

Teachers as software development coordinators

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Abstract: We report the results of an EU-funded project and its impact on participating teachers. Teachers participating in the project had practically no previous knowledge of game-based education whereas they got a thorough understanding of it at the end of the project. In addition, and most importantly, teachers had to guide pupils in designing and implementing computer games. In a way, teachers became software developers, and this is definitely something that strengthens the profiles of the teaching professions. Thus, these EU-funded projects can be beneficial for teachers if teams select interesting projects.

Keywords: game-based education, Erasmus+ project, teacher training, computer game design, computer programming

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1 Introduction

Game-based education is a trend in learning theory that advocates the use of computer games (i.e., video games) in schooling. Since the theory is mature enough and is currently used by many institutions and schools, there is no need to elaborate on basic ideas. Instead the reader should consult the literature for more information [e.g., see (Gee, 2007), (Prensky, 2006), and (Whitton, 2014)]. In most cases, educational computer games for kids are designed by specialists for kids. However, in order to design a successful game, we need to be able to think like our potential beneficiaries and understand what they do like and what they do not. Clearly, the most suitable game designers are kids that have received some basic training and are coached in the development phase. The training should include a broad introduction to game-based education and the introduction of some ideas about game design, in general, and educational game design, in particular [see (Schell, 2020) for a



thorough presentation of the theory of game design].

Forty years ago, programmers developed whole games and their work included the development of art and sounds and/or music. Nowadays, programmers write code that supports the work of designers and artists. In fact, it is quite common to use a platform to develop a game. However, the advent of mobile devices and the proliferation of HTML5 browsers, fostered the use of the HTML5 canvas element for the design and implementation of relatively simple computer games. In addition, the introduction of WebAssembly (often shortened to Wasm), made it possible to design complex games that can be played on any computer platform that supports a browser that can understand Wasm. This means that virtually all platforms support this since Firefox is available on almost all platforms. Unity (McCabe, 2017) is a computer program that can be used to create computer games that are compiled into Wasm, thus allowing people to play them in virtually any computer system.

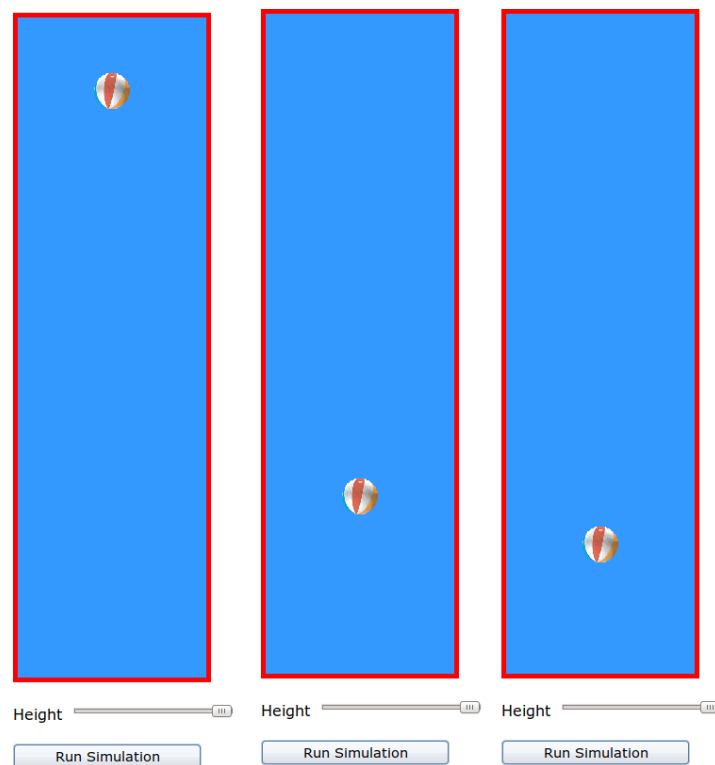


Figure 1. The interface of a free-falling ball web application.

In European countries many schools have to follow a curriculum, which has been designed by the educational authorities of each country (all schools that participated in the project have to follow a central curriculum). In this case, there is no room for experimentation in school. Fortunately, there are tools that allow such schools that are located in different countries to form partnerships and work on a specific

subject. In different words, these tools allow schools to experiment on new educational methodologies and philosophies, among other things.

