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Problems and ways of improving project-oriented learning in Ukraine

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ABSTRACT

Project-based learning is a student-centered learning process that provides opportunities to explore and combine theory and practice. This study aims to examine student responses after their participation in project-based learning and identify the skills that students have improved after completing the project-based learning process, using its 4 stages. An experimental verification of the possibilities of applying project-based learning for students to acquire project competencies through the development and implementation of their own projects was conducted. A total of 70 students who studied at the faculties of management under the educational program "Project Management" participated in the study. The results showed a positive reaction of students to their experience of participating in project-based learning, which combines elements of theory and practice. In addition, the results of this study showed that project-oriented learning has a positive impact on the development of behavioral competencies of students and their further professional orientation. Students responded that thanks to project-based learning they have improved their thinking skills, problem-solving skills, gained a sense of self-realization, as well as teamwork skills. The work has further developed the iterative learning method by applying it to assess professional competencies in project management in different ways of learning: on personal experience, the experience of other lecturers and students, or combined learning in the first and second way. The proposed mathematical method for calculating the time for students to acquire project management competencies allows you to calculate whether a graduate, if included in a group, will have time to master the reference set of professional competencies, as those that are laid down in the educational program. The scientific novelty of the study lies in the application of project-based learning for students to acquire project competencies. The results of the study are confirmed during the experimental verification of the impact of project-based learning on students during the development and implementation of their own projects. The practical value of the study lies in helping educators to improve the quality of education. The study showed that project-based learning is an effective method for students to acquire project competencies. The article may be of interest to educational workers, scientists, and practitioners in project management.

Keywords: Project-based learning; iterative learning; project competencies; educational process; project management; project managers

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INTRODUCTION

The modern educational paradigm is aimed at becoming a person with high intellectual potential, able to learn and work in conditions of constant dynamic changes in the information space. This is especially evident in the crisis caused by the Covid-19 pandemic.

The success of adaptation to a changing environment increasingly depends on the competencies of individuals who have to make decisions in difficult conditions of uncertainty [1].

In the process of implementing student-centered learning, project technologies are very effective, which provide not only students' mastery of project methodology, but also the ability to apply the acquired knowledge in solving various problems of the state.

Project-based learning (PBL) allows to most fully combine academic knowledge with their practical application, as well as to develop leadership qualities of future managers.

The technology of PBL differs primarily in providing students with vocational guidance through the implementation of students' own projects.

In addition, the practical application of project management methodology, as practice shows, serves as a tool for human self-development throughout the management of their own project.

The dynamic development of new information technologies, which has been observed recently, necessitates the provision of the future project manager not only quality professional education, but also to develop the ability to quickly update and supplement the acquired knowledge of information and communication technology (ICT) [2].

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Widespread use of ICT opportunities in the educational process has led to the emergence of new components in the education system, which opens wide possibilities for improving the educational process. The most important components are the using of distance learning courses, the formation of virtual communities of practitioners, the using of cloud technologies for collaboration and much more. Digital transformation of education is an open way to attract a set of opportunities and change a number of processes, models and much more in order to use the capabilities of digital technologies in an integrated way.

1. ANALYSIS OF LITERARY DATA

Work on the project can become an important component of the educational process aimed at developing skills to work in the information space, professional development, focused on the systematization of professional competencies [3]. The issue of using PBL is reflected primarily in many works of foreign and domestic scientists. Today, design technologies have become widely used in colleges and universities in Europe and the United States. Proper using of creative projects in teaching is suggested by domestic researchers S. Bushuyev, N. Bushuyeva, V. Rach, V. Chumachenko, S. Chernov, R. Yaroshenko and others. In particular, a significant part of youth seeks to obtain higher education, perceiving it as an important factor in life success [4].

However, from the perspective of constant change, the impact of PBL on promoting the development of specific professional competencies remains an area that requires further research.

Much attention of researchers (D. Bushuyev, S. Bushuyev, R. Yaroshenko, etc.) in the field of PBL is paid to the international requirements for the competencies of specialists in the field of project management “International competence baseline” (ICB), which is a qualification standard of the International project management association (IPMA) [5]. For IPMA-forming national organizations, the ICB model is the basis for the international four-level certification (4-L-C) of professional project managers under the IPMA system. The fourth version of the ICB 4.0 contains the “eye” model (Fig. 1) of the description for the IPMA four-level certification system in the form of 29 elements of professional competence [5].

These elements are divided into three groups:

- People: behavioral competencies are 10 elements related to the personal relationships of individuals and groups in project management activities;

- Practice: technical competencies are 14 elements related to the content of project management activities;

- Perspective: contextual competencies are 5 elements that determine the interaction of project management activities and the project environment for development “through projects”.

