Building Teachers' Competences
for Computer Game Based Education

Daniela Tuparova, Georgi Tuparov

Abstract: The teachers can give creative ideas for development of educational game scenarios with strong relation towards the school curricula, the psychological and pedagogical characteristics of pupils. We believe that successful implementation of computer games in educational process needs competent and motivated teachers. The game-based teaching and learning approach is not new for the primary school teachers, but in most cases teachers are not ready to implement educational computer games into their teaching practice. Our observations in master degree programme "ICT in primary school" show that primary school teachers need complex competences for adoption of educational computer games in the classroom and extracurricular activities. In this paper we present requirements for teachers' competences for successful implementation of game based education in school practice and propose a blended model for teacher's training.

Key words: Teachers' training, computer game based education, cooperative e-learning.

INTRODUCTION

Using game-based teaching and learning approach is typical for primary school education. The game playing is usual activity for the pupils in this age group. Often the pupils see and interpreter the environment around them through games. Nowadays computer games throw ordinary games into the background. Recently we observe an increased number of studies about advantages and disadvantages of computer games usage in primary school. ([3], [5, 6, 7, 8, 9])

The game-based teaching and learning approach is not new for the primary school teachers, but in most cases teachers are not ready to implement educational computer games into their teaching practice. In the work of De Grovea at all [4] determinants of computer games adoption into the class room are analysed. They focus the research on the determinants at teacher and school levels and summarise the opinion of a lot of researchers "that the use of digital games in a classroom is often looked upon with skepticism by teachers". Baek [2] outlines six factors that hinder teachers' use of games in the classroom: "Inflexibility of curriculum, Negative effects of gaming, Students' lack of readiness, Lack of supporting materials, Fixed class schedules, and Limited budgets."

De Grovea at all [4] argue that "Making teachers and pre-service teachers familiar with using digital games in an educational context can only be successful when adequate content is available."

Several questions are arising – How to train and motivate teachers to adopt educational computer games in the classroom? What kind of competences do teachers need to implement successfully educational computer games?

Zapušek & Rugelj [12] suggest the model SADDIE (Specification, Analysis, Design, Development, Instructional and Evaluation) for designing serious games by prospective teachers. The main focus in the model is on the specification phase with clear definition of learning goals of serious games. Their approach is based on team-working on the serious game development.

Our observations in master degree programme "ICT in primary school" show that primary school teachers need complex competences for adoption of educational computer games in the classroom and extracurricular activities. In this paper we present our experience in training primary school teachers through e-learning technologies to implement educational computer games in school practice.

REQUIREMENTS TO THE COMPETENCES OF PRIMARY SCHOOL TEACHERS

Nowadays primary school teachers have to face the challenges of the contemporary information society. They have to achieve a set of competences to carry out their daily

employment obligations. These core competences could be summarised as follows:

- Didactical competences – set up and analysis of learning objectives, implementation of different interactive teaching and learning methods including game based activities, implementation of core didactical rules, planning of assessment and evaluation procedures, planning of lessons activities and content.

- Psychology – knowledge of psychology characteristics of pupils and in some cases of parents, psychology of perception of learning environment and digital technologies.

- Class management – organising of class activities.

- Digital competences – use of different IT tools to support personal and educational activities, ability to choose appropriate tools for implementation into classroom, evaluation of didactical and technological characteristics of a huge set of educational tools existing in cyberspace, ability for lifelong learning and self-learning in area of ICT and adaptation to new emerging technologies.

- School Subjects related competences – teachers in our primary school should teach basic knowledge and skills in all school subject included into the primary school curricula. That requires from the teachers to have core knowledge and skills in all subjects and specifics of their teaching.