First, we give some background information about the whole project. Then, we discuss the project in more details. Next, we explain how this project enhanced the profile of teachers, which is particularly important. Being a teacher is quite a demanding task and anything that enhances the profile of this job is really important.

2 Background

Each year the European Union, through the Erasmus+ program, funds a good number of projects designed to promote novel ideas in education. Typically, these projects involve 5–6 schools from different EU countries and/or program countries (i.e., countries that are not members of the EU but participate in the Erasmus+ project). In 2017, five schools from Austria, Greece, Lithuania, Romania, and Turkey worked together to submit an application for a project about game-based education. The project was approved and in the first stages both teachers and pupils were introduced to ideas related to game-based education and how to use JavaScript to develop simple computer animations. In the next stages, teachers took up the role of software project leaders and guided pupils to program educational games that they had designed.

Initially, teachers did not have any expectations. In fact, it was common secret that the outcome of the project would be a bunch of simple animations (e.g., things like the study of circular motion or the study of a free-falling ball) and that would be an acceptable deliverable (figure 1 shows the interface of such an animation). However, in the course of the project, we discovered Unity, a tool that is (almost) freely available. This tool can be used to create HTML5 games without much effort. Of course, coaches were free to experiment with other tools and to guide pupils to realize their game designs using different tools. But, in what follows, we will concentrate mainly to the projects that used Unity. Although this is not the first time pupils have worked to create educational games [e.g., (Baytak & Land, 2010) reports such a project], still in this project, teachers with virtually no previous programming experience took up the role of leaders of teams of “software engineers.” This was a particularly difficult task, nevertheless, it was also a useful experience since teachers have not the opportunity to work on such demanding projects.

3 The Project in Detail

Since most participants of this project had no previous knowledge of game-based education, it was necessary to introduce teachers from each participating organization to the relevant theory. Sonja Gabriel, a colleague teaching at KPH Wien with some experience in game-based education, volunteered to introduce them to the basic notions and to provide a list of recommended publications for self-study. In addition, the first named author introduced teachers initially and pupils later to HTML5 and JavaScript “programming.” Instead of recommending some general literature to teachers, the instructor wrote an introduction, especially suited for the needs of these teachers. This way other teachers could benefit from this project in case they wanted to perform similar experiments. Also, pupils were introduced to the ideas of game-based education through a computer game bootcamp. There they had the chance to play games and realize what it means to learn by just playing a game. In addition, they had the chance to see different approaches to the design of educational games. This was particularly useful for both pupils and teachers. In particular, teachers had the chance to discuss with pupils all the aspects of several games and to see how learning is incorporated in different games. On the other hand, pupils realized that designing a game is not a trivial task and so their expectations became more realistic. Usually, pupils are overenthusiastic with exciting new projects and it is necessary to lower their expectations in order to avoid disappointment and frustration.

The next step involved the actual design and implementation of educational computer games by pupils under the supervision of their teachers. Initially, we asked pupils to try to create a simple board game or a simple outdoor game. We insisted on this step for two reasons. First, we wanted to teach our pupils how to create games and second, once one has a board or outdoor game, it is possible to create a computer game that is based on it.

All pupils came up with some game ideas. Moreover, pupils played these games during one scheduled meeting (the project included mobilities of all participating teachers and pupils hosted in the schools that participated in the project). This interaction was quite beneficial since it allowed pupils to improve their designs and make better games. In the end, these designs were used to create actual computer games.

During the implementation phase teachers had the duty to guide pupils. Teachers worked closely with pupils and introduced them to Unity (McCabe, 2017).

Quite naturally, different schools employed different teaching approaches. However, the teaching experience was unique since teachers employed all their skills to make pupils understand the fundamentals of Unity programming.

Teachers from the Austrian partner school managed to set up an elective class for Unity programming. Naturally, only pupils with real interest in programming took this class. In the classroom, teachers had to improvise and use all available material to teach their pupils the basics of Unity programming. In particular, they used tutorial videos, short online tutorials, and also textbooks. Later, pupils worked on little problems where the solutions of these problems formed the basis for their final game. The overall experience was extremely rewarding, and both teachers and pupils enjoyed this collaboration. Figure 2 shows two screenshots of the games designed by the Austrian partner.

