italy, India, Rumania, Bosnia and Herzegovina, USA, Egypt and Nigeria. They were presented 82 scientific papers; 42 from Serbia and 40 from the above mentioned countries.

The papers presented at the Conference and published in Proceedings can be useful for teachers while learning and teaching in the fields of informatics, technics and other teaching subjects and activities. Contribution to the science and teaching development in this Region and wider has been achieved in this way.

The Organizing Committee of the Conference

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Development of Interactive Educational Applications Based on TouchDevelop

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Abstract – Recently, we are witnesses of major technological changes: the powerful, user-friendly mobile devices, such as smartphones and tablets, became more prevalent than desktop computers and laptops. In this paper we will use this new reality to focus on use of mobile devices in an educational process. In particular, we will explain the development of interactive mobile applications directly on mobile devices using TouchDevelop. It is a cloud-based integrated environment for developing, testing and running programs. The programs are coded in the TouchDevelop scripting language. The main goal is to make students active participants in application design, instead of being just passive users. At the same time, this will encourage them to continue to actively participate in programming process, using different devices.

I INTRODUCTION

Mobile technology has become an integral part of our lives. Mobile devices and applications are changing the way we do things and how we connect with other people. Equipped with various sensors, mobile devices became a powerful tool for everyday activities. Children are also accustomed to the daily use of these devices. Mobile devices are changing the way today's children learn.

Analyses have shown that the use of mobile educational applications improves the learning experience, provides an effective and motivational learning environment where students can acquire skills and competences and promote critical thinking [1, 2, 3]. New style of learning requires new ways of teaching. There is a necessity to increase the teacher's trust as well as to promote the active use of technology in education process [4, 5].

Mobile technology promote diverse learning experiences that support students in "consuming" information (e.g., reading, searching, observing) as well as "creating" information (e.g. Storytelling, educational applications). From passive consumers, students became active participant in the process of creating applications. TouchDevelop environment, developed by Microsoft Research, can help students to accomplish this goal. It is an interactive development environment used to develop mobile applications using mobile devices (smart phones, tablets or laptops). The development environment also includes a facility for testing and debugging the program's user interface.

The abundance of literature speaking about TouchDevelop, as well as the support offered by Microsoft, can encourage students to take active part in the programming process [6, 7].

This paper presents some of the opportunities that TouchDevelop offers, through the creation of interactive educational applications that can be used during the classroom teaching process and in extracurricular activities.

II TOUCHDEVELOP DEVELOPMENT ENVIRONMENT

TouchDevelop is a cloud–based integrated development environment that connects three types of users:

- Designers of a Touch Develop Environment

- Authors/creators of applications that use Touch Development Environment

- End users, who can use the applications, and at the same time can change and improve the functionality of the created applications [8, 9].

Fig.1. TouchDevelop Development Environment

Actually, TouchDevelop is a structured programming language, built for mobile devices that use touch-sensitive screen as the main input device

for writing the code [10]. Instead of the traditional text editor, TouchDevelop uses a semi-structured code editor that allows building of objects or tables. The reason of using this editor is not to eliminate syntax errors, but to facilitate the navigation between the syntax elements, which can be accomplished easily with a touch of a button of the user interface screen (Fig. 1).

The eco-system architecture of TouchDevelop allows users to retrieve and store all information, scripts or other data, in the touchdevelop.com cloud service, no matter if they are using their phone or computer's web browser. The cloud infrastructure enables sharing and acts as a repository of all scripts developed and published by users. This characteristic of a TouchDevelop actually provides a social experience for its users [8].

III USING TOUCHDEVELOP IN THE EDUCATIONAL PROCESS

A. Suitable for beginners

Programming environments used for learning programming skills in primary schools are usually based on the principle of building blocks, which is easy and funny way for students to learn the basic principles of programming, without actually dealing with the correct syntax of the professional programming languages. TouchDevelop allows that kind of learning.

