Exploring Service Provision in Blended Learning Environments: A Project-Based Analysis

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ABSTRACT

During the course of computer graphics and web design at the Bohdan Khmelnytsky National University of Cherkasy for first-grade students, we performed the selection and analysis of services for the project activity organisation. The research was carried out for students of engineering specialities in the blended learning setting. The purpose of the research was to solve the problem of increasing project work organisation effectiveness.

Students got a collection of services (cloud, online and offline) for each stage of the project. The respondents analysed these services advantages and disadvantages, performed a research on additional resources for work on the tasks. Besides, we analysed the services for the project management that fit for creating a website layout.

Students can easily use the current criteria to selecting services for their education and professional tasks solution. These tools provide the possibility of group interaction. The accessibility of software (free distribution), the flexibility of interface, cross-platform, multilingualism and integration with other services for most of the proposed tools are key advantages.

During the study, students used a collection of services and tools to work at different project stages. Each student, respectively, tested the services and provided a review of their usage. After that, we made a comparative analysis of the student and expert reviews for the appropriate services.

Students can use the created list of tools while working on real projects and during the learning experiment. It is also important that these services are well adapted for blended learning setting.

INTRODUCTION

Recent data from several studies and surveys prove that the implementation of project-based learning in the educational process is a socially logical step. The approach provides opportunities for increasing information technology and education interaction [1, p. 6].

The main goal of using project-based learning in the area of higher education is to form fundamental soft and professional skills and students' project thinking to use these methods in future professional activities. It is especially important during the initial phase of the project method studies for effective group learning environment

organisation. That is why participants in the educational process need to create a database of tools for every stage of the project.

During working on the problem of creating a list of the best services for group work and work on the project, students can choose their own base of tools for organisation of educational, scientifically and workspace. The list of services they are going to use in future courses and during the working at individual tasks from the companies in the educational university hub. The list of best practises almost repeated the list of services, which presented by specialists the field of Automation and ComputerIntegrated Technologies who use it for the educational process at their course and during organisation work ecosystem at the university.

As a part of the course "Computer Graphics and Web Design", the teacher offered a list of services for work on different project stages. Students chose services, whom they used during educational semester at different stages of the work. They analysed the advantages and disadvantages of these services. They also made their own list of tools for project activity. Through group discussion, we carried out the choice of the most useful service.

Students' project activities should promote the forming of creative skills and ability to ask questions, development of independence, activation of brain activity and teamwork skills, necessary for the future professional activity. The work on the problem is effectively solved by methods of brainstorming. The project-based learning encourages students to a constructive investigation.

Without information and communication technologies (ICT), we can use the project method, but it provides great advantages since it allows realising the opportunities for cooperation between teachers and students.

The organisation of project activities for the information and educational ecosystem of higher education provides opportunities for enhancing students' motivation, developing teaching possibilities and necessary competencies of students [2, p. 4].

The project-based technology follows the concepts of research-related articles on "project-based learning", "problem-based learning", "active learning", "design conception", "collaborative learning, "information technology education", and "design experiments", that conform to the criteria above [3]. The analysis of literary sources reported that professional problem-solving skills in information technology (IT) require an ability to reach a solution using data, whilst attempting to satisfy the clients' demands.

The growing pool of online materials represents another aspect of sustainability, as the experimental results are more persistently visible in comparison to the usually written paper protocols that vanish after correction by the supervisors. Online services for project management turn out to be suitable tools presenting the results of project activity and performing a human self-reflection. Students use these tools for working in groups, performing research, preparing and conducting an experiment, working on the interface of a new product or service.

The project and problem-solving methods contribute to students' independence in all spheres of life, provide for student's individualisation in the educational process and develop communication skills.

1. CONCEPT OF PROJECT-BASED LEARNING IN ENGINEERING

Project and problem tasks are closer to professional activities and therefore, take a longer period than other learning tools (they may extend over a semester, a week or a few weeks) [2, p. 11].

At the research stage, project participants (4 groups of students) discuss the tasks and begin to understand what they should get as a result. From this moment, it is important to realise all project stages, how much time it takes to implement, what are the target audience and the stakeholders [4].

At the planning and training stage, it is necessary to coordinate different task parts between the team participants, to agree on the best way to solve these tasks, to divide the responsibility areas between the participants. It is also necessary to draw up an action plan in accordance with the time management principles [5].

Communication is important at the project implementation stages. That is why the student projects' organisation is effective with the use of blended learning. This method involves continuous inclusion in work (using social networks or specialised services for online or offline exchange of ideas) [6].

