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**A Playful form of Teaching and Learning using  
Micro-World Applications**

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**Abstract:** The article summarizes the long-term experiences of the authors in the field of creation and use of didactic micro-world-based applications in education. In this article, there are systematized principles of creation and effective use of didactic application developed in micro-world named Imagine. Special attention is paid to didactic transformation, visualization, interactivity and active learning of pupils. The authors summarize recommendations regarding the graphic design, visualization of knowledge presentation, interactivity of applications in order to transform the learning process into a great entertainment and interesting game in which everyone wins. The authors in article present a wide range of didactic applications created in the micro-world Imagine for pupils at the first level of elementary school. The main focus is on applications for language learning, both mother tongue and foreign languages. Interesting applications are in the form of didactic games. The difficulty level of playing or playing form of learning can be easily increased, from the passive perception of the language to the active application of language rules and the cultivation of language sensitivity. A simple vocabulary extension can be increased from a simple assignment of the name of the object to the image that represents it, through the direct naming of the picture after the active use of the vocabulary, for example by creating the sentences, completing the story etc. In the field of grammar, it is from familiarity with the rule, through its perception in context, after its active application to solving the new language problem situation. Thus, it is possible to create applications for the development of all language communication skills: listening, reading, writing and talking "with understanding"

**Keywords:** Gamification of Teaching and Learning process; Micro-world Applications.

## INTRODUCTION

According to the profile of the current modern European teacher, the teacher should not only be a skilled user of modern digital devices, ICTs and other educational technologies but should also be able to create their own didactic applications. The teacher can make use of several tools to create didactic applications. Generally, for teachers (non-informatics) to acquire the first experiences and habits of using digital educational technologies, an ICT-targeted subject in education is identified [3]. We assume that students have already completed general didactics from a common core subject and perhaps several chapters also from subject didactics. This subject must also give scope for the practical application of didactic principles, the application of the forming pedagogical flair and the mastery of the adepts of the teaching study. Future teachers, including preschool and elementary pedagogy teachers, will learn to develop their own interactive applications to use with whiteboard, in an appropriate environment using appropriate digital education technologies. They have to be familiar

with tools for creating presentations (PowerPoint, Prezi, etc.), have to know how to create educational websites using a simple interactive html editor, use test tools (eg Hot Potatoes), and create electronic questionnaires (eg Google form) and so on. Creating applications in programming environments such as Flash, Java, HTML5, and so on for a regular teacher can be challenging or unmanageable. For such teachers, the creation of didactic applications is sufficient via environment that in a simple interactive way allows the efficient creation of custom applications according to their own needs and ideas [6, 9].

Microworld environments occupy an important place in this group of tools for didactical software creation. Those small "virtual laboratories" allow discoveries through testing and experimentation thereby support the learning by doing, as well as they support active learning [5].

## **I. THE IMPORTANCE OF MICRO-WORLDS IN THE CREATION OF DIDACTIC APPLICATIONS FOR ELEMENTARY SCHOOL**

Suitable environment for the creation of didactic multimedia applications are for example the micro-worlds in which teachers without programming knowledge can create engaging, charming and interesting (custom) applications, which allow them to do something meaningful, personally suitable for them. Such applications are typically focused on thematic units and can not only appropriately diversify the teaching process but also increase the children's interest in the subject. Students are unique, and so is the way how they can learn. The micro-worlds open the way to new educational opportunities.

We have studied programming concepts of several micro-worlds programming environments: the programming style, programming constructs, code representation, preventing (syntax) errors, as well as the forms of sharing the results [4]. We have chosen the Imagine Logo from the potential micro-world programming environments. It has graphical environment and intuitive control of objects on the screen, allow users to monitor the flow of the command execution and objects' responses to the events. Our choice for developing applications in Imagine Logo was influenced also by: rich supply of tools of the environment, as well as by wide variety of set of commands, graphical support for creating animations and the option of integrating multimedia files [1, 2].

## **II. CREATION OF OWN DIDACTIC APPLICATIONS BY PRIMARY SCHOOL TEACHERS**

For teachers to be eroded users of modern didactic tools, universities which educate future teachers employ subjects into their study programme, which prepare teachers to be able to handle their new roles in computerization of education. These subjects prepare students not only for using new technical tools, but also for application of new didactic technologies and creation of software applications. We have introduced the subject Informatics 4 (hereafter INF4) in the study programmes for teachers of primary education at J. Selye University in Komárno. Our intention was focused on creating own educational applications and games. We decided to find such a creative environment, where discoveries can be achieved by testing and experimentation [1].