- Competences for implementation of educational computer games into classroom activities and for development of computer game scenario. These competences are extensions of all the above mentioned competences – didactical, psychological, class management, digital, school subjects related. They can include knowledge about specific characteristics of educational computer games, positive and negative psychological reflection of the computer game-based education, abilities for didactical and technological specification of an educational computer game, evaluation of pedagogical usability of educational computer games, plan implementation of the educational computer game in lessons or extracurricular activities, etc. The schema of competences for implementation of educational computer games is presented on Fig. 1.
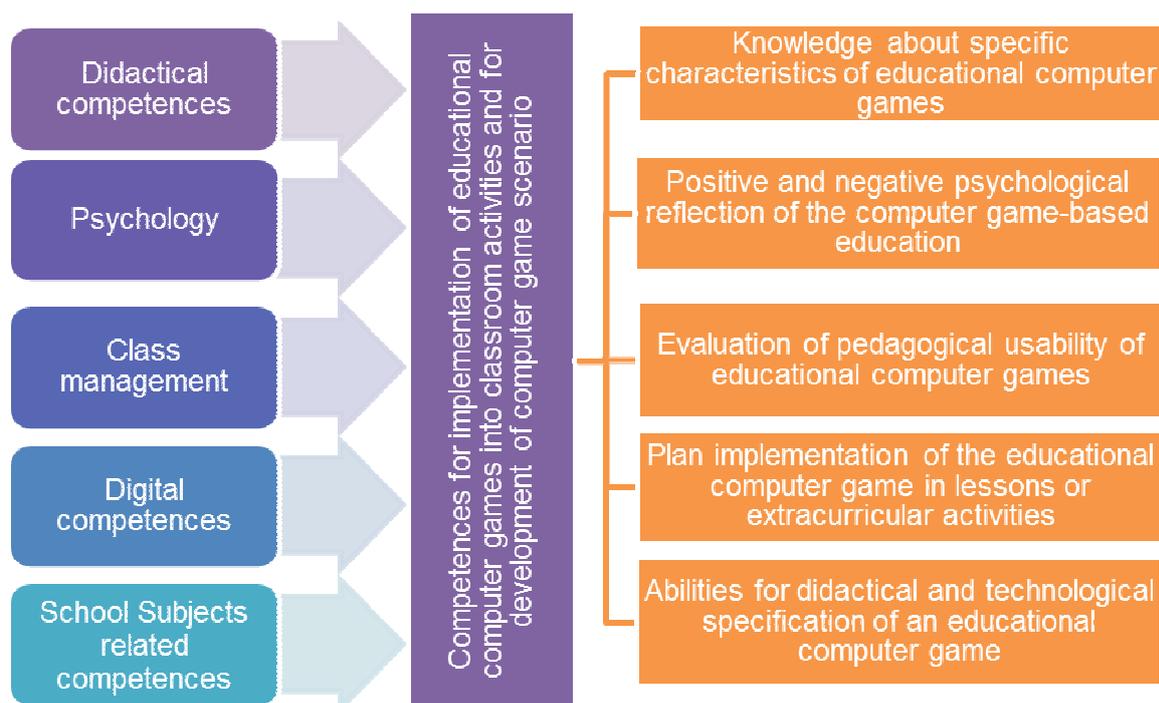

Fig. 1. Schema of teacher's competences for implementation
of educational computer games

MODEL FOR DEVELOPMENT OF COMPETENCES FOR COMPUTER GAME-BASED LEARNING

The general aim of the course "Computer games in education" is to form knowledge, skills and abilities about educational computer games and their successful implementation into the educational process in primary school level. The course is a part of Master degree curricula "ICT in primary school". The students, who apply for this master programme, already have a bachelor degree in primary school education (grades 1 to 4). They have no programming skills and we do not expect from them to program educational games. These students have competences in the areas of didactics, psychology, class management, teaching methods and their implementation in all subjects in primary school. They teach maths, mother tongue, geography, history, music, art, etc. They have teaching experience and they use non-computer games as a tool for motivating pupils and establishing of interactive learning environment. These students have to achieve competences regarding educational computer games and their specific implementation into educational process. The proposed model for training is focused on: the collaborative learning methods; e-learning environment; knowledge transfer from well-known area as game based education in primary school to computer game based education. Components of the model are: Content, Assignments development and collaborative work in e-learning environment, Assessment of assignments.

Structure of the course "Computer games in education"

The content of the course covers main topics as following: Role of the game in the primary school; Scope of computer games – classification and characteristics; Educational computer games – characteristics and purpose; Didactical specification and requirements to educational computer games.