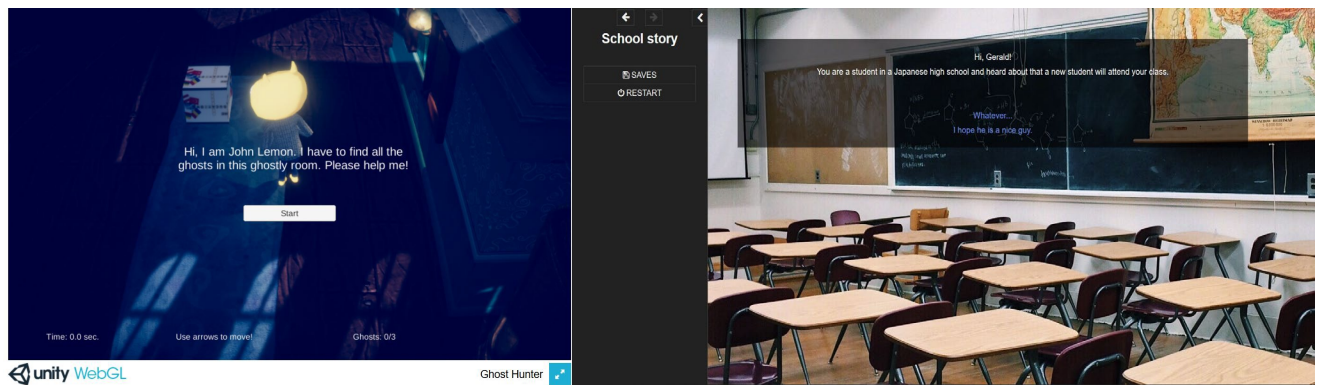


Figure 2. Screenshots of two games designed by the Austrian partner school.

The colleagues from the Romanian school had the most challenging task to accomplish—they work with pupils having special educational needs and/or mental disabilities. The teachers decided to work on a game that would nicely fit into their curriculum. The next task was to find a way to explain programming and involve pupils in the writing of the code for the game. After some experimentation, they concluded that the best strategy is to let them copy the code written by the teacher and then to learn where and how they can insert text and images. In addition, the teachers realized soon enough that although it would be particularly difficult for their pupils to write new code, nevertheless, they could help in graphics design. Being the graphic designers for the final product was a great chance for them to explore their creativity and to learn what free choice artistry means.

Sometimes pupils are more self-motivated and may have a self-acquired solid background in computer programming. This was the case with the Greek partner

school. There the teacher responsible orchestrated the design and implementation and let pupils do the hard work. However, the whole experience was quite professional since pupils were quite aware of many things and needed only some guidance. In particular, the game was about cryptography and so pupils wanted to be absolutely sure about certain notions and ideas. Figure 3 shows two screenshots of the game designed and implemented by the Greek partner school.

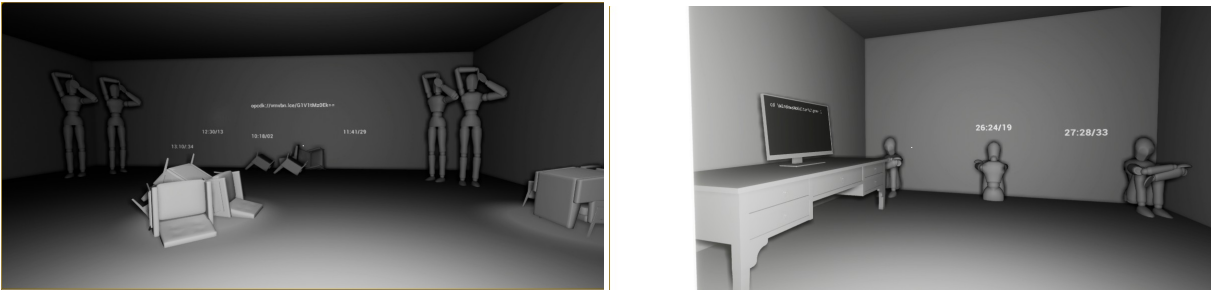


Figure 3. Screenshots of the game designed by the Greek partner school.

