Project Based Learning: Students' Design of Interactive Multimedia CD/DVD with Educative Content in secondary school

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Abstract. *The purpose of this paper is to find out the extent to which high school students consider the project based learning successful within the scope of developing their skills and the extent to which they consider themselves ready to work in this way regarding the experience they have had with it.*

The paper shows the development and the design of multimedia educative materials performed through the optional secondary school courses. The content is based on a further development of the existing classic teaching materials through the project based learning.

The purpose of these activities is to provide for an interactive learning and to train students-through the clearly defined and challenging tasks-to develop and acquire the practical skills of programming, graphic designing, producing multimedia elements, planning of projects, team working; Creative skills are also to be acquired, namely critical thinking, problem-solving, interpretation and visualization.

Keywords. multimedia, e-learning, multimedia CD/DVD, project based learning, interaction, interactive multimedia educative content

* The interactive CD/DVD "Moj grad i ja" (*My Town and Me)* won the First Prize at the State Competition in Graphic Technologies and Audio-Visual Technologies within the Realm of Multimedia ("The State Competition" in further text) in Varaždin in 2008.

* The interactive CD/DVD "Glagoljica" (*Glagolitic Script*) won the First Prize at the State Competition in Zadar in 2009.

* The interactive CD/DVD "Hrvatska tradicijska glazba" (*Croatian Traditional Music*) won the fourth place at the State Competition in Split in 2010.

1 Introduction

Today the process of teaching is under strong influence of technology. Students, using various research databases or search engines, can quickly reach the required information. Teachers face with the fact that students are no longer interested in teacher-centred lessons.

Now, teachers teach students how to reach knowledge rather than transfer it [6]. Teachers teach students to take active part in the teaching process, to browse and effectively use various information sources, to think critically and to evaluate it [9]. The development of curiosity and aptness to research in

students are the keys of their future advance in learning.

Some research results showed that students can learn better and retain information longer when they are more engaged by initiating and completing projects that is, when they are actively involved in the learning process [6, 20]. According to [18] empowerment learning environment encourages students to shift from passive information receivers to active constructors of knowledge.

Student-centred learning can be based around of a problem, an issue, a case, or a project [13]. In this paper we have been focusing on project based learning.

With project-based learning students can develop skills such as problem solving, critical thinking, communication, collaboration, and creativity that are being looked for by today's employers [19].

The objective of the activities related to the development of a multimedia CD/DVD on students' own was to encourage the interactive learning process in students, or, in other words [9], to encourage learning by means of researching or working projects in the course of a school year. The challenge to create a multimedia product for a target audience serves as the central curriculum activity to drive students to learn and solve problems along the way [8]. Consequently, the students were given not only an opportunity of honing their practical knowledge of programming, graphic designing and designing multimedia elements but as well an opportunity of enhancing their skills of problem-solving, planning the projects, team working, critical thinking, interpretation and visualization.

The authors of the paper wanted as well to find out the attitudes of students related to the project-based multimedia learning and their perception of these activities on success within the scope of developing their skills. Also the secondary aim was to see in which way the students perceive the teaching process by means of particular tasks in which the students had to recognize, implement and demonstrate the educational process. The result of the project activities is the multimedia CD/DVD contents for which some of the students won awards and prizes at the State competition in graphic technologies and audio-visual technologies within the realm of multimedia.

2 Project based learning

One research report [14] states that main reasons students quit school is because they're bored, and that with project-based learning they can be encouraged to "explore their own interests and to make connections to the world beyond school". The education process is "more effective when students use the knowledge by making sense of it" [6].

Project based learning can be defined as a meticulously planned and envisaged teaching process whose objective is the acquisition of knowledge through a research into a particular situation done by means of interactive learning [3]. Another definition is by Moursund [12] where he defined the project based learning as an individual or a group activity that lasts for a certain period of time and results in an outcome, a presentation or a performance. A similar definition was offered by Köse, in accordance with whom the project based learning is „a learning approach that organizes students' learning activities around projects" [6].

