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# PROJECT-BASED LEARNING APPROACH TO THE FORMATION OF DIGITAL COMPETENCIES OF STUDENTS OF UNIVERSITIES IN RUSSIA AND INDIA

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## Abstract

Modern challenges in society require universities to move from a traditional to a competency-based technology integrated learning environment. Students must master a variety of newer complex competencies such as: learn to independently search for information, analyze it, and apply it to solve various real time problems through their content knowledge. One of the possible tools for developing these newer competencies is ICT integrated project-based learning (PBL). The present study conducts an ICT integrated practicum to the internationally paired undergraduate students of Indian and Russian universities. The practicum included a collaborative work towards a common theme. Findings of the study reveals that the outputs generated by ICT integrated PBL provided confidence to the participants to use technology tools in a global learning environment to solve real time problems. Study suggested requirements for project organization, technology tools, and a design to implement such projects. Further, it reveals how virtual teams work on a project in an online environment. Study recommends future researchers to focus on more such empirical studies and its efficacy.

**Keywords:** project-based learning, PBL, ICT-integrated project, online project method, international paired practicum.

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# ПРАКТИКО-ОРИЕНТИРОВАННЫЙ ПОДХОД К ФОРМИРОВАНИЮ ЦИФРОВЫХ КОМПЕТЕНЦИЙ СТУДЕНТОВ УНИВЕРСИТЕТОВ РОССИИ И ИНДИИ

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## Аннотация

Современные вызовы, стоящие перед обществом, требуют от университетов перехода от традиционной к интегрированной образовательной среде, основанной на компетентностных технологиях. Студентам необходимо овладеть рядом новых сложных компетенций, таких как: самостоятельный поиск информации, ее анализ и применение для решения различных проблем в реальном времени с помощью своих знаний. Одним из возможных инструментов для развития этих новых компетенций является интегрированное проектное обучение в области ИКТ. В исследовании приводится интегрированный практикум по ИКТ для студентов индийского и российского университетов. Практикум включал совместную работу над общей темой. Исследования показывают, что результаты, полученные с помощью внедрения проектной деятельности, вселили в участников уверенность в использовании технологических инструментов в глобальной среде обучения для решения проблем в режиме реального времени. Проанализированы требования к организации проекта, технологическим инструментам и дизайну для реализации проектной деятельности. Кроме того, представлены механизмы работы виртуальных команд над проектом в онлайн-среде, что позволяет повысить эффективность работы.

**Ключевые слова:** проектная деятельность, проект, интегрированный с ИКТ, метод онлайн-проектов, международный двухсторонний практикум.

## Для цитирования:

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## 1. Introduction

In the context of the orientation of education towards the intensive and innovative development of the country's economy, transformations in higher education must inevitably take place. It is necessary that we move away from the traditional approach, which focus on the transfer of knowledge, skills, and abilities from teacher to student, to a new, competency-based approach. This approach presupposes the formation of a complex personal resource in students [1], which provides the ability to interact effectively with the outside world in general and to effective professional activity in particular. In the course of such training, the student acquires the ability to solve life and professional tasks, fulfill social roles, and act in the best way in various situations.

The difference between the competence-based approach and the traditional approach as seen by B. Elkonin is, "We have abandoned not knowledge as a cultural subject, but a certain form of knowledge (knowledge "just in case", that is, information)" [2]. According to V. Bolotov and V. Serikov, the traditional approach to higher education differs from the competence-based approach in about the same way as "familiarity with the rules of the chess game from the very ability to play" [3]. In other words, the acquisition of knowledge as one of the most important tasks of the educational process remains, however, it turns from an end in itself into a means of forming a variety of competencies as a set of knowledge, abilities, skills, and ways of their practical application [1]. The student acquires the ability to independently find, analyze and apply the information he needs to solve specific problems [4].