During the project work, students can make the application of their knowledge, while during problem-based learning, they need to focus on the knowledge improvement. Time and resource management, as well as task and role differentiation, are extremely important in the education process. Self-education is stronger in project work, which is especially useful for engineer courses [7]. The projects are usually combined with traditional education methods within the same course. One person or small groups can carry out them [8]. The teachers in project-based learning are facilitators and advisers.

2. PROJECT METHOD TOOLS FOR WEB-DESIGN COURSE

Services are an important component of the project work, as they accompany all activities of the team members. That is why the proposed project "The Creating a Services List for the Project Activity" in the field of web design has provided a practical aspect for problem-solving.

The research objective is to analyse the designing stages and tools for creating the site's layout during the group work.

Methodological background of the research:

- conceptual analysis of available specialised scientific and technical literature;
- study and generalisation of tools, solutions and services for project implementation;
- using the methods of generalisation, comparison, selection.

During the work on the course materials, including practical tasks, the author of the course made a software list for using at every stage of the project realisation (see Fig. 1).

Tools for the Project Work:

1. Communication (Voice, Text).
2. Task Management (Team, Individual).
3. Requirements Management.

4. Storage of Project Artefacts (Documents, Tables, 3D Models, Wiki).

5. Drawing and Mind Mapping.

6. Designing Interfaces.

Students need to analyse services that provide project activity, solve project tasks and develop product outcomes. The experiment is implemented for a group of students from information technology speciality within the course "Computer Graphics and Web Design". Students can enhance the tools list with the services they use in their activities.

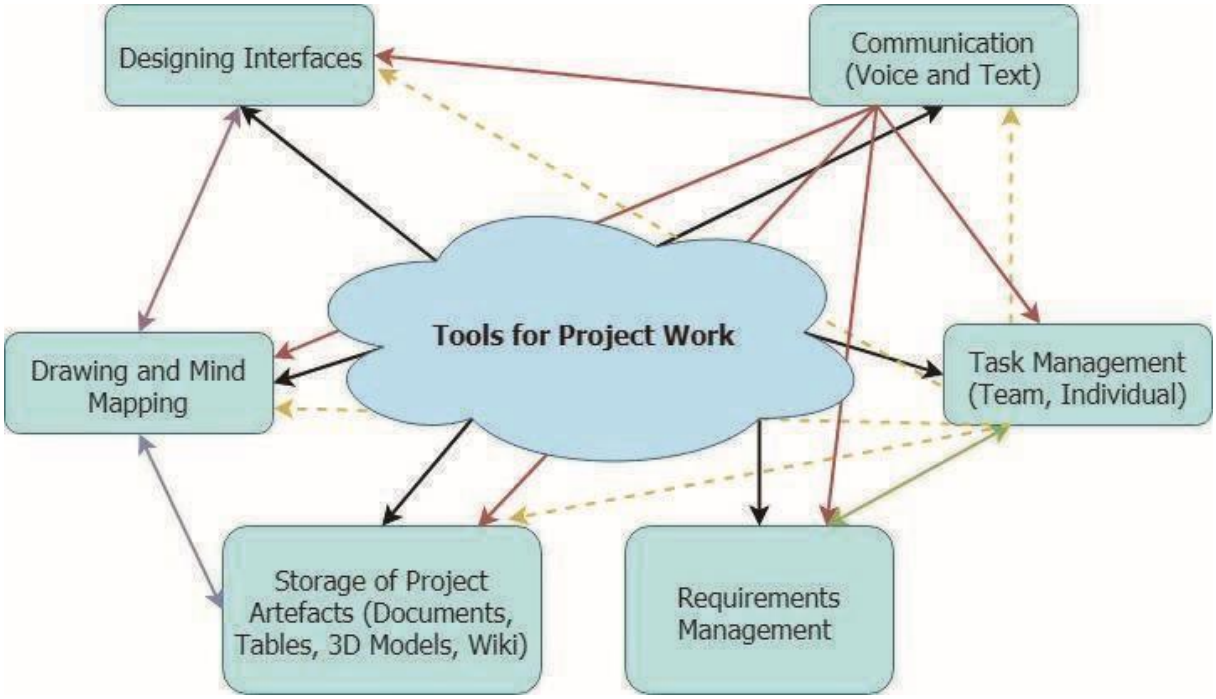

Fig. 1 Tools for Project Work

At the end of the project, students have to present a protocol at an online platform: make a presentation, video or infographics with describing the conducted experiment and the results.