Project-based learning [1] represents an environment where teacher is a facilitator. Teacher designs activities and provides resources and advices for students. Students [1] trough interdisciplinary project collect and analyze information, make discoveries, and present their results.

According to [11] the students who take part in project based learning activities are better motivated and „demonstrate better teamwork and communication skills" and „have a better understanding of the application of their knowledge in practice and the complexities of other issues involved in professional practice". The deployment of the interactive learning as well develops a democratic environment, openness, self-incentive quality in students, open-mindedness and tolerance [9].

Wurdinger et al. [20] say that projects should be challenging ones, which encourages the critical way of thinking in students while they plan, test and implement a project, but yet not too demanding so that the process of learning is not blocked. The traditional way of teaching where a teacher applies a step-by-step process in showing the students the way of completing a particular task has been criticized. The students in such case simply copy what the teacher said and do not think too much of what they have done. On the other side, planning, testing and reflecting become an integral part of the learning process in which the students can experiment in their own way [20]. This way of learning makes a student share responsibility for his/her work and the outcome of learning.

A teacher encourages students to do research, helps them to plan and envisage a project, and sets an attainable set of objectives and tasks. The goal of project based learning is to overcome the traditional way of learning which is primarily oriented toward the gathering and memorizing facts and other forms of information; it as well encourages the understanding of materials, the search for meanings related to the patterns of experience, critical evaluation of ideas etc. [4].

3 Multimedia project

According to [5] students are more "likely to be motivated to choose an activity and persist at it if they enjoy the activity and are interested in it". Liu & Hsiao [8] report the results of a research that made

students take part in multimedia designing by means of using a project-based learning approach. They say that making students to take part "as multimedia designers (is) one type of project-based learning, which requires students' active participation, and engages them in authentic problem investigations"[8]. And according to [20] project-based learning can enhance students' motivation and their effectiveness in the classroom.

Learning multimedia is more complex than traditional lecture instruction [2]. As the morphology of the term multimedia indicates, multimedia is eventually an amalgamation of numerous media. The multimedia elements are labelled as text, sound, graphics, video and animation [16].

When such materials are created, the skills that have to be taken into account are programming, graphic designing, producing multimedia elements, planning of projects, team working, critical thinking, problem-solving, interpretation and the visualization in an innovative way by means of using the contemporary information technologies.

By taking part in a multimedia project, students "are engaged in a variety of activities from brainstorming, gathering and researching information, writing, creating art works, to programming and evaluating" [8]. McGrath et al. [10] say that the self-respect in students increased while they were taking part in implementation of a multimedia project.

Simkins et al., [15] introduced term project based multimedia learning which is a method of teaching that combines project based learning and multimedia in which students acquire new knowledge and skills by designing, planning, and producing a multimedia product.

According to same authores project-based multimedia learning has seven key dimensions: core curriculum, real-world connection, extended time frame, student decision making, collaboration, assessment, and multimedia [15]. These elements have been included in project activity of making interactive multimedia CD/DVD.

4 Case Study: Making of Interactive Multimedia CD/DVD with Educational Content

The students of the secondary School of Building and Crafts Čakovec attending the WEB Designer and Multimedia Technician courses are generally taught in a traditional classroom with deployment of Power Point presentations, informative Web use or multimedia CDs/DVDs as teaching aids. The use of the combined model of teaching with the use of the contemporary ICT, Web contents and online education through CARNet online course is specific for the WEB Designer and Multimedia Technician courses:

1. "Rendering pictures in GIMP"
2. "Creating Flash animations" and
3. "Processing of audio/video recordings"

(the courses are implemented in the regular teaching process).

The origin and the development of multimedia CD/DVD digital contents are related to the optional subject "Processing of audio/video recordings" taught and moderated by one of the authors of the paper.

The approach to designing project activities was defined by the proposed themes related to the State Competition with the themes "My Town and Me", "Glagolitic Script" and "Croatian Traditional Music in 2008, 2009 and 2010, respectively. For the year of 2011, the proposed theme is "Graffiti".

