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METHODS OF IMPLEMENTATION OF MODERN PEDAGOGICAL TECHNOLOGIES IN THE ORGANIZATION OF EDUCATIONAL PROCESSES FOR STUDENTS OF THE DIRECTION OF TECHNOLOGICAL EDUCATION IN UZBEKISTAN

Yusufkhodjayeva Firdavskhon Mukhtarovna
Kokand State Pedagogical institute, Uzbekistan
Khamdamova Venera Anvarovna
Kokand State Pedagogical institute, Uzbekistan

Abstract. The purpose of the research is to develop a technology for incorporating project work in undergraduate engineering student training. A pedagogical experiment was conducted in the regional universities of Russia, the Kyrgyz Republic, and Uzbekistan in 2018-2022 among second-, third- and fourth-year engineering students. 126 students and 14 educators took part in it. To achieve the research goal, the authors used project-based learning, the authors' technique for changing the content of the subject, and the questionnaire method. The authors designed the surveys in the Google forms service and processed the results with MS Excel. According to the experiment results, it can be argued that the successful implementation of project work in training is available through six techniques determined from the ratio of the time spent on face-to-face and independent study on the subject or learning and extracurricular activities. All the participants of the pedagogical experiment evaluated the techniques positively.

Keywords: technology, technological education, pedagogical technology, method, modern methodology.

Introduction

An essential component of undergraduate engineering student training is learning through vocational project activities, which is confirmed in the Federal State Educational Standards. There are Project Design and Implementation, Teamwork, and Leadership groups of competencies of general-purpose distinguished. The requirements of the standards are necessary to meet, so educators face the urgent task of naturally integrating project activities into their teaching methods. Many researchers believe that the Project-based learning model is worth it when it is integrated. However, universities are focused on developing student research skills more often than on professional or transferable competencies. As a result, there is a gap between what students learn at university and what they need at work. Project work helps to combine technological foundation and physical reality; it enriches and supports theoretical concept-based vision, and focuses more on real-world applications. Project-based learning uses an action-learning principle, that is learning by carrying out a certain action.

Grant notes that students become more autonomous in developing and presenting their academic achievements due to this teaching method. Tiantong and Siksen find out that Project- based learning improves students' creativity and psychomotor skills more. The paper defines a positive attitude of Electrical Engineering students towards knowledge development based on projects as a supplement to the classical teaching approaches. Habók and Nagy find out that the success of a project in learning depends on the number of classes for students and a good learning environment. The results of Chen and Yang's study show that PBL has a more positive impact on student academic performance than direct learning. Ricaurte and Viloria's study presents a Project- based learning methodology. The peculiarity of it is the training inclusion at different levels of Engineering Bachelor programs. It allows interaction between students from different semesters who cooperate in a common project. Kuppuswamy and Mhakure argue that the Engineering education design curriculum, based on Project-based learning, offers students an opportunity to experience engineering design as it is practiced and modeled in industry. Nair and Suryan's show successful experience of cooperation with government departments and local self-government institutions in implementing project activities in training. The article describes the way Project-based learning helps students acquire the technology and know-how through project development. Kłeczek, Hajdas, and Wrona propose changes of PBL project structure aimed at solving complicated problems of using various and minor projects instead of one large project task. The study reviews the relationship between the levels of knowledge accumulation by students in asynchronous online discussions and Project-based learning. The article presents the experience of integrating project activities to improve student scientific skills. Bakhru and Mehta develop a system of continual tasks, learning, and exams based on project work and used it in the Engineering Bachelor program.

The purpose of the research is to develop a technology for incorporating project work in undergraduate engineering training.

Materials and methods

The pedagogical experiment was carried out between 2, 3, 4- year Engineering students at Sholom- Aleichem Priamursky State University, Osh State University, Orenburg State University, Primorskaya State Academy of

Agriculture, and Tashkent University of Information Technologies named by Muhammad Al-Kharizmi in 2017-2021. 126 students and 14 educators took part in it all together.

The study used Project-based learning, the technology of changing the content of the course, and the survey method. The surveys were designed in Google forms, and the results were processed with MS Excel.

The authors maintain Krajcik and Blumenfeld's definition that Project-based learning (PBL) is a teaching method that involves students in knowledge development, making them carry out significant projects and develop real products. Such a process requires student cooperation to find solutions to actual problems in integrating, applying, and awareness promotion. In this context, educators act as facilitators, providing feedback and support to students to help them in learning.

The technology of changing the content of the course can be described in several arguments. When studying the course, it is necessary to perform a demo learning research project. A student is to take all the steps of scientific research. The vocational subjects of the curriculum should be supplemented with topics related to scientific research. It is necessary to contribute to student interest due to the points for completed tasks. The students are to participate in competitions for merit-based scholarships in academic science and applications for grants. The lecturers of the relevant department should create an atmosphere of student joint participation and promote interest in their scientific research.

Results and discussion

It is necessary to remodel both the teaching methodology and the subject content for the successful implementation of the research goal.

The authors can offer several technologies for integrating project work in Engineering training through academic courses such as 100% Independent Study Technology; 50+50 Technology; 30+70 Technology; 100% Technology; 100% External Technology; Hybrid Technology. They were tested by the authors and other lecturers of the corresponding departments who participated in the pedagogical experiment. The authors are going to reveal the ideas implemented in the proposed technologies in this paper.

