Project Based Learning in Vocational Studies

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Abstract— The paper will give an example of project learning in the subject Computer Graphics and Multimedia, which is performed in the study program Business Informatics and Programming, in basic vocational studies. The aim of the course is to understand the role of computer graphics and multimedia in modern business and communication and to master the basic techniques of creating graphic and multimedia content. For the needs of the proposed project learning, students should first get acquainted with the theoretical foundations of creating raster documents: techniques of processing raster objects (tool palette, layering, selection, transformation, coloring, lighting, filters, actions, text input and editing…), creating content for the Web, preparing for printing and publishing. The proposed example will be implemented through the following phases: selection of the topic - defining the problem to be worked on, project preparation and work plan development, project flow, presentation of project results and evaluation. The focus is on recording, analyzing and processing images on a given topic. It is expected that it will give an example of project learning that can be implemented in primary vocational education as a method for educating students in Computer Graphics and Multimedia, that students will achieve better exam results and that this method of work will be gladly accepted by students.

Keywords— project-based learning, higher education, computer graphics and multimedia, raster object processing

I. INTRODUCTION

Continuous improvement and improvement of the knowledge transfer process aims at more efficient production of professionals who will be able to respond to the future challenges of their profession, and to take responsibility for their decisions [1]. In modern didactics, the largest number of criticisms refers to frontal work which is aimed at satisfying the needs of only average students. This way of working is based on the transfer of ready-made knowledge where students are passive participants. In order to overcome these problems, it is necessary to modernize the teaching process by developing and using new methods of work [2] that would put students in the forefront as active participants in the learning process. One such form of active learning is project-based learning [2].

II. REVIEW OF LITERATURE

Project-Based Learning is a comprehensive approach to teaching and learning in the classroom designed to involve students in research on authentic issues [3]. It is a form of learning that trains students in real-world challenges they may face in future professional career [4]. Project-based learning enables students to learn by working and applying their ideas, to deal with real, meaningful problems that are similar to the activities of adult professionals [5]. Through this type of learning, students are given the opportunity to research, ask questions, suggest hypotheses and explanations, discuss their ideas, challenge the ideas of others and try new ideas. Research has shown that students who learn teaching content organized through meaningful problems, show better results than students who study in the traditional way [6, 7, 8]. Project-based learning has long been used in higher education as a method for educating students with the help of realistic problem tasks [9, 10]. These tasks usually require initiative and independence from the student. They need a lot of time to complete, result in the production of the final product (eg reports or presentations) and use educators in an advisory role [3,11,12]. Projects can often involve students working in groups with the aim of encouraging collaboration and developing interpersonal competencies. This approach has already been implemented as a good practice in bioinformatics training [13]. PBL - Project Based Learning allows students to learn organized in groups in which they work together to solve specific problems and finally present the final result of their work-projects in the form of a multimedia presentation, written report, website or constructed product [2].

Project-based learning (PBL) is an active form of student-centered learning. It is characterized by student autonomy, constructive research, goal setting, cooperation, communication and reflection in real world practice. Research conducted in different contexts at different stages of schooling, from primary to higher education, could not determine with certainty the causal link between PBL and the positive results of both students [14].

Experiential learning is a key factor in acquiring knowledge through experiencing things. The basic idea of project-based learning is to connect students' experi-

ences with school life and to provoke serious thinking as students acquire new knowledge. Through experiential learning, and especially through PBL, a connection with real-world problems is made [15].

In his paper, Dimmitt [16] analyzes the extent to which project-based learning (PBL) contributes to learning efficiency and the extent to which it provokes critical thinking among first-year university students. The results of his analysis showed that the PBL method can learn students effective techniques for increasing self-confidence and independent, critical thinking that are necessary for students to be successful in their academic endeavors. Sulaiman and colleagues [17] investigated the effectiveness of involving students in environmental projects. The results of the research showed that the greatest impact on the students had projects that required them to make pleasant and unusual final products such as a documentary, a campaign throughout the school and an environmental exhibition throughout the school. This result indicates that PBL can be implemented with few resources, within the school building and in the time allotted for processing the topic.