B. Simple code sharing

Each developed application has a unique code, consist of four or more letters. Every student can easily create and publish his own application, so the other users can access, install or modify the application, according to their needs, by simply entering the code. The students can also rate the application and share their opinion with other students.

C. Classroom management

For an easier TouchDevelop class management, there is an option of making user groups – groups of students that can work on the same script simultaneously. The benefit of having a user group is the shared space that can be used for leaving messages and comments as well as a collaborative real-time script editing. The group is composed of group creator and the users who joined the group. Comments, visible only from the members of the group, are used to improve created script.

IV THE USE OF EDUCATIONAL APPLICATIONS AND GAMES IN SCHOOL CURRICULUM

In classroom, composed of a different student structure, the teacher has to find a way to realize the curriculum which is very extensive. Because of this, instead of adapting the materials to the students, the students are forced to adapt to the learning materials. Furthermore, the rapid technological development affected the way students learn. There are huge informal learning possibilities that the new technologies enable. But, to exploit this opportunities, teaching strategies and curriculum need to be adapted within the regular classroom [11]. Interactive educational applications and games can be an excellent addition tool, only if they are adapted to the learning materials and environment. On the other hand, their incorporation in the extracurricular activities is considered to be unique due to the fact that it provides a degree of working freedom in various environments, a freedom of goal adaptation and a solution to some problem-solving tasks.

A. Creating interactive tutorials and online lectures using TouchDevelop

Interactive tutorials are step by step manuals build-up of codes and comments, where one step corresponds to a single action (Fig.2). Tutorials can help students to learn quickly and easily about the process of writing scripts and algorithms which are important part for the programming course. Depending on the correctness of the written command, students can continue to the next step until they finally reach program execution.

With lectures created using the TouchDevelop environment, teacher has the possibility to express in his mother language. Every lecture can contain exercises for evaluating the student progress. The students can complete these exercises individually. In this way the learning material will become more accessible for students who want to study independently.

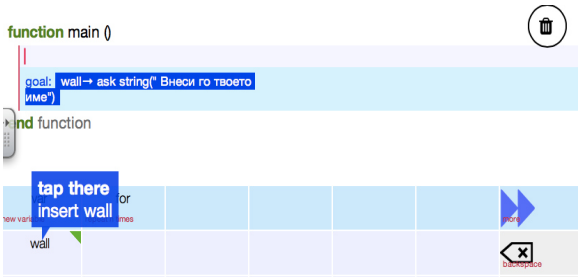

Fig.2. Interactive script-making tutorial

B. Educational application for learning shapes

Educational application called "2D shapes" is created using the TouchDevelop environment (Fig.3). It is designed for sixth-grade students studying mathematics according to the Cambridge Program. During the school year students learn about different forms and shapes gradually. The developed application uses a combination of all

curriculum materials with the added option for student examination. By pressing the touch screen buttons the students can choose their desired geometrical shape, and to learn all the elements in this group through drawings and definitions. At the end, they have the opportunity to solve the exercises related to the corresponding shape. For every correct answer a positive comment appears and the student receives one point. If the student has problems solving the exercises, he can always return to the theoretical part to get some help, and to learn better the material.

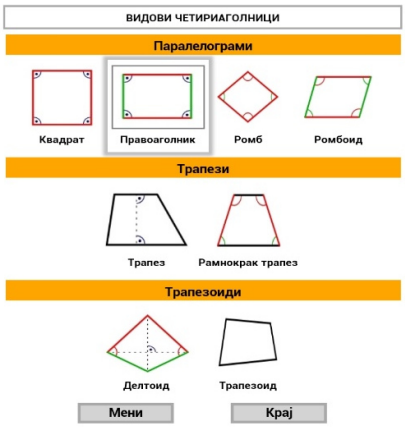

Fig.3. Application for learning and practicing 2D-forms

The content of the application is organised in the way that gives users a comprehensive insight into the categories, similarities and differences of the shapes, and also provides formulas and formula derivations for all 2D shapes. The most important characteristic of this application is the fact that it is a free application and it is available for all students who want to review or learn the selected material, and want to make a self-evaluation using the exercises.