The applied teaching methods were based on the *constructivism*, *active learning* and *learning by doing*, with connection to the *project-based and problem-based learning*. The final concept of the methodology we met via qualitative research strategy is named Design-Based Research [1, 2].

Participants acquire basic knowledge and skills in the use of building elements in Imagine Logo environment at the first five weeks of teaching (the semester lasts 13 weeks). Into the content of five teaching units are allocated the following elements: motivation, exposition, fixing and diagnostics, which are dealt with during the activities aimed at different phases of teaching.

The first activity (on first week of semester) is focused around creating simple animations. The animation is made using the turtle object as well as the movement control, with option of custom background, event control and multimedia elements. The emphasis of the second activity is on random placement of objects on the page, determination of the object position, as well as the opportunity of

move the object by gripping and dragging and control by event-button. The idea behind the second activity is also moving the objects on the page (and on the background of the page). Creative work within the third activity aims to use the basic properties of the object turtle, which can leave an imprint by an event of turtle. The fourth activity is concentrated on using text as an object (textbox) by inserting the missing words or completing sentences. The response can be a text or it can be represented by specific shape of the turtle. The fifth activity is based on the use of multimedia – as button objects in the applications, as well as on the options for testing of overlapping objects. This concept serves as a solid foundation for developing the next interesting educational game and application, with the content of the chosen subjects at the level of primary schools [1].

At the next we subsequently provide enough time and space to students for their own creation in a given programming environment in frame of the next five weeks of the semester. They were given the opportunity to show the acquired work skills in developing of educational applications and games support the selected topic of the subject at the first level of primary school.

### III. APPLICATIONS FOR EDUCATIONAL SUBJECTS IN THE FIRST GRADE OF PRIMARY SCHOOL

The future teachers should be mindful of didactic requirements for the application during creative activities. Besides the easy and intuitive handling (for students), the games and applications should meet the requirement to serve for educational purposes, thus, to help to motivate students and supported the playful rehearsing of the subject matter, optionally to its understanding. The application should be multimedia, interactive, and use animations to motivate, inspire and maintain the attention of elementary school pupils.

One such application created by the future teacher of the primary school for environmental education for the 3rd class (on primary school) is presented on Figures from 1 to 3. The first picture is the main menu of topics: Introduction, Getting to know with time, The clock, The digital clock, The round clocks, The analog clock, The dayparts, How does digital clock show?, Time puzzle. Selected interactive tasks for some topics are presented on the next pictures.



Figure 1. Environment Knowledge: The measurement of time [8].

Two tasks (topics) are presented in Figure 2. In the first task, it is necessary to specify (by entering text) the time variables whose success is subsequently tested and evaluated. In the second task, it is necessary to correctly name the individual parts of the digital clock (by placing the term in the correct position). Figure 3 illustrates the task of recognizing the exact time (as digital as the analogue). The result is also evaluable.

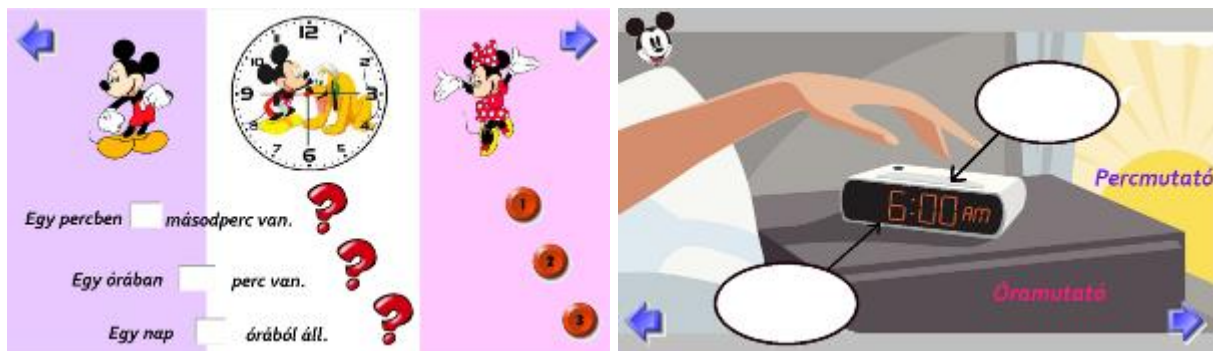


Figure 2. Topics - Getting to know with time, The digital clock. [8]

The application is interactive and uses animations to motivate and maintain user attention. It was implemented in the Imagine Logo environment as a semestral work (extended as Diploma Thesis). Application as an executable file takes up 15 727 KB of memory.