Branch [18] conducted a study to determine the effects of project-based learning on student achievement in mathematics. The study examined differences in student achievement in two charter schools in Chicago. In one school, the traditional way of learning was applied, and in the other, project-based learning. The results revealed that there are statistically significant differences in student achievement between schools that used project-based learning as a learning approach and schools that used a traditional learning approach.

The interdisciplinary field of mechatronics encompasses a coherent interactive design process that facilitates, innovates and develops desired skills by adopting experiential approaches to learning. Mechatronic educational and experimental systems have been developed to facilitate experiential learning and improve the learning process in order to stimulate thinking skills in undergraduate students. Developed educational and experimental systems of Mechatronics are designed, implemented, programmed, tested and successfully used by students within the designed laboratory. Developed systems have their own learning indicators where students acquire knowledge and learn certain skills. Knowledge is acquired through engagement, practical experience focused on students inspired by collaborative participation, reflection and interactive discussion. The integration of learning outcomes related to the developed educational and experimental systems of Mechatronics, combined with the project-based learning approach, has given the desired results that indicate the improvement of the learning process. The effectiveness of the developed experimental systems has been demonstrated through an experimental laboratory and through project-based learning at Sanio_Onoda City University, Yamaguchi, Japan, and the American University in Cairo [19].

Numerous studies have investigated the effectiveness of learning based on examining the effectiveness of the application of the PBL method in the education of engineers in various countries. For example, Ruikar and Demian [20] found that there was a link between learning success and engaging industry partners through multimedia podcasting in the UK. Industry partners provide real-world cases that put them in the context of theoretical content.). Multimedia content podcasting also addresses the issue of student engagement. They can adapt to different ways in which students learn (eg VARK - video, audio, reading / writing and kinesthetic sensory learning modalities). The paper describes a case study of the application of podcasting in the final year design module at Loughborough University. The students were assigned a master planning project on which to work. An industry partner was hired to record an audio-visual session in which he gave a report on key design considerations and rationale for the master planning project. Later, in a dedicated lecture module, an audio-visual podcast was released. Students were briefly introduced to the scope of the podcast's content. The survey found that the student showed very good results on the test and gave a very high grade to the podcast in the questionnaire that asked for their subjective reaction to the experience.

Hassan et al. [21] have adopted an integrated, multidisciplinary, project-based learning methodology in e-engineering in Spain. Fernandes et al. [22] also applied a project-driven education model developed by Powell and Weenk (2003), and applied it as a learning model to students at the University of Portugal.

Another study looked at project-based language learning. They used the theory of activities in the university language program in Ireland. This study showed mixed results in learning outcomes for study participants. Such results are a consequence of contradictions identified in the system of activities (unequal division of labor, lack of time due to community obligations or opposition to the rules governing activity in modules). [23].

III. EXAMPLE OF PROJECT LEARNING ON THE SUBJECT OF COMPUTER GRAPHICS AND MULTIMEDIA

Basic information about the project: Project learning is extremely suitable for learning in the IT group of subjects through which, in addition to theoretical knowledge, some organizational skills are acquired, communication skills, creativity, ability to take responsibility and ability to work in a team. From the group of informatics subjects that are studied at the basic vocational studies is the subject Computer Graphics and Multimedia. From the curriculum of the subject Computer Graphics and Multimedia, a certain unit has been singled out, which refers to the processing of photography. Through lectures in higher education, on the processing of photography, teachers convey important theoretical information. Exercise classes work on the practical improvement of theoretical knowledge by applying creative methods of work on selected content. Learning can be organized as a project research

task. Students are engaged in processing the photo so that it is convincing enough for the observer. Editing and processing a photo can be extremely interesting because its quality can be improved, and even top quality photos can be obtained. The project would be organized over three weeks (6 school hours). Students are divided into groups of 5. The groups are heterogeneous. Each group has a full task.

A. Preparatory phase

Project topic: Creating raster documents: techniques of processing raster objects (tool palette, layering, selection, transformation, coloring, lighting, filters, actions, text input and editing…).

Project objectives: General objective: to understand the roles of computer graphics and multimedia in modern business and communication and to master the basic techniques of creating graphic and multimedia content.