Pupils from Lithuania had a couple of courses in C++ programming and so they were familiar with basic programming concepts and principles. Although they did not know how to use the tools, for someone who has some experience in programming in any programming language, it is far easier to learn one more language and start using it. Since the teacher of this school has coordinated many school programming projects, this was not a new experience for him. Figure 4 shows two screenshots of the games designed and implemented by the Lithuanian partner school.

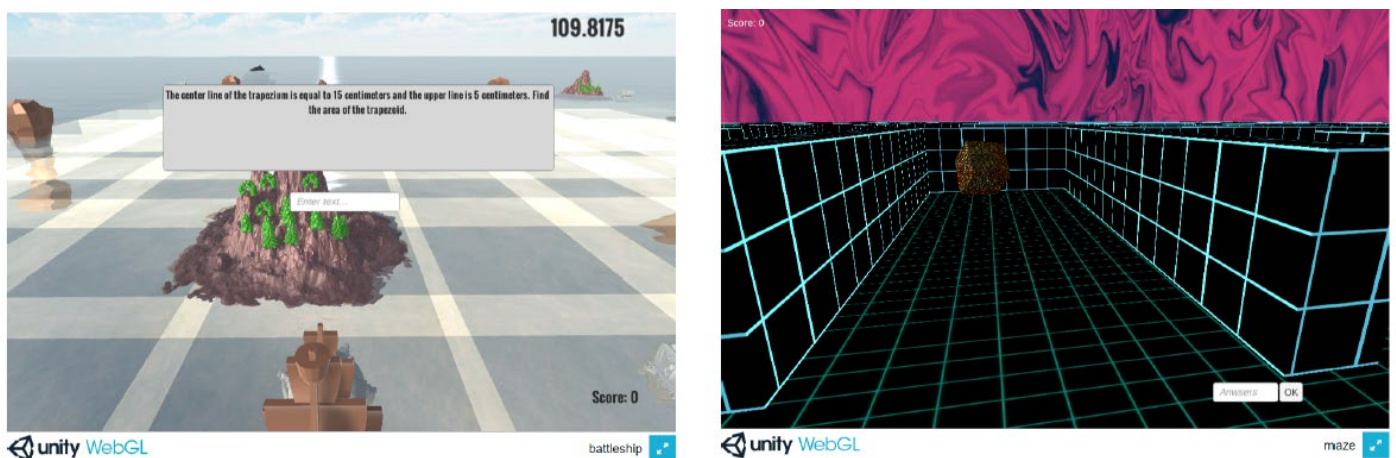


Figure 4. Screenshots of the games designed by the Lithuanian partner school.

Before this project, one could say that both pupils and teachers of the Turkish partner school were lousy gamers. This did not prevent them from learning things and to create a simple game they called Guess the Element Get the Pokémon. This is a block based educational game that aims to teach the subject matters of science and art. The game was created with the Scratch programming language, thus deviating from the initial idea.

One last aspect of the project is that all teachers were continuously in touch with the project “coordinator” and so they could exchange ideas, ask question questions, and report their progress. We could say that this added a touch of professionalism to the project and hopefully this has contributed to the successful outcome of this project.

4 Impact on Teachers

Many Erasmus+ projects are designed to foster communication between pupils and teachers of different European nations. Still, there are some projects that aim to strengthen the profiles of the teaching professions and the project we described so far was one of them. Naturally, setting a goal is quite different from achieving an objective. In order to assess the impact of this project the teachers that participated in the various activities, we created a questionnaire that was answered by all participants. Since we did not have large sample sizes, we could only make a qualitative assessment. Figure 5 shows the questionnaire that we had used to assess the impact of this project to teachers.

All participants are still working as teachers and most of them are teaching for more than 20 years. Still most of them had little or practically no experience with game-based education. This is quite natural since most schools in Europe strictly follow a government-designed curriculum. However, most teachers agree that they have learned things during the project and probably they use them in their classes. Certainly, the teachers that worked with pupils and designed games are in a better position, since they acquired knowledge and experience that one cannot easily get. A negative thing is that some teachers view such projects only as a way to have fun. Fortunately, this was not the case with project. In general, all professional activities should be fun but seeking only some good time is certainly not a professional way to view things.