Fig. 1 presents tools for project work. These tools have different connections. The black arrows indicate the number of instruments. The red arrows indicate on communications that provide the relationship. The yellow dashed arrows show the communication between management and other tools. Double arrows point to an inverse relationship between tools.

3. RESULTS

During February and March of the educational year 2018/19, students participated in the Command Project for the blended course “Computer Graphics and Web Design”. We have posted the course activities on the Google Classroom platform. The service provides support for blended learning. On the platform, students performed group assignments, worked on the project, exchanged experiences and presented reports. The course is accessible via the URL: https://classroom.google.com/c/Mjg3Njg4Mjg2NDJa. Class code: 27m520.

During the work at the project, each team developed a peer-reviewed report of the best services for communication between project participants, created a new list of the most suitable tools (see Table 1), and tested all services during the educational semester. They also made a survey of stakeholders from IT sphere, which helped in realising all stages of work on the project.

The real-time sessions in this course were designed with flexible structures to help the students to better engage in it. For instance, practice sessions, ground rules, and guidelines were presented prior to the meeting while scaffoldings and technical aids supported the students' discussion activity during the project. In addition, after each meeting, the students were required to write reports and a reflection paper that aimed to help the students' reflection on their performance.

Table 1. Comparative Analysis of Services for Communication

Services for Communication	Chat	Voice Messages	Computer and Mobile Version	Web-version	Possibility of Attaching Document	Video and Photo Message	Group Chat	Online Conference
Telegram	✓	✓	✓	✓	✓	✓	✓	X
Viber	✓	✓	✓	X	✓	✓	✓	✓
Messenger	✓	✓	✓	✓	✓	✓	X	X
WhatsApp	✓	✓	✓	✓	✓	✓	✓	X
Instagram	✓	✓	Just mobile	✓	X	✓	✓	✓
Slack	✓	✓	✓	✓	✓	X	✓	X

Analysis of services was rated the following criteria: free workspace for using, flexible interface, the possibility of group work, AGILE, the possibility of integration with other services, explicit instruction of using. The model ADDIE [9] was used for the analyses of each service and building an effective system for teamwork.

It has shown that it is best to use the *Trello* service to organise workspace (https://trello.com/). The students immediately organised the activities with the tool: they created a joint room for the team, distributed the task and monitored the progress.

They also noticed the *Basecamp* tool (https://basecamp.com/), project management service and team communication software. The tool provides the ability to communicate with the team, share documents, create to-do lists, assign tasks responsible for assignments, add comments etc. *Jira*

(https://en.atlassian.com/software/jira) is a complex and versatile system that allows bug tracking and agile project management.

For storage of artefacts *Google Drive* (https://drive.google.com) is the most suitable and flexible service. *Draw.io* (https://www.draw.io/) is a great service for drawing, building diagrams and models. The benefits of the service include integrating with Google Drive.

Most web designers use wireframing design techniques to create layouts. It is necessary to understand the structure of the site, its components and their placement. *NinjaMock* (https://ninjamock.com/) is the best tool for creating a layout. The process of creating a project framework for this service is fast enough. Users can easily share results with the client or with someone from the team.

The practice of group activities forms self-determination and responsibility for one's work and work of the team as a whole. Work on the project showed that teachers could use the following techniques for managing the project team:

1. Painting at the stage of project preparation to highlight the main criteria of service work.

2. Design thinking (empathy and definition) to show that it is necessary for the user of services: "Are there analogues of the proposed services?", "How to improve the existing list?".

3. Principle CDIO (Conceive Design Implement Operate) at the stage of goal setting. The system and project approach application to analyse the services technical component.

4. TRIZ for the project implementation. At this stage, students need to formulate the problem: Why do not the relevant services dispose of users to solve specific problems? Describe what resources we need to use the most effective services.

5. The human self-reflection. Its goal is to summarise results, main conclusions and suggest new problems, self-reflect (on the part of students and teacher). We can implement the human self-reflection with using conceptual tables, infographics or diagrams for representing the students' understanding of the functional features of the services to project work. The students expressed an impression of the work that they would like to change or do next time.

6. When students are working on a web page layout, it is important to do prototyping (creating a site prototype). In fact, this is a visual diagram of a page or its skeleton, which shows the logic between the functional blocks of the site and the script.

4. DISCUSSION

Introducing the project method for part of tasks during the course is a very successful way of organising educational activities. The method provides the teacher with the opportunity to use group tasks, create problem cases with the next effective solution by students [10]. These approaches ensure the development of creativity and critical thinking.