## 2. Literature review

On the one hand, the competence-based approach implies the formation of a graduate based on the results of studying at a university who can solve a variety of problems in the field of his professional activity and related fields, including new problems, and effectively use non-standard methods of solution. On the other hand, the teacher must have a wide range of competencies that are required to develop such a graduate.

Universities in the world are changing from a teaching-centered approach to a learning-centered approach. It is important for academicians to have sufficient scientific data to use such methodologies to evaluate students and understand its usefulness and functionality. L. Combey and B. López found that, learning-centered approach sought students' commitment and active participation while using questions, simulations, cooperative work, practical activities, research project, portfolios, etc. The learning strategies of the students who participated in the educational intervention with the leaning-centered approach improved their learning than their peers,

who studied the same course by traditional methods. These results prove the validity of learning-centered methods and motivate teachers to choose learning-centered approach. Moreover, it is relatively easy to apply learning-centered methods in classrooms with ICT integration especially in project activities [5].

One of the possible tools for the implementation of learning-centered approaches is the design method. Gradually, the project-based learning method have crept into the general education system in educational institutions [6–8].

The research conducted by S. Bylkova et. al. on Tourism with project based learning opportunities in digital environment has not been sufficiently studied in the field of education. The implementation such projects into education may allows the use of IT technologies in learner-centered approaches. Thus expands the opportunities for students' in terms of their mobility and access to the educational process from anywhere in the world, nevertheless attracts intellectual, creative, and technical resources. Project-based learning in the digital environment has considerable prospects for students to gain professional skills, develop creative ideas, and introduce research methods into the business environment [9].

The essence of the ICT integrated project-based learning consists of the independent solution by students under the guidance of a teacher of a specific practical problem in the field of their future professional activities. In the course of solving the problem posed within the framework of the project, students develop or improve both theoretical knowledge and practical skills. This ensures the accelerated and effective formation of general cultural and professional competencies as expected by both Russian and Indian education. The main task of the projects is to improve the quality of education, bring its content in line with the realities of the market.

The main content of the project method remains unchanged: ensuring a significant increase in the various abilities of students and obtaining practical results for the real sector of the economy. According to I. Yurlovskaya, the project method is "an innovative teaching technique in which students acquire new skills in the process of step-by-step, independent (under the guidance of a teacher) planning, development, implementation and production of increasingly complex tasks, aspects of the problem, its micro-themes" [10].

Ch. Alink and H. Berg highlight the following key characteristics that a design method should have [11]; the key role of the project, openness of projects, the key role of students, variability, cooperation, interdisciplinarity, interactivity, realistic projects, the important role of mentors (leaders), etc. With these characteristics, the design method is capable of bringing significant results to the educational process. The effectiveness of its use has received wide recognition abroad and is confirmed by several studies. For example, at the University of Minho (Portugal),

for three years, a study of the impact of the project method on the students' abilities and the effectiveness of their learning was carried out. The results showed that, according to the students themselves, the use of the project method increases their role and the degree of participation in the educational process, and has a positive effect on its results [11]. M. Vitorino note that the project method helps to increase the responsibility, independence of students, teaches them to manage their knowledge [12].

Therefore, the present study aimed to understand the directions, mechanisms, and results of the application of IT technologies in project-based activities of undergraduate students from Indian and Russian Universities [9, 13].

### 3. Theoretical background

Technology acceptance model (TAM) guides the present study. It is an information system theory. A group of students comes together accepts and use the technologies available at hand to solve the problem given by their mentors. Students' attitude towards technology influences the group behavior and their collaborative work. When group plans to work with a technological tool, they face two factors informing their decision they are perceived usefulness and perceived ease-of-use (Davis, 1989). Thus, present study ICT integrated project based learning is guided by TAM.