Although almost all teachers had no previous knowledge of game-based education as teaching method- ology, or philosophy if you prefer this term, still the

project provide them with basic understanding of the relevant ideas. Naturally, one cannot cover all the literature and all relevant ideas in a few hours, nevertheless, such actions should prompt them to further investigate the literature and consequently enhance their understanding of game-based education. Indeed, as we expected, most teachers took the chance to read papers and articles about game-based education and in the end, we think most of them became “experts”. Also, teachers tried to find ways to introduce game-based education in their classes although this was not always easy. The main difficulty seems to be the structure of a course. This means that one had to work really hard to create a new game that could be effectively used in a classroom. Obviously, this is not a trivial task.

Questions	Answers
1. How many years have you been teaching?	<input type="checkbox"/> 1–10 <input type="checkbox"/> 11–20 <input type="checkbox"/> 21–30 <input type="checkbox"/> 31–
2. Have you participated in any other Erasmus+ school partnership program?	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. I believe that this project and the trainings I received have enhanced my classroom instructional practices ...	<input type="checkbox"/> Strongly disagree <input type="checkbox"/> Somewhat disagree <input type="checkbox"/> Neither agree nor disagree <input type="checkbox"/> Somewhat agree <input type="checkbox"/> Strongly agree
4. I believe that this project and the trainings I received positively affected my students learning experience...	<input type="checkbox"/> Strongly disagree <input type="checkbox"/> Somewhat disagree <input type="checkbox"/> Neither agree nor disagree <input type="checkbox"/> Somewhat agree <input type="checkbox"/> Strongly agree
5. Why did you prefer to be in such a project (you can choose more than one reply)?	<input type="checkbox"/> Personal choice out of interest in the area <input type="checkbox"/> Personal choice for career advancement <input type="checkbox"/> Personal choice to improve my teaching <input type="checkbox"/> To have fun and spend good time <i>Continued on the next page...</i>

Questions	Answers
	<input type="checkbox"/> It was “mandatory” to attend
6. Were you familiar with game-based learning before this project?	<input type="checkbox"/> Not at all <input type="checkbox"/> Somehow familiar <input type="checkbox"/> Familiar <input type="checkbox"/> Quite Familiar <input type="checkbox"/> Very Familiar
7. Where did you learn about game-based learning?	<input type="checkbox"/> During this project <input type="checkbox"/> At the university <input type="checkbox"/> Reading literature <input type="checkbox"/> From a colleague <input type="checkbox"/> Other:
8. Where did you learn about educational digital games?	<input type="checkbox"/> During this project <input type="checkbox"/> At the university <input type="checkbox"/> Reading literature <input type="checkbox"/> From a colleague <input type="checkbox"/> Other:
9. How often do you currently use game-based learning in your teaching?	<input type="checkbox"/> Never <input type="checkbox"/> Rarely <input type="checkbox"/> Occasionally <input type="checkbox"/> Regularly <input type="checkbox"/> Always
10. What would you say has your personal level of expertise in digital gaming and game-based learning enhanced after this project?	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <i>Continued on the next page...</i>

Figure 5. The questionnaire that we used to assess the impact of this project to teachers (pages 1–3).

Questions	Answers
	<input type="checkbox"/> 4
11. Has the amount of digital games you apply in your class increased after this project?	<input type="checkbox"/> 0 <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4
12. What did prevent you from using digital games in teaching?	<input type="checkbox"/> Your age <input type="checkbox"/> Your understanding <input type="checkbox"/> Student resistance <input type="checkbox"/> Structure/lesson planning <input type="checkbox"/> Other:

As already mentioned, a few teachers were involved in programming tasks. Previously, most of them could not deal with something outside their basic understanding. However, their work as team leaders in this project gave them confidence to try to work on anything that can be taught in a classroom. Naturally, this does not mean that these teachers became knowledgeable in everything. It simply means that learned how to start working on something they were not previously familiar.

5 Conclusion

It is clear that this project has helped teachers to improve themselves and to become better teachers. In particular, it allowed them to become more knowledgeable about game-based education and it allowed them to take the role of a leader of software development team.

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