Figure no. 3. Topic – The analog clock. [8]

#### IV. APPLICATIONS CREATED IN IMAGINE LOGO FOR TEACHING MATHEMATICS

During the activities we frequently focused on the topic of Mathematics and other subjects of science and languages, what is proved by marked partiality and positive relations of course graduates connected to these teaching subjects.

Further, we would like to present an application developed for students of 1st class (on primary school), which attempts to explain and practice the addition and subtraction operation through interactive games, focusing on textual type tasks, which cause the greatest difficulty for students (at the level of interpretation).

Three different interpretations of the addition were processed in the project – merge, adding, surplus expression (in 8 little game tasks). Figure 4 illustrates the task of addition as adding.

This game integrates the first four sample activities (several program constructions and objects settings, as well as responding to events), during which future teachers have the opportunity to get acquainted with the micro-world of Imagine Logo and to get practical experience of creative work (playful programming) in the given environment. We have described the individual activities in the third chapter.

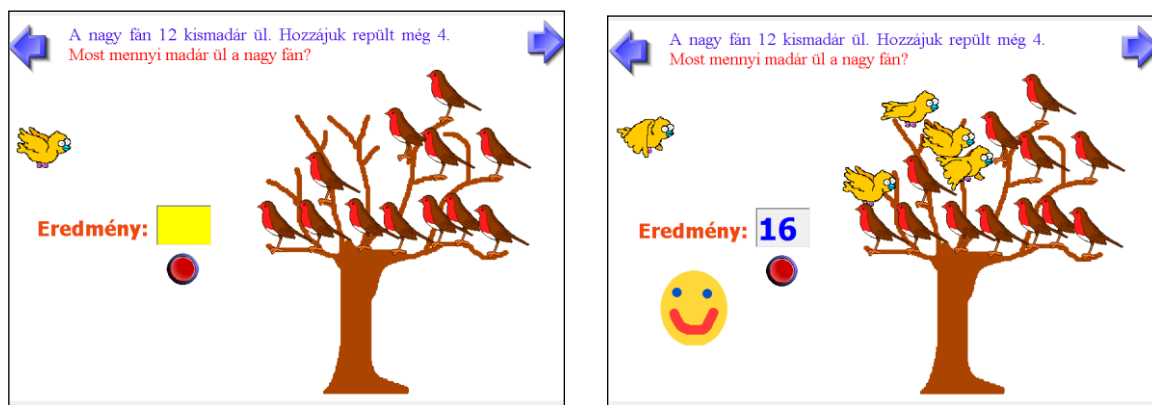


Figure no. 4. Topic – Addition as adding (Birds on the tree.) [7]

The creation of task lines was based on the mathematics textbook, among which we can find tasks with opportunities to freely change or modify the task question. It can bring several new tasks and solutions. Of course, here the teacher has to check the correctness. Figure 5 illustrates an example for addition as merge with opportunity for freely change the quantity of trees by hide the trees (to press the right button on the selected tree). The trees are randomly placed in a row at the bottom of the page. We have also placed a switch button on the page to request new shuffle. Thus, this task can be solved by several students one after the other without making the game boring.