### 4. Methodology

As the present study aims to understand the directions, mechanisms, and results of the application of IT technologies in project-based activities among

UG students of Russian and Indian University. Study employed exploratory research design. In which students work on a theme selected by the mentor teacher with technology acceptance model and project-based learning approach. Study selected a group of 10 students from each country under the supervision of a mentor teacher from respective country. Each student had a partner student from other country and each student can interact with any of the other 18 students. Table below presents the demographic details of the study participants.

### 5. Practicum procedure

As mentioned students are internationally paired and allowed to interact on the web-conferencing software. The teacher mentors from both the countries collaborated and came up with the problem themes of the project practicum based on real-life situation. The internally paired student groups were monitored and mentored for their progress from the mentors. Students worked on theme with technology tools and followed design method procedures.

The present study employed technology tools such as mind maps for developing the project design. In order to organize various project related work, study employed Jira Software, Asana or Trello. Communication among project participants, study employed various video-conferencing software such as Zoom, Skype, Google Meet, Cisco-Webex and for written communication they used Slack, Zulip, WhatsApp, and Telegram [14]. Digital technology has become a central aspect of higher education, inherently affecting all aspects of the student experience. It has also been linked to an increase in behavioral, affective and cognitive student engagement [15].

Table

Demographic details of the sample

Sl. No	Russia			India		
	Pseudonym	Gender	UG	Pseudonym	Gender	UG
1	R1	M	Computer Science	P1	F	BCA
2	R2	F	Computer Science	P2	M	BCA
3	R3	M	Computer Science	P3	F	BCA
4	R4	F	Computer Science	P4	M	BCA
5	R5	F	Computer Science	P5	F	BCA
6	R6	M	Computer Science	P6	F	BCA
7	R7	F	Computer Science	P7	M	BCA
8	R8	M	Computer Science	P8	F	BCA
9	R9	M	Computer Science	P9	M	BCA
10	R10	F	Computer Science	P10	M	BCA
	Mentor Teacher	M		Mentor Teacher	M	

## 6. Ethical clearance

The present study sought the approval of institutional review board of both Russian and Indian Universities. Study sought informed consent from each participants and the mentor teachers of this project practicum. Nevertheless, study used authentic licensed version of technology tools to execute the present practicum.

## 7. Results and Discussion

The present study adopted the principle of design method to conduct this ICT integrated project-based learning practicum. The project is conducted between internationally paired student groups of Russian and Indian Universities. The output of the project practicum are recorded to understand how the global learning environment works. Design method is a widely accepted project-based learning method across higher education institutions in the world. The study found this practicum method as the most suitable for the selected participants and to the selected real life based project problem.

Firstly, in the course of work on projects, students not only gained new knowledge but also largely independently learned to apply this knowledge in practice, find ways to solve problems, and assessed their feasibility and effectiveness. Secondly, teachers, being leaders and mentors of students, acquired additional experience of immersion into real time activities, built up their potentials, and increased the efficiency of its use. Thirdly, the results of students' project activities may help while writing scientific articles, preparing reports at conferences of various levels, performing work within the framework of grants, etc. Fourthly, it is possible for students, undergraduates (UG) to

carry out their final qualifying works in the form of startups [12].

Respective University mentors of this project agreed to the fact that, there is lot of deep learning and individual learning occurred among the students. The ICT enabled project-based teaching method is a promising way to learning-centered approach. For successful implementation, there is a need for proper planning and design. For the practical use of the project method in the educational process, in addition to understanding its essence, in our opinion, it is necessary to formulate the basic requirements for the organization of project activities of students at the university, as presented in Figure 1 [16].

These requirements outline the specific tasks of project activities that distinguish it from other forms of the educational process at the university. Working on projects involves solving a specific practical problem, which, on the one hand, solved based on the knowledge, skills, and abilities of students, on the other hand, requires additional efforts and involves the development of new abilities.

Like any other, the project method presupposes a certain sequence of stages of its implementation. Researchers put forward different points of view regarding the staging of the design method. I. Yurlovskaya believe that the technology of working on a project in an educational institution should include four stages as presented in Figure 2 [10].