Before the making of the CD/DVD and defining the tasks, the students had been divided into teams of two to four, depending on their own (personal) choice. The chance of doing the personal creative work was provided for everyone. The process of designing the multimedia contents depended on the students' abilities, but the deadline expired in 3 months (the competition deadlines had been set). The stress of the activities was on the content of the final CD/DVD-a as viewed by the students, in other words, the students could express their ideas in the multimedia way by means of including their previous experience in working with various media.

The research into the proposed field was done prior to the development of the multimedia contents. Once the research was completed, determination of the optimal platforms for the development of the CDs/DVDs took place. Anyway, the contents that were to be implemented into CDs/DVDs were worked out and carefully selected. Each of the finished interactive CDs/DVDs started with an introductory film. The introductory film (intro) provides for an introduction into the interest sphere and makes a viewer acquainted with the basic content of a CD/DVD medium. Students have implemented the "skip" option in order to move to the next starting point of a CD/DVD. There was also the navigation available at any moment and in any part of the visible area. The functionality and appropriateness of the content were meticulously taken care of. The attached pictures illustrate the attractiveness of the navigation (Picture 1, Picture 3 and Picture 5).

Picture 1 - The basic interface of the interactive CD/DVD "My Town and Me"

The professional design level and simplicity in one hand and the didactic and methodology elements in the other hand provide for the following multimedia quality (Picture2, Picture 4 and Picture 6): CD/DVD "My Town and Me" has the following content:

1. The Town of Čakovec /description/
2. Video gallery / on the life in the Town /
3. Secret pictures /pictures of the spots in the town that are hard to access/
4. Quiz /knowing the history of the local community/
5. Culture, youth, sports /information on clubs, events, associations/
6. Air view – Čakovec by night /unusual pictures, Čakovec by night/
7. Dance /3D animation showing the learning of how to dance
8. „Music and video player" /listening to the music /….

Picture 2- Quiz, Culture, youth, sports, Secret pictures – multimedia quality and interactivity with a user – "My Town and Me"

Picture 3 – The basic interface of the multimedia CD/DVD "Glagolitic Script"

CD/DVD "Glagolitic Script" has the following content:

1. The history of the Glagolitic script /a sequel and the history/
2. Glagolitic letters /a comparison with the Latin script letters
3. Translator /an interactive transcription from the Latin script into the Glagolitic script/
4. Video footage on the Glagolitic script /a film about the Glagolitic script /
5. Quiz /knowing the Glagolitic script /
6. Contact /cooperation via the Internet/…
7. „Music player" /listening to the pop-music – interactive transcript of the lyrics into the Glagolitic script

Picture 4 - Translator, Quiz, Contact – multimedia quality and interactivity with a user - „Glagolitic Script"

Picture 5 – The basic interface of the multimedia CD/DVD "Croatian Traditional Music"

CD/DVD "Croatian Traditional Music" has the following content:

1. Tradition of Međimurje
2. Picture Gallery
3. Tradition, customs, present time/getting to know the tradition and the music of the present time
4. Musical instruments/Croatian traditional music instruments
5. Quiz/recognition of songs and musical instruments/
6. Dance /3D animation showing the learning of how to dance
7. „Music and video player" /listening to the music

Picture 6. Musical instruments, quiz and dance – multimedia quality and interactivity with a user - "Croatian Traditional Music"

For the purpose of creating a multimedia CD/DVD, an array of application was used - Adobe® CS4 Photoshop, Adobe® Flash CS4; the animation was edited and rendered with Adobe® Premiere Pro® CS4 v4.0; the special effects were added with Adobe® After Effects® CS4 v9.0; the virtualization of the space was made with Cinema 4D® v11.5 software developed by MAXON Computer GmbH, 3D Studio Max etc.

The processor and memory requirements were reduced to the minimum.