The work uses blended learning technology, which provides more opportunities for effective interaction between group members and tutors.

Blended learning model in Google Classroom helps students valued time flexibility; give more opportunities for the development of virtual teaming skills. The course organisation with the flipped-classroom model [11] for collaborative work in groups is helpful. Possibility of preparing to work in class before the lesson with online services show that teamwork is more important than independent work for their online learning. Students can choose the place where they can receive content online and control the study pace. In this case, they review professional and technical skills. The complementarity of everyone's skills is maximised in the collaboration.

Unlike traditional learning, with project learning, students can effectively design the project, managing its activities, making reports, and reflection. In this case, students have possibilities to develop research skills, can learn collaboration with stakeholders and team members. Project-based learning is focused on the students' knowledge and their experience, while classical education has based on the theoretical approach.

Within a variety of learning forms, a mix is made of online and offline, individual and group, synchronous and asynchronous activities. The range of types is provided to facilitate the learning process. Students perceive well clear course timelines, course notes, and easy to understand course descriptions were found to be helpful. According to the participants, the relatively tight deadlines and regular supervision under the guidance of competent tutor are determining factors for successful completion of the process.

However, the provided method has some disadvantages. Some students do not perceive the classroom climate as motivating or supportive. For example, computers and smartphones have diminished the students’ attention span and distracted them from developing the project. Some of them could not learn in their own way, because they have a low level of self-motivation.

Hence, we need to restructure the learning process and adjust their classroom material to accommodate such change, or else some parts of the tasks will appear tedious to students. The students also say that online communication is less personal. These results emphasise the importance of virtual individual and collaboration skills for the online learning effectiveness of students.

Proposed services for the organisation of project-based learning are effective in planning and providing group and individual activities, and presentation of product results.

We can analyse the problems for the project-based learning, the setting of the research objectives with using online services by collaborative working at the platform for online learning Google Classroom, through brainstorming, by using tools for graphical interpretation of information. Besides, to analyse the target audience of the project and to solve problems, students can create mindmaps or infographics, based on the results of the collection and structuring the information [2, p.8].

We can solve problems by using interactions in Slack, with Google Services. Teamwork, research planning can be organised using a variety of tools (such as Trello or Jira).

We assume that for most of the students, especially in the early stage of their studies, they may not have the skills of group and project work. That is why it is important to introduce the technology of blended learning in the educational process. Such an

approach will help to human self-reflection on face-to-face meetings and train methods for solving problems, developing critical thinking, group activities.

We can evaluate students at the course "Computer Graphics and Web Design" based on executed projects, presentation of the result of the project and human selfreflection. That is why the estimation of the project work is often more important to them. They can see how academic work can quickly connect to real issues and understand the benefits of flexibility the project-based learning.

Interviews with the students showed that especially the groups who had experience with tools for working on projects during their school time were quick in finding project ideas or even wanted to proceed with their former school projects.

We assume the key components needed to succeed in the project are:

1. Facilitator presence.
2. High level of IT tools knowledge.
3. Ability to ask questions.
4. Communicativeness.
5. Ability to independently choose a leader and follow his instructions.

5. CONCLUSION

The main aim of the research services for project-based learning is to introduce students to situations of real project research and they should be motivated for hard group working and engaged in solving difficult issues in Engineering field or IT.

Students can easily use the current criteria for selecting services to their education and for solving professional tasks. These tools provide the possibility of group interaction. The accessibility of software (free distribution), the flexibility of interface, cross-platform, multilingualism and integration with other services for most of the proposed tools are key advantages.

Students confirm the appropriateness of choosing the best services using the "Why?" Method [12, 13]. According to the method, the member of the project team needs to ask a colleague about the service and its features, starting with the question "Why?". In answer to the question, the respondent needs to justify why he chose the appropriate service for work.

The created list of services students can use during working on real projects and during a learning experiment. In completing their projects, students also refine their organisational and research skills, develop better communication with their peers and adults, and often work in their community, watching the positive impact of their work [14].

It turned out that this concept of organisation educational process is highly appreciated by the students. Especially students positively judge the flexibility in scheduling the time for the project work.

We believe that the concept of project-based learning in engineering studies together with transdisciplinary tools, for example, by blended learning elements such as online content or tools for brainstorming, is highly attractive and improve problem-solving research projects. Nevertheless, the project method should also allow the freedom of

a researcher to choose his questions, to design experiments and to schedule his time on his own.

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