It seems that, in principle, this scheme of work on a project in an educational institution is correct and may form a strong base. However, it is a general outline and needs to be supplemented and concretized. The key role in the selection of project topics belongs to the teachers of the departments qualified in the relevant field. Figure 3 presents the criteria for selecting project topics [16].

Requirements for the organization of project activities of students at the university	The task set within the framework of the project should not be of an abstract, purely theoretical nature
	This task should be feasible for students, taking into account the level of knowledge, skills and abilities
	The solution of the problem should require additional efforts so that students not only use the already existing store of knowledge, abilities and
	Project activities should be carried out by a team of students.
	Work on projects should not take place in the classroom form of lectures and seminars, otherwise the line between project learning and the traditional
	Mentoring should be carried out using innovative methods of active learning, effective independent work of students in order to teach the student to independently search, analyze information, develop practical recommendations on a particular problem

Fig. 1. Requirements for the organization of project activities of students at the university



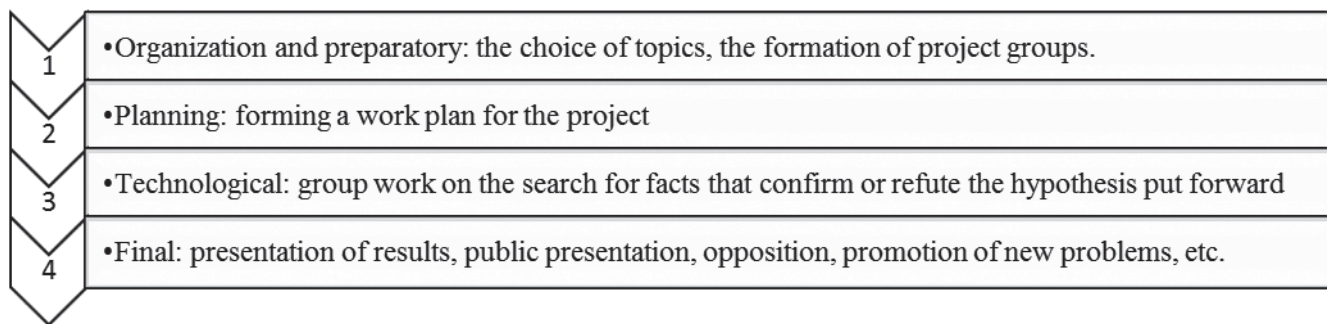


Fig. 2. Stages of work on a project in an educational institution

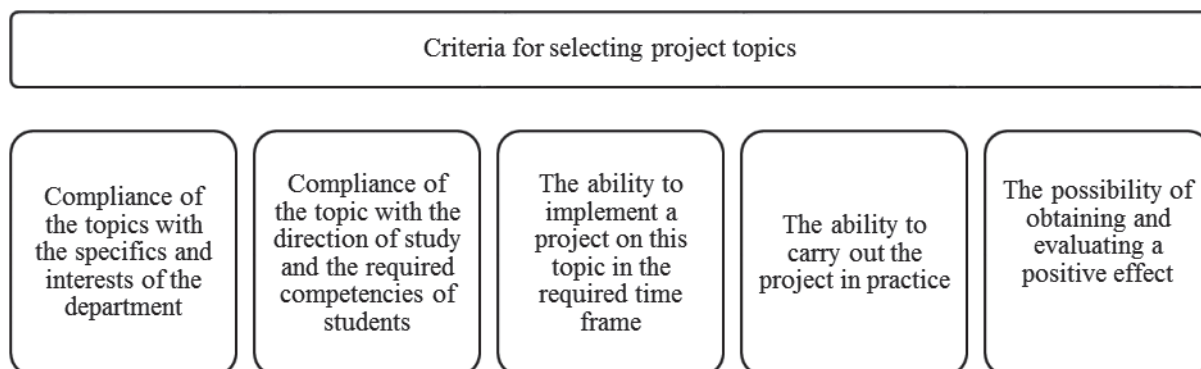


Fig. 3. Criteria for the selection of project topics

The second stage of work on projects at the university should be the selection of mentors and project participants, that is, the formation of project teams. If at the previous stage the project was already nominated by a certain teacher or group of students, then the topic was agreed at all levels and approved, the corresponding part of the second stage can be skipped. The formation of groups should not be carried out mechanically, just as in most cases the usual study groups of students are formed today. Project teams need to be created based on specific criteria presented in Figure 4.

The listed criteria are designed to ensure the formation of groups whose members are most interested

in the implementation of projects on time and in achieving the required results. When implementing projects, it is important to organize teamwork. A team is a group that works together to achieve the results that each person in the group aspires to. The team's potential is much higher than the potential of a group or individual efforts (the law of synergy) [17, 18]. Thus, a team is a union of like-minded people; a group of people rallied around a leader, around a common goal and common values. Project teamwork meets the requirements of digital education and contributes to successful professional self-realization of university graduates if it is well designed, accurately planned, and monitored by the educator to the extent necessary [19].