100% Independent Study (Self-Study) Technology

All project activities were performed at the time set aside for independent learning of the subject. The educator is a mentor. The project customer was an external representative of the industrial partner. The technology was applied in the Network databases course. The task was to develop an online course. It was necessary to develop the content, tasks, and video content. Students were engaged in the subject in a regular way. The exam mark was given based on the results of the project presentation. As a result, an online course was developed, which was used by the customer when teaching universitystudents.

50+50 Technology

50 % of the classroom time was made for project activities. A lecturer could combine the parts of a mentor and a customer.

The 50+50 Technology was used in the Robotics course. The lecturer of the subject was a mentor and a customer. The project was aimed at developing a pack of laboratory works. The students were engaged in the classroom lessons 50% of the time. The exam assessment was made according to the results of the project presentation if minimum practice and laboratory work were performed. As a result of the project, six laboratory works were developed for the Robotics course. The presented project was used by the customer to apply it in the program for training personnel for the digital economy Digital Certificate.

30+70 Technology

30% of the classroom time was made for project activities. The lecturer was a mentor, and the project client was an external representative of the community concerned. 30% of the time was made on obtaining the minimum required knowledge and skills. 70% was made for the project implementation from the industrial partner.

30+70 Technology was used in the Project Management of Information Systems course. The time distribution was made as follows:

30% of the time was devoted to students' performance of several laboratory works. After that, they began implementing the educational training project Quadratic Equation Solver, in which they went through all the steps of designing, implementing, and presenting a software product.

70% of the time was given to students for a real task from an industrial partner with a deadline scheduled for the exam after the presentation of the educational project. The order was to design a website for the city Cossack society Tikhonkaya Station. In the classroom, the lecturer acted as a mentor and a tutor, who consulted, monitored and helped to arrange project activities.

The students chose a team leader and a public relation man in the team. The team leader guided the project to the Trello project management system and managed the teamwork. The part of the public relation man was to cover the teamwork in social media.

The project was presented in public at a special conference with the customer invited.

Students were recommended to take various free online courses to gain and consolidate theoretic knowledge. The following online courses were used Project Management Basis,IT-Project Management for the Project Management of Information systems course. To improve student project management skills, they were to play Web

Business Simulator Web Tycoon and reach level seven. It was necessary to conduct an independent study of the selected project management software environment and write a scientific article.

100% Technology

In fact, it is a modification of the 30+70 technology without 30. All classroom time allocated to the subject was devoted to the project. The theory was learned within an online course. The lecturer could combine the functions of a mentor and a customer.

The 100% Technology was applied to the Artificial Intelligence Technologies in Management course. Students implemented a project on the classification of information attacks on the Hyundai car controller.

100% External Technology

The 100% External Technology was used during the project-intensive courses. A project workshop is a project-based learning model developed for universities by the University 20.35. The main thing in it is the student work on real tasks from business and industries as a way to get the skills and competencies that are commercially successful. The educational model combines project activities, the transition to individual learning paths, and the design of a digital profile. The teams consisting of different year-students from different faculties work on projects, i.e. the problems from real companies and firms.

There was a typical team structure in the experiment: a team leader, a public relations specialist (an Advertisement or Journalist student), an IT specialist (a student who is good at IT), project executives, and a mentor. The students were engaged in the projects at the extracurricular time. After presenting the project in front of the customers, the university commission offered students bonus points from industrial partners and lecturers of the subjects.

The projects of industrial partners of various directions were implemented in the project workshop. Let the authors introduce some topics: The museum website of Smidovich settlement, A set of academic activities for the development of elementary mathematical concepts in the pre-school group of children, A set of multi-level problems and exercises for the correction and cognitive development of younger school children with special needs using information and communication technologies, Architectural and urban planning solution of the territory, Branded university products, Market research of packaging products.

Hybrid Technology

The Hybrid Technology allows one to combine freely the previous types. The educator can combine the functions of a mentor and a customer.

The Hybrid Technology is suitable for mathematical courses, for example, Function Theory of a Real Variable. An online course was designed as part of the project activity. The tutor-educator gives lectures in the classroom and provides more complete tasks within the project after studying the relevant section. The required number of hands-on is held during the entire period for the discussion of the project.

Lecturer survey findings

The survey has found that introducing project work in the course appears to be a rather complicated psychological problem for the majority of lecturers (72%). Educators feel dependent on the conventional education system. Students' lack of confidence in the mastery quality of the subject content might be emphasized. All the lecturers participating in the experiment (100%) commented on the positive influence of embedded project work on the teaching methodology and stated their willingness to continue using it.

Student survey findings

After presenting the project and receiving the report on the course, the students answered the questions using Google form privately to record the response of the project activity.

Here are the results. 92% of students assessed the introduction of project work positively. 94% of them answered 'yes' when they were asked about the positive impact of project activities on vocational competencies. 22% of students answered 'yes' to the question 'Would it be easier to pass the tests or the exam in the subject at an offline event?' 94% also responded positively to the question 'Does the project require independent learning of advanced technologies?' While doing the projectactivity, the students noted that they had improved their communication skills (88%), and they would continue to show the results of the project to employers (96%).

Discussion

The survey results show a positive impact on all the project participants, both educators, and students. From the point of view of educators, it tends to change the teaching methods, gives a field for further research with the students involved. To the students' minds, projects reveal their proficiency and develop their soft skills.

Conclusions

According to the results of the study, it can be argued that it is worth restructuring the teaching methods and the content of the course for the successful integration of project work.

The integration of project activities is available through several technologies with a variation in the ratio of the time made for face-to-face and independent work in the course, techniques of implementing in learning, and extracurricular activities.

All the participants of the pedagogical experiment express a positive attitude to the tested teaching methods of using project work in the course.

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