Specific objectives: to improve the levels of information literacy by collecting and selecting information; to develop and improve communication skills; to develop more efficient and effective collaborations-cooperation of an individual in a group in order to achieve a common goal; to form critical thinking (ability to distance oneself from one's own beliefs and prejudices in order to come to well-founded and logical conclusions about what to believe and what to do); to develop ICT skills needed to work with computer and communication devices, software, applications ...; to establish cooperation between the two Academies of Vocational Studies in Sabac and Valjevo.

Project outcomes: Students' ability to: organize and see the project (acquire the ability to learn, research and search, select and use information, develop social skills, collaborate, acquire practical and managerial skills ...); self-creation of posters, flyers, brochures or similar graphic solutions; self-creation of a logo or illustration on a given topic; taking and processing a photo on a given topic / need.

Holders of activities: Students, teacher. A cooperative relationship is formed between them to solve the problem. This attitude contributes to the development of self-initiative, greater freedom in work and encourages the responsibility of students to take the initiative in finding solutions.

Methods of work: Individual and group method, Method of oral presentation (description, explanation, reporting), Method of conversation (discussion, brainstorming), Method of reading and working on the text, Method of writing, Active and interactive methods of work (Activity encouraged by teaching technique, content or teacher instructions, Interactive methods have the task to transfer the activity from teacher to student, to help students learn together, solve tasks and evaluate work.).

Forms of work: Team work (projects) - Working in a team motivates the student better than working in a group. There must be a willingness, knowledge and ability among the members of the group to make a full contribution to the achievement of a common goal according to their abilities and role. Group form of work: The composition of the group is determined by agreement between teachers and students. According to the tasks, all groups do the same task.

B. Project planning

Explanation of the project topic: An image is an artifact that displays or records visual perception [24]. An image can be defined as a two-dimensional function f (x, y) where x and y are spatial coordinates, and the value of the function represents the intensity at a certain point in space. Given that about 90-95% of the information about the world around us is obtained through the visual system as visual effects, quality images must be convincing enough to leave a good impression on the viewer. Regardless of how the photo was created and whether it is product of an amateur or a professional, for high quality, it sometimes needs to be subjected to beautification - digital processing with the help of digital computers. Digital processing is performed to improve the visual characteristics of the image in order to achieve a satisfactory image perception by the observer.

The Chinese proverb "A picture is worth a thousand words" confirms that our mind prefers to work with visual elements than to use words. We can describe reality in words, but we can directly show reality in pictures. And if we prefer to use visual thinking as an important aspect of information processing, unfortunately, in the field of education, graphic methods are mostly neglected and knowledge transfer is most often done verbally. In the middle of the last century, a new concept of "visual thinking" emerged as a pedagogical approach that advocates the view that the ideal way to create, share, develop and manipulate ideas is to present in a visual sense. We process images much faster than any information in text or oral form. Visual information leaves a deeper impression on us than what we read or what they tell us. It is clear that language, as written, so is the oral, very sophisticated and useful means of conveying ideas, however, this means of conveying concepts has no immediacy or closeness to the image. Example: it is much easier to learn what an apple is if seen in a photograph or in real life than if we remember its definitions [25].

Preparation for the selected topic: Students and the teacher jointly define the main topic and plan activities and contents, evaluate the learning process and their results, generate and choose possible options. All team members should be equally engaged. Members agree with each other. Upon completion, each team prepares a report on the results of the project.

Each team was given the same task, to download an image from the Internet and approach the development of an image processing plan with a specific tool.

The teacher suggests tools that I can use: Adobe Photoshop and Adobe Lightroom. Adobe Photoshop is selected.

Reason for choice: Adobe Photoshop (Photoshop) is the market leader among professional programs in the field of digital image processing and creation [26].

Choice of information sources: scripts from lectures and exercises, PowerPoint presentations, materials from the Internet, tutorials.

Choice of required resources: Computer, Software and image processing application. Instructions-tutorials available on Youtube can be used to use some tools. Take into account what was presented in the theoretical classes. Focus on the levels and phases of digital image processing.