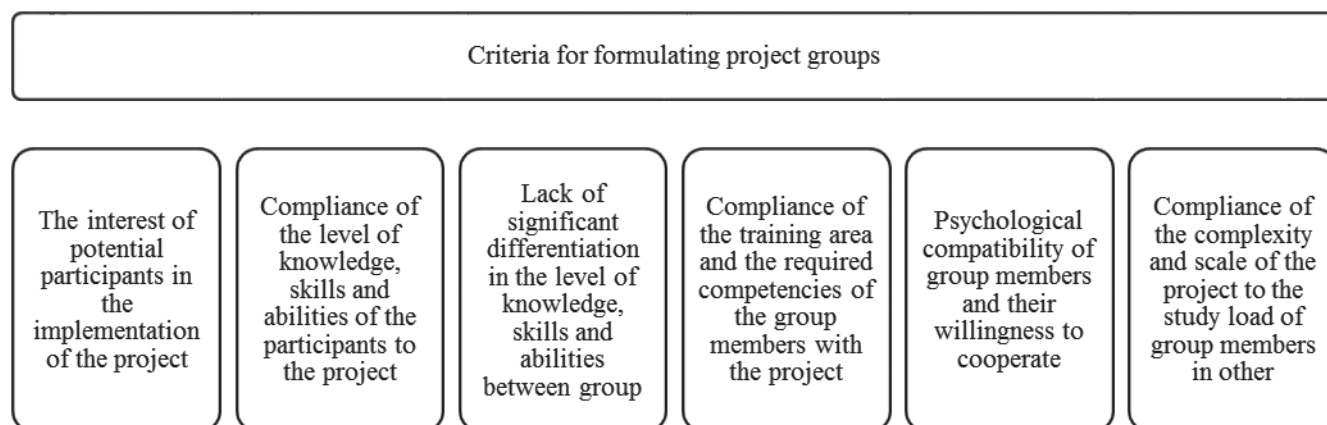


Fig. 4. Criteria for the formation of project teams

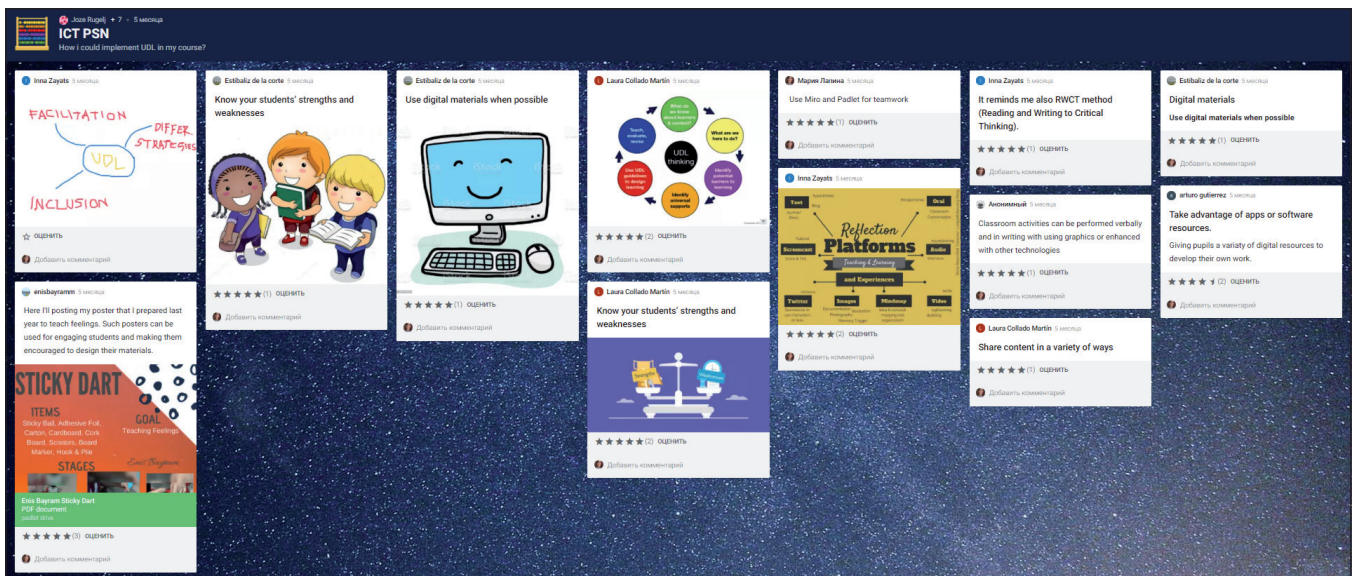


Fig. 5. Padlet — IT Technologies in Education

## 8. Field test results

Virtual teams have a lot in common with traditional teams, and above all, it is the presence of a common goal that team members achieve jointly, sharing responsibility on the way to achieving the result. It should be noted that researchers use a variety of terms such as “distributed”, “remote” or “dispersed” teams. The term “distributed” teams came to management or education

from information technology, or to be more precise, technological systems [20–25]. It is most correct to use the wording “virtual teams”, because this form does not exclude the activities of teams, whose members are within walking distance, but for one reason or another, they use ICT in the activities of the team.

The present study examined how digital technology integration contributes to the enhancement of students’ academic performance through project-based learning