C. Games adapted to Computer Science course

Games that we created using TouchDevelop and which were included in our research were fairly simple, but they were adapted to the material from Computer Science course, which is often difficult to understand by students, due to the limited time of the classes.

Several games were developed, but in this paper we will present only two. The goal of the first game was to find dots in a rectangular coordinate system following assigned coordinates. In order to receive points, students should give an answer very quickly. For every mistake that he makes, he loses lives. The game ends when student lost all his lives (max. number of lives are 3), or when he reach the maximum number of points.

The second game was to learn the decimal-to-binary conversion. The idea came from the fact that the sixth-grade students have difficulties to understand that the computer works only with two numbers, one and zero. This problem seems to be too abstract for the students. Because of this we have created a game, to help the students to learn the specific material in a more interesting way. The game interface is shown on Fig. 4. The conversion of the presented numbers has to be solved within a time limit. Results can be saved and a rank list can be made, which would give the competitive character of the game. Adding an element of competition motivates and at the same time energizes students.

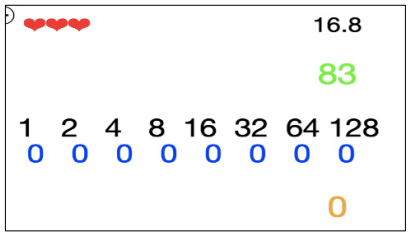

Fig.4. Decimal-Binary number system conversion game

D. Creating applications for extracurricular activities

The extracurricular activities are an excellent opportunity for students to apply obtained knowledge in a problem-solving situation. As a part of the activities of multiethnic section we have created an application for promoting a multicultural state in our country. Using this application students have a chance to learn more about famous Macedonian citizens. They are organized in various categories like: science, historians, musicians etc.

The game interface is shown on Fig. 5. The application is made bilingual, so the students can choose the language they prefer. Flash card with a picture of a famous citizen is presented on the screen, so the student should recognize the person, and write a name in a text box.

Fig.5. Applications created by a student group

Application also includes a quiz with questions that should be answered by the students. For every correct answer student gets a point and for every wrong answer there is a notification.

V EVALUATION AND DISCUSSION

Developed interactive educational applications were evaluated with the students, teachers and parents.

Students from a sixth grade were included in the evaluation process. They were divided in two groups: creators and end-users. Students that were involved as creators of the applications highlighted the advantage of working with TouchDevelop, and stated that the creation process was interesting and fun, and that they learned a lot from each other. The end users, which used the developed applications, were also very satisfied with the learning methods, emphasized that this type of learning allows them to learn everywhere and at any time.

Teachers also expressed their satisfaction to actively participating during the application design process, with their own ideas and suggestions. During the evaluation process teachers also kept track of a students' progress. At the end, they have stated that the student motivation, especially for students who have problems with the traditional ways of learning, has increased, as well as the students' outcomes. Teachers also highlighted the necessity for the development of a larger number of educational applications, which will be adapted to the curriculum materials.

Parents also expressed their positive opinion about this new method of learning, which gave them a possibility to study together with their children.

VI CONCLUSION

The use of interactive educational applications and games in the school curriculum proved to be an effective method among students for learning different subjects. Creating interactive applications can not only contextualize learning but also offer a huge stimulus for students and teachers in achieving learning outcomes. They can transform education, engage students and personalize learning.

In this context TouchDevelop environment offers huge opportunities. TouchDevelop allows all user groups to actively participate in application developing process, thus adapting it to the needs of the students.

In this paper we have presented several applications developed with TouchDevelop. The evaluation has shown that the developed applications have stimulated collaborative learning, increased socialization, and strengthened teacher-student relationship.

In the future, teachers can take additional steps to promote these practices in and outside the schools, in order to enrich the database of educational applications, and to meet the interest of a larger number of students.

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