With respect to the general aim of the course we set the main focus of the content on the development of didactical specification and requirements to educational computer games. Didactical specification is based on the following points:

- Name of the game and URL in case of the game is accessed in web space.
- Knowledge Domain(s) – description of school subjects and main concepts, procedures or skills that will be developed or assessed by the game;
- Educational level – requires description of grade or ages of the pupils;
- Learning goals – includes precise description of learning objectives with strong relevance to the Bloom's Taxonomy or revised Taxonomy of Anderson and Krathwohl.
- Number of players – Description of number of players and eventual characters of the game.
- Interactions of the player with the game and/or other players.
- Levels of difficulty – number of difficulty levels. Each level of game's difficulty can cover one or several levels of learning objectives according to the used taxonomy of learning objectives.
- Tracking/Counting of achieved results – is there any kind of achievements' tracking or not. In case of tracking and counting of archived result students have to describe mechanism of obtaining of points and grades, description of scale for transfer of points to grades.
- Positive stimulus of the players – description of different kind of stimulus – voice congratulations, graphical awards, points etc.
- Typology of the game according to their development functions. The development functions can be directed to perception, attitudes, skills, knowledge, creativity and fantasy, memory, logical thinking, attention, sensory and motor skills, etc.

- Typology of the game according to game scenario – adventure, tales, historical and ethnographical games, open ended games, non-stop games etc.
- Game scenario – detailed description of game plot.
- Place of the game in educational process. Students describe how the game can be used: in lessons, or for self-learning, or for assessment, or for motivation, or for management of self-activities of the students, or for development of algorithmic thinking, or for development of students' creativity, and etc.

Students use the framework of didactical specification, discussed above, to prepare their main course assignments – description of existing game in Internet space or standalone application and development of game scenario for educational game.

Implementation of the course in blended mode

The course was organized in blended mode with support of the e-learning environment Moodle. The students had 15 hours lectures and 15 hours exercises in "face-to-face" mode. During the lectures they learned about mentioned above topics of the course. During the face-to-face exercises the lecturer presented and discussed different Web based and standalone educational computer games. In form of discussions students identified the learning objectives of existing educational computer games and suggested ideas for implementation of these games into classroom practice.

The students are employed as teachers and prefer to study part-time. Therefore we offer the course in e-learning environment with possibility for cooperative work through discussion forums and grouping of assignments according to school subject and grade.

We have to note that in this course the students met the e-learning environment for the first time. Therefore one hour was spent for explanation of basic rules of use of e-learning environment. Students' basic activities in the course were focused on two streams: first – To find in Internet a suitable computer game for implementation in determined subject and grade in the primary school and to describe the game and the possibilities for it implementation in the class; and second – To develop didactical specification for their own computer game. The grouping of the students in the e-learning environment could be done automatically with the help of a "Jigsaw" block [11] or manually by the lecturer according the student's preferences. The student can choose the subject domain of the game and grade. The Jigsaw method is proposed by Aronson [1] and manages cooperative activity in which every participant is extremely important for the realization of the ultimate goal. In [10] we implemented this method with modification.

The first course in the master degree programme "ICT in primary school" started in 2009 in the e-learning environment Moodle with 27 students. The number of students was enough to apply Jigsaw method. Organisational schema of the course with use of "Jigsaw" collaborative method is presented on the Fig. 2.

Every year we enrol the students in the same course in the e-learning environment. Until now we have 60 students enrolled in the course. Due to decreasing of number of students in the next years we join the students to the assignments manually. That allows the new course members to see works of students from previous years, to learn from their successful points in the projects and their mistakes.

We collect data from logs in e-learning environment and compared number of activities in the course conducted by the students grouped by Jigsaw block and manually. Due to the small number of students in both groups we applied non-parametric method Man-Whitney U Test. For statistics calculation PSPP Software is used. The results are presented on the Table 1. and Table 2.