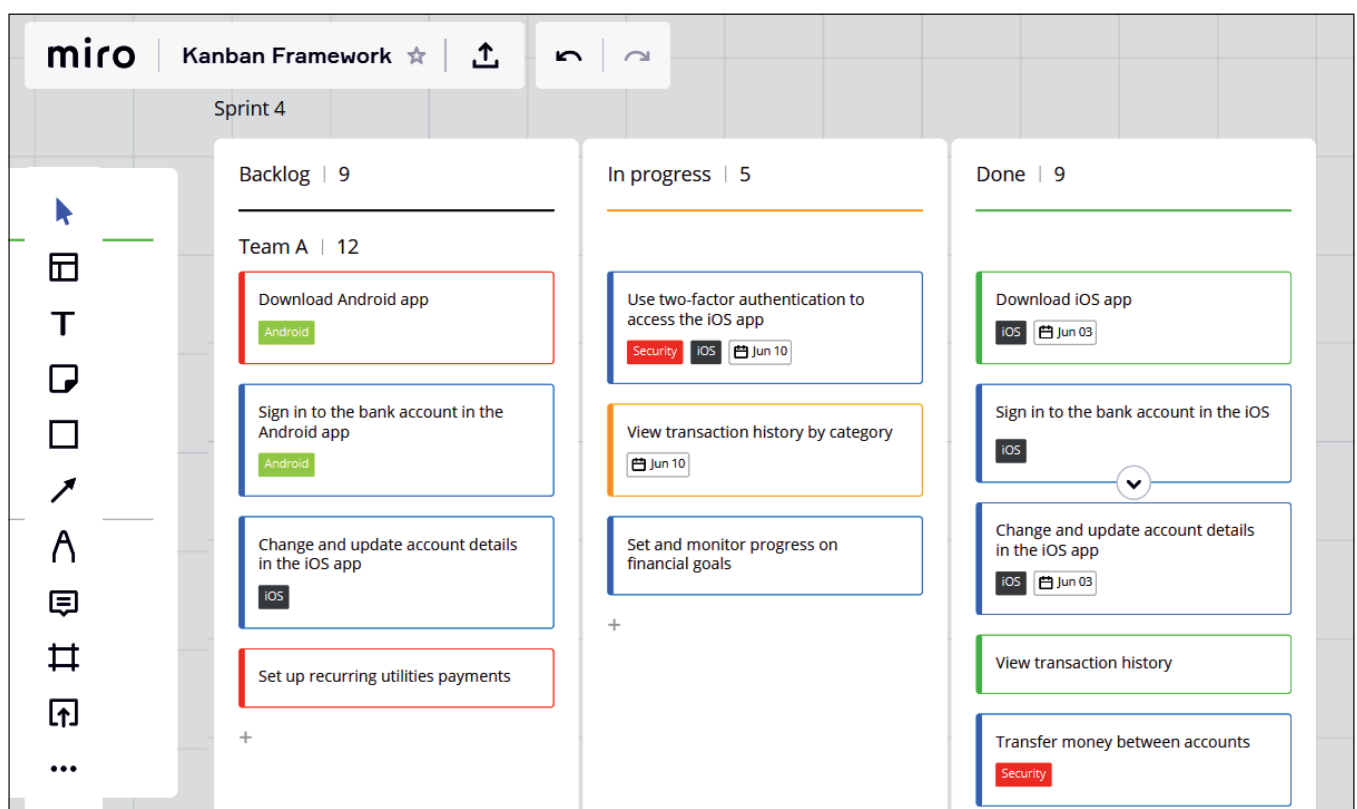


Fig. 6. Miro — Kanban Framework

(PBL) amongst undergraduates in higher education. In this study, the technology acceptance model (TAM) was used as the basic model to explore the digital technology environment in terms of the perceived usefulness, perceived ease of use and attitude towards integrating digital technology and the influence of these factors on undergraduates' learning engagement and academic performance within PBL [26, 27].

## 9. Technologies integrated for effective teamwork

Padlet is an intuitive, convenient, and multifunctional service for storing, organizing, and collaborating with various materials [28].

Miro — virtual whiteboard, distributed team collaboration platform [29] (Fig. 6).

Trello — online project management system.

Collaboration system with Google documents.

As a practical implementation, students were asked to work on the project-based practicum using IT technologies in an online global learning environment. Below are examples of project implementation outputs.

## 10. Conclusion

The article considers the technology of organizing the practical implementation of the project method with a internationally paired teamwork. The requirements for the organization of students' project activities have been substantiated, the stages of work on projects in universities have been clarified. The principles and criteria for the selection of project topics are presented. Criteria for the formation of project teams and methods by which it is possible to assess the compliance of potential group members with these criteria have been developed. The requirements for potential mentors of student project groups are also substantiated. The features of teamwork on a project using IT technologies are given. The principles of organizing virtual teams for working in an online environment are considered. As an example, projects implemented by students with the use of IT technology in teamwork online are presented. When working online, the efficiency of interaction between team members increases, the involvement in work, technological solutions allows better tracking of joint work. The study provided opportunities for students develop the confidence in a global learning environment to solve real time problems using IT integrated project-based learning.

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