5 Research methods

The aims of this research was to discover the attitudes of students related to the project-based multimedia learning and their perception of multimedia project activities on success within the scope of developing their skills. Also the aim was to see the extent to which they consider themselves ready to work in this way regarding the experience they had with it. The research was done by means of a survey.

The questionnaire was applied on the sample of 92 students attending the WEB Designer and Multimedia Technician courses of all grades (First grade-Fourth grade). Students from both courses took part in project based activities in the field of multimedia. The students could give up at any stage of the surveying, and they could accept the survey or reject it so the results can be considered relevant.

Two short questionnaires were applied, each containing approximately eight (8) questions. The students were asked to express their opinions on a Likert scale where they could mark 1 (they strongly disagree with the statement), 2 (they disagree with the statement), 3 (they do not have an opinion as to the statement), 4 (they agree with the statement) and 5 (they strongly agree with the statement).

6 Research results

The first questionnaire investigated the student's opinion on the knowledge and the skills they were supposed to have after they completed all classes and exercises regarding multimedia. The second questionnaire investigated the students' attitude toward the knowledge and the skills they had after taking part in the project based activities.

Table 1. The opinions of students before taking part in the project based activities on making multimedia CDs/DVDs with educative content

I think that….	
…I have mastered a satisfactory level of knowledge and skills of creating multimedia applications.	
Mean	Std. Dev
2.696	1.003
…I have mastered a satisfactory level of practical skills required for getting a job in the production sector of economy.	
2.717	0.941
…I have mastered the use of (Adobe® CS4 Photoshop, Adobe® Flash CS4, Adobe® Premiere Pro® CS4 v4.0, Adobe® After Effects® CS4 v9.0. Cinema 4D®, 3D Studio Max etc.), the applications	

similar to those used in the production sector of economy.	
2.315	1.048
…I can successfully take part in all the stages of planning and developing of a multimedia application.	
3.533	0.931
…I can successfully cooperate in a team work.	
3.283	1.009
…my knowledge and skills level in the area of planning and organizing resources (time, space, material, equipment) needed for fulfilling activities are satisfactory.	
3.326	0.903
…I do have the skills of finding and using the relevant information for challenging multimedia problems.	
3.696	1.024
…I do have the skills for a creative solving of multimedia problems.	
3.728	1.049

Table 2 - The students' attitude toward the knowledge and the skills they had after taking part in the project based activities on making multimedia CDs/DVDs with educative content.

I think that….	
… I acquired the new valuable knowledge and skills in the realm of multimedia through the project and I had not had them before.	
Mean	Std. Dev
3.902	0.712
… I acquired the new valuable knowledge and skills in the realm of multimedia that I had not had before and they enable me to get a job in the production sector of economy.	
3.902	0.696
… through this project, I acquired the skills for a successful use of the technologies similar to those used in the production sector of economy (Adobe® CS4 Photoshop, Adobe® Flash CS4, Adobe® Premiere Pro® CS4 v4.0, Adobe® After Effects® CS4 v9.0. Cinema 4D®, 3D Studio Max etc.)	
4.054	0.894
… through this project, I enhanced my successful teamwork cooperation skills.	
3.772	1.384
… the multimedia project has been conducive to the enhancement of my skills of planning and the organization of resources needed for completing the activities (time, space, material, equipment).	
4.228	0.757
… through this project, I developed the skill of a deeper understanding the stages of the development of a multimedia project I had not featured before.	
4.304	0.707
… through this project, I developed additional skills of finding and using the relevant knowledge in the realm of multimedia I had not featured before.	
4.391	0.662
… through this project, I furtherly developed the creative problem-solving skills in the realm of multimedia I had not featured before.	
4.446	0.652

Question results are marked with PBx for group of statements relating to questions considering opinions of students before taking part in the project based multimedia activities. Question results are marked with PAx for group of statements relating to questions considering opinions of students after taking part in the project based multimedia activities. "x" is an in-group identification number of question.