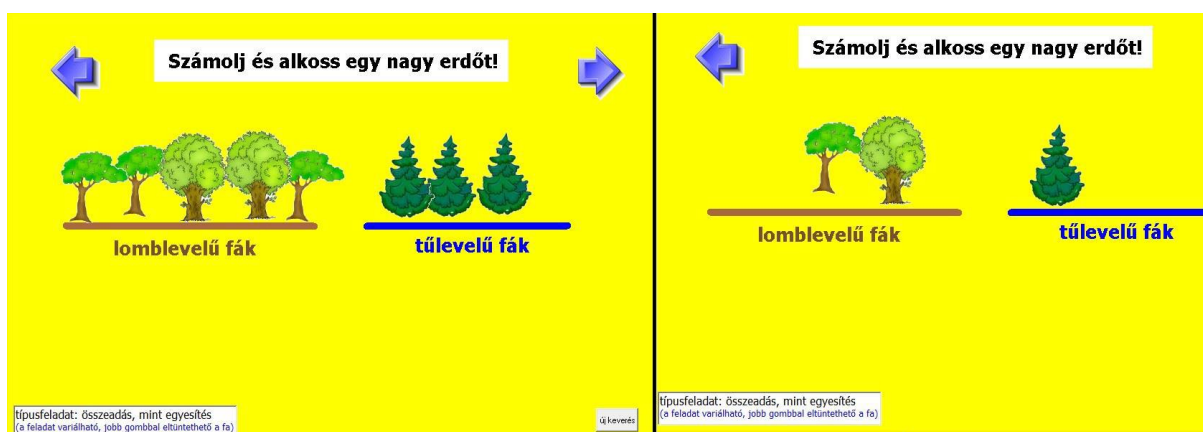


Figure no. 5. Topic – Addition as merge (Count and create a big forest!) [7].

Three different interpretations of the addition were processed in the project – incomplete subtraction, ecounting, reversal of merge (in 7 little game tasks). Figure 6 illustrates an example for subtraction as incomplete subtraction with opportunity for freely change the quantity of girls by adding (to press and hold the left button on the first girl object and make imprint). We have also placed a switch button on the page to request new task.

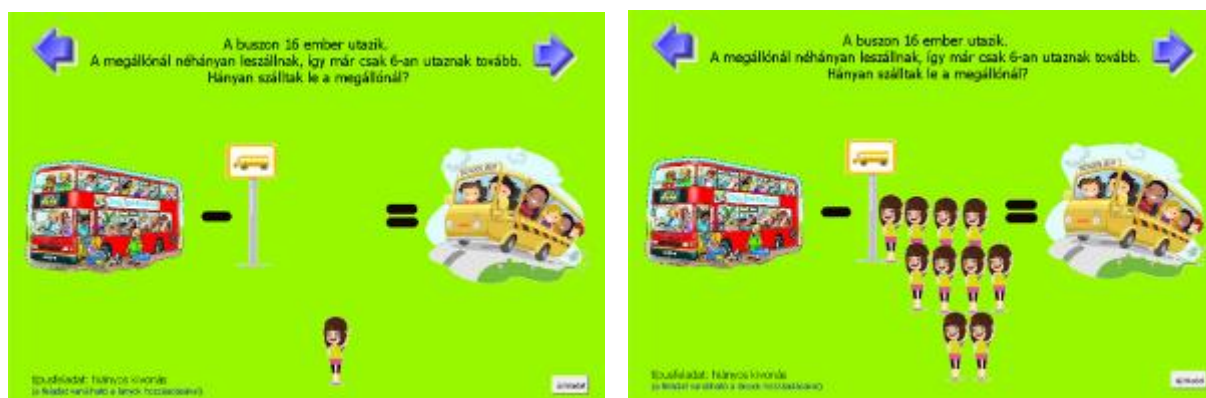


Figure no. 6. Topic – Subtraction as incomplete subtraction [7]

## V. CONCLUSION

In the article, we indicated not only the acuteness and actuality of the enhancement of the digital literacy of future teachers, but we also proposed new ways of teaching through interactive technologies in primary education and to bring fun and pleasure to the learning process at the same time by using games and by innovation of the curriculum through the subject which is focused on developing educational software applications and computer games. The teaching process is dominated by active learning method which is called "learning by doing". Students are working (programming) in the micro-world environment of Imagine Logo, which supports the learning paradigm based on constructivism. Students of primary school teacher program, for developing their own applications and games, used commands that were not in many cases part of the contents of the first five teaching units. We can say that they discovered other possibilities of the tool for creating applications on their own and in this way they developed their own knowledge system and gained experience from the process of creation and skills from using the micro-world elements. Our experience shows not only the student's disposition for learning, but it also highlights the importance of interaction and individual contact with the environment and their creativity, fantasy and ability for pedagogical transformation of teaching topic. Another important discovery for us was that future elementary school teachers are able to learn basics of creating didactic applications in the environment of micro-worlds in just one semester and that they enjoy this kind of work, they are initiative and are interested in creating effective, interesting and attractive teaching tools for their pupils.

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