Students worked in cooperation through Jigsaw block are more active in online sctivities. There is significant difference between activities of the students grouped by Jigsaw block and grouped manually.
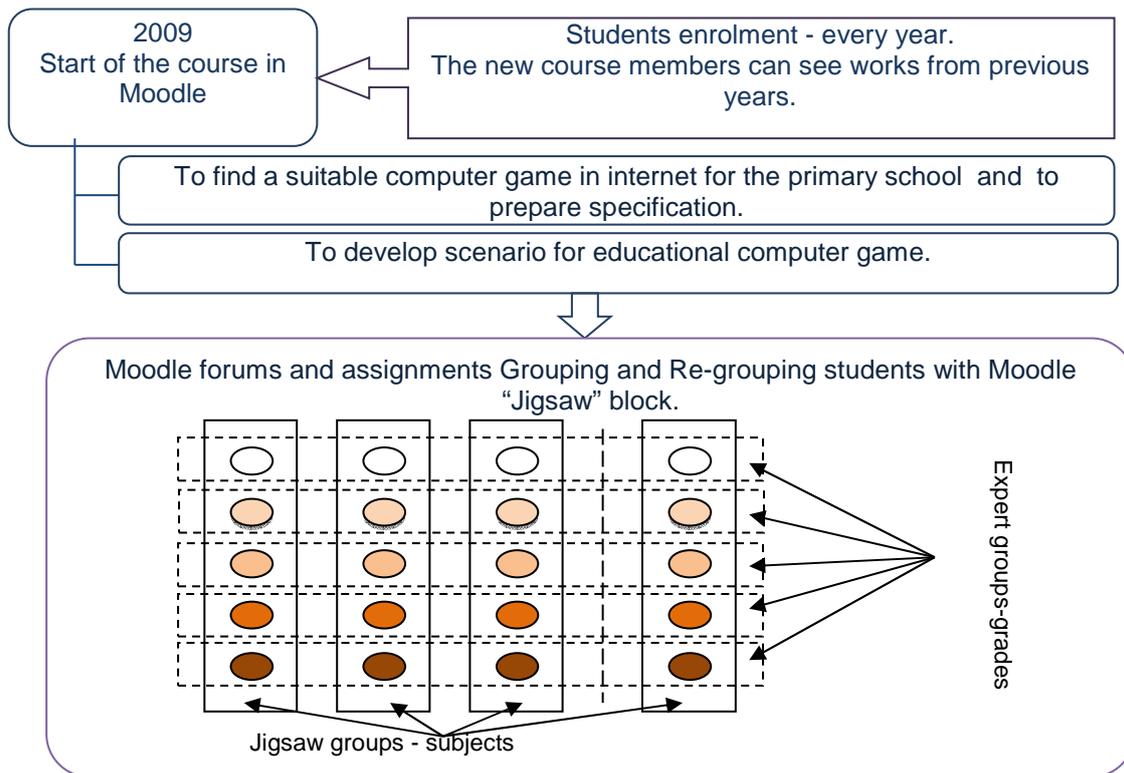
Fig. 2. Organisational schema of the course in e-learning environment
with use of Jigsaw method

Table 5. Ranks of number of activities

	N			Mean Rank		Sum of Ranks	
	G	**G**	**otal**	**G**	**G**	**G** (**N**)	**G** (**J**)
Act ivities	3,00	7,00	0,00	9,88	3,48	56,00 (6)	174,00 (1)

Table 6. Man-Whitney U Test Statistics

	Mann-Whitney U	Wilco xon W	Z	Asymp. Sig. (2-tailed)
Act ivities	95,00	656,0 0	- 5,21	,000

Six of the students' works have been extended to Master theses with deep studies regarding the use of computer games in the classroom and development of didactical specifications of their own computer games.

Assessment of students' achievements is based on the developed assignments and participation in online discussions. Main issues of assessment are: performance of good digital competences, clear and precise description of didactical specifications of the games.

CONCLUSIONS AND FUTURE WORK

In this paper we share our experience in building competences of primary school teachers to implement effectively computer game-based learning.

The students more actively participate in the proposed activities in e-learning environment with support of Jigsaw block. They gave constructive suggestions for

improvement of game specifications. Students prefer to explain the game scenario through interactive presentations. As part of the course we intend to involve tools for rapid prototyping of the game.

We believe that successful implementation of computer games in educational process needs competent and motivated teachers.

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The paper has been reviewed.