The results showed a significant increase in the students' self-confidence related to the knowledge and skills in the realm of multimedia (PB1 Mean = 2.696, Std.Dev =1.003, PA1 Mean = 3.902, Std.Dev. = 0.712). The same went for the students' perception of the possibility of employment in the production sector of economy (PB2 Mean = 2.717, Std.Dev = 0.941; PA2 Mean = 3.902, Std.Dev. = 0.696). As to the use of multimedia tools Adobe® CS4 Photoshop, Adobe® Flash CS4, Adobe® Premiere Pro® CS4 v4.0, Adobe® After Effects® CS4 v9.0. Cinema 4D®, 3D Studio Max, the difference in the attitudes is even bigger (PB3 Mean = 2.315, Std.Dev = 1.048; PA3 = Mean = 4.054, Std.Dev = 0.894), which means that the students estimate the project activities more if particular tasks from the production sector of economy are involved.

As to the perception of the students' cooperation within a team, the results showed no significant difference with statements related to the time before and after the implementation of the project, although the results did show a larger percentage of agreement with the statement that they have additionally developed their successful teamwork cooperation skills (PB4 Mean = 3.283, Std.Dev = 1.009; PA4 Mean = 3.772, Std.Dev = 1.384).

Further results showed that the students were far more self-confident in expressing their opinions related to their skills of planning and organizing resources (PB5 Mean = 3.326, Std.Dev = 0.903; PA5 Mean = 4.228, Std.Dev = 0.757). The students as well stated that the process of taking part in the project was conducive to their deeper understanding of the stages of the development of a multimedia project (PB6 Mean = 3.533, Std.Dev = 0.931; PA6 Mean = 4.304, Std.Dev = 0.707). They as well stated that they had developed additional skills of finding and using the relevant knowledge in the realm of multimedia (PB7 Mean = 3.696, Std.Dev = 1.024; PA7 Mean = 4.391, Std.Dev = 0.662) and the creative problem-solving skills in the realm of multimedia (PB8 Mean = 3.728,

Std.Dev = 1.049; PA8 Mean = 4.446, Std.Dev = 0.652).

The purpose of the research was to determine the students perception on level of their self-confidence related to the multimedia applications before and after the projects were implemented from which in turn is possible to determine whether the project activities were conducive to the readiness of students for (further) project activities.

5 Conclusion

The possibility of distinguishing oneself and the possibility of adapting oneself are the important elements of application of ITC in the course of a lifetime. The employment of new technologies requires dedicated work on the part of both teachers and students in order for the new technologies to be applied successfully and willingly. Besides other things, the implementation of new IT inevitably changes the traditional teaching process (learning and teaching). This is why the objective of any teacher is – at the individual level- to alternate various methods and procedures, to define clear rules and to provide for a good working atmosphere, an interesting conception and an appropriate level of expertise.

Multimedia seems to be an "ideal vehicle to encourage students to become active builders of knowledge, rather than just receivers of information or proficient presenters" [17]. Taking part in creating multimedia CDs/DVDs considerably enhances the students' interaction in various fields and the transfer and application of the new knowledge is enhanced as well. Furthermore, it can freely be said that this way of work "refreshes" the traditional teaching process. Some of the features of the traditional teaching process, dominated by a teacher's activity and a student's passivity, the frontal way of teaching, memorizing and reproduction of facts are therefore overcome. The activity of students contributes to the increase in motivation, creativity, freedom, intelligence and the quality of adapting to new situations [7].

Their attention is increased as well and there has been a chance for them to develop a more professional approach as early as the secondary school level. Students have become able to actively apply the new knowledge and skills in their lives. This in turn develops the competences that comply with the requirements imposed by the challenges and the tempo of the contemporary life. Further research activities will be concerned with verification of these pedagogical effects of a project-based multimedia learning.

Therefore for now, it can be concluded that the students' perception of their own knowledge and skills changes through multimedia project activities. The project-based learning has shown to be very useful in engaging students' interest, motivating them to learn and in increasing their self-confidence in field of multimedia application development. Similar research results were obtained in the research of Liu & Hsiao [8].

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