IV. PROJECT IMPLEMENTATION

Implementation and materialization of ideas. Monitoring the work plan, documenting the implementation of the project (notes, pictures...). Possible example of concretization of the project topic - opening the project.

A. Task 1: Turn a photo into a drawing.

Fig. 1. Example of concretization of a project topic (Initial photo) [17]

Step 1: Launch Photoshop and upload the import photo via the “Open” option.

Step 2: To get a black and white drawing, remove the color from the photo. Menu bar- find the Image > Adjustments > Desaturate option. Now color of the photo becomes "black and white".

Step 3: Duplicate a layer of "black and white" photo. The Layers palette shows all the layers of the photo stacked on top of each other. Right-click, select the layer and select the Duplicate Layer option in the context menu and then select the OK option. A new layer appears on the palette above the "Background layer” called "Background copy".

Step 4: Convert the "Background copy" layer to photonegative. Select it if it is not selected (the active layer is colored blue) and use the Image > Adjustments > Invert option.

Step 5: Work on the layer continues - return to the layers and mix colors. Use one of Mod's merges on the Layers palette to mix the colors of two photos. Select the Color Dodge option from the drop-down menu. Turn the white surface into a drawing using a Gaussian Blur filter. The Gaussian Blur filter is located on the menu line Filter> Blur> Gaussian Blur. Select Gaussian blur and make adjustments (value ranges between 1 and 10 pixels), 10 pixels were used for work purposes.

Step 6: You need to “glue” the layers by selecting the "Background copy" layer, and right-click to select the Merge Visible option. Only one layer is visible on the Layers palette now. Then the photo editing was successfully completed.

Step 7: After converting the photo into a drawing, add the text to the photo. Select The Horizontal Type Tool. Use font settings (Brush Script MT, Italic) and font size (57 pt,strong) to add text.

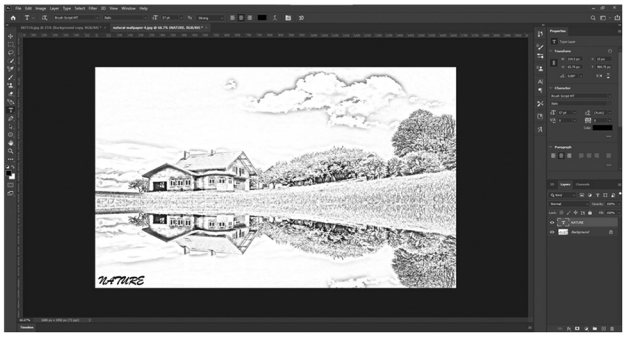

Fig. 2. Example of concretization of the project topic (Final photo after editing)

B. Task 2: Photo retouching. In Adobe Photoshop, retouch the original photo. Remove irregularities and make corrections on the skin and face and make a uniform tonality

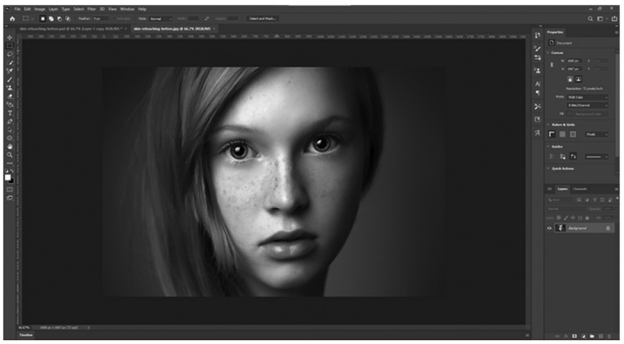

Fig. 3. Example of concretization of a project topic (Initial photo) [18]

Step 1: Open the original photo and duplicate that layer (Layer > Duplicate Layer).

Step 2: Select the Spot Healing Brush Tool from the Toolbox. By applying this tool, irregularities on the skin are eliminated.

Step 3: Select the copy of layer and again make a duplicate of it (Layer > Duplicate Layer), and then apply the "Dust & Scratches" filter (Filter > Noise > Dust & Scratches) to that layer.

Step 4: On the same layer, apply a "Gaussian Blur" filter (Filter > Blur > Gaussian Blur) with a radius of 2 px, in order to obtain a soft skin tone.

Step 5: To get a more natural look, add a "Noise" filter (Filter > Noise > Add Noise).

Step 6: Add a mask to this layer via the icon on the Layers palette. Fill the mask layer with black (keyboard shortcut D, X then ALT + DELETE). Then invert the color of the foreground and the background so that the color of the foreground becomes white (X on the keyboard), select the paint brush (B) and use the brush to "paint the skin" in the necessary places.

Fig. 4. Example of concretization of the project topic (Final photo after retouching)

V. PROJECT PRESENTATION

Presentation in Word and PowerPoint presentation with a description of the work process supported by photographs documenting each step. Various tutorials contain instructions for making presentations. The presentation of the project results is done in front of the teacher for 10 minutes. If necessary, the presentation time can be extended, but not longer than 20 minutes, because a longer presentation reduces the attention of the listeners. The questions are short and are asked at the end of the presentation. Question time - no longer than 15 min.

VI. EVALUATION

Since the presentation of project results is done in front of the teacher, it can be more extensive in the form of conversations between teachers and students and based on feedback, an assessment can be given. The survey technique was chosen in this project. The project implementation is being evaluated. Students should give their opinion in order to find out their position on the implemented project. The example of the questionnaire for students is arranged according to the survey, ie. Evaluation sheet for students [29] with certain modifications:

1. Do you like the way you work on the project?

YES - NO - PARTIALLY - I DON'T KNOW

2. Are you satisfied with the team way of working on the project?

YES - NO - PARTIALLY - I DON'T KNOW

3. Are you satisfied with the working conditions on the project?

YES - NO - PARTIALLY - I DON'T KNOW

4. Are you satisfied with the coordination of teachers' work on the project?

YES - NO - PARTIALLY - I DON'T KNOW

5. Do you better understand the essence of the content through classroom lectures or project teaching?

YES - NO - PARTIALLY - I DON'T KNOW

6. Would you prefer team work, project teaching and research tasks to be more represented in regular classes?

YES - NO - PARTIALLY - I DON'T KNOW

In addition to the evaluation of the project, future research may also evaluate the work of teachers, the work of group leaders and the work of each student individually, the evaluation of available literature and the evaluation of evaluation. In addition to evaluation in further research, the effects of the application of project-based learning in higher education can be examined.

VII.CONCLUSION

The subject Computer Graphics and Multimedia is a subject that is taken at the basic vocational studies of the first degree. The set goal of the course implies that students at the end of the learning process should understand the role of computer graphics and multimedia in modern business and communication and master the basic techniques of creating graphic and multimedia content. The competencies that are provided in the Curriculum of the course are expressed through the outcomes of the course and must be in accordance with the requirements of the profession. Through the envisaged competencies in this subject, which represent knowledge and skills, students should be trained for a job in the profession for which they are studying. Research has shown that project-based learning significantly contributes to better student outcomes and performance. Project learning can be designed and implemented in most subjects. The main disadvantage of such learning is the limited time frame for the material, which is extensive. This kind of learning requires more times than classical learning [30]. Excessive material and a condensed schedule burden students. Because they may be uninterested in work that additionally burdens them and takes away their free time. The problem can also arise because students have different places of residence, so there is a problem

of organizing meetings outside of school. The advantage of the method is that real life contexts and high technology tools can be introduced into subject curricula through project learning. In this way, students are encouraged to work independently, develop critical thinking and lifelong learning skills.

The proposed example of project learning could be implemented in learning in which students and the teacher would try to organize learning so that the set task is done together in order to reach the set goal. For successful implementation of such learning, not only certain experience is needed, but also good organizational skills of teachers, but also the will to step out of the beaten path of classical learning, to accept the challenge and to be more engaged in creating higher levels of student education. It is expected that he will give an example of project learning that can be implemented in primary vocational education as a method for educating students in Computer Graphics and Multimedia, that students will achieve better exam results and that this method of work will be gladly accepted by students.

According to the Australian College of Teachers' Code of Ethics: "Teachers have an obligation to keep pace with learning achievements and with theories and strategies of teaching... They are responsible for what they teach and for the way they build relationships with students" (F. Haynes).

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