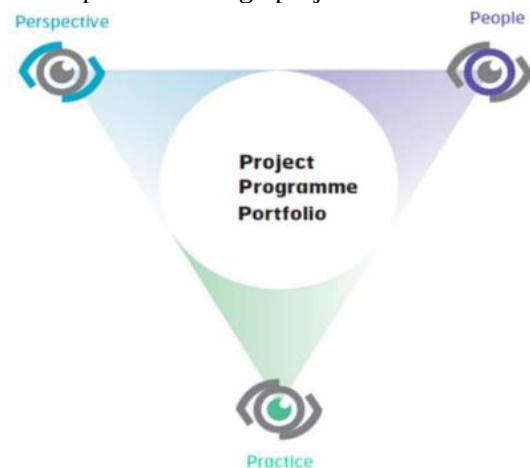


Fig. 1. The eye of competence from fourth version of the International competence baseline

Source: compiled by the [5]

A number of authors note that “the application of the competency approach in the management of innovative projects is associated with an understanding of the levels of necessary competencies of project managers, project teams and organizations” [6]. Some researchers note that “modern creative technologies allow in a turbulent environment [7] and a high level of uncertainty to manage the creative and cognitive potential of management teams and build strategies for projects and development programs to achieve this goal” [8, 9].

According to employers’ estimates, there is currently a mismatch between project management educational programs offered by educational institutions and the necessary competencies established by globally recognized organizations that promote professional project management, such as the Project management institute (PMI), the Australian institute of project management (AIPM), IPMA, and the Association for project management (APM) [6].

The current lack of research on project managers’ career development is problematic both from a project management perspective and from a competency development perspective. Project managers who lack the proper set of knowledge put the success of their projects at risk. The lack of research on forming project managers’ competencies

is an obstacle to understanding both project management and career development.

These psychological and pedagogical studies claim that after passive participation in the learning process, the acquired knowledge is quickly forgotten. It is estimated that after a prepared and well-structured lecture, the attentive listener is able to reproduce 70 % of the information in three hours, and only 10 % in three follow days [10].

The organization of team project work within one discipline is considered in many scientific works [11]. Project development and implementation is not limited to the study of one project methodology. When developing projects, most of the tasks are aimed at forming the behavioral competencies of students. At the same time, teachers provide only consulting support, placing the responsibility for project results on the project team.

An interdisciplinary approach is considered necessary to address the challenges of the modern world in conditions of uncertainty. Project managers are increasingly faced with challenges that require professional management of stakeholders, the ability of employees to constantly support the development of organizations and their products [12]. This means that the need for “soft” skills for project activities is constantly growing. Therefore, in the process of training future project managers it is necessary to develop students' leadership skills, the ability to boldly solve complex interdisciplinary problems and apply the skills of teamwork on projects.

Therefore, we propose to develop the competencies of project managers throughout the solving complex problems by projects in the uncertainty that characterizes the modern environment. The skill sets needed to succeed in the modern workplace have changed dramatically over the past few years. Today's global marketplace and dynamic environment require project managers to have “soft skills” in addition to technical skills. The role of the project manager has changed from a simple project administrator to a significant managerial creative position engaged in the practical implementation of the organization's strategy [13].

In a competitive market, the discovery and development of managers' talents is the main driver for organizational success. Demographic, economic and social changes are influencing the fact that talent management has become one of the most important topics in today's educational institutions. Nowadays, more and more business owners are beginning to realize that talent is a major competitive advantage and a key factor in the success of organizations [14]. In modern Ukraine, it has become clear that the

management and implementation of talented students is closely linked in the project management. PBL is a tool for attracting natural talents and providing employees with opportunities for their development through planning skills and experience in applying basic project tools [15]. Thus, project management serves to support talented students. Project management can be useful in providing students with an understanding of their capabilities and creating an enabling environment that allows them to learn, support and innovate.

2. THE PURPOSE AND OBJECTIVES OF THE RESEARCH

The purpose of this work is to study the possibilities of joint application of PBL for students to acquire project competencies through the development and implementation of their own projects.

The research tasks are to conduct an experimental verification of the impact of PBL on students and the impact on their acquisition of project competencies during the development and implementation of their own projects.

3. RESEARCH METHODS

In order to study the change in behavioral competencies previously defined by the elements of ICB 4.0, an empirical study was conducted among future project managers. First, a qualitative study was conducted, which aimed to understand the competencies required for the implementation of a master's project in any field of the student's choice. For the above purpose, in 2021, in-depth interviews were conducted with 2 groups of project managers with a total number of 70 students.

In general, a sample of 70 people is sufficient for most studies, but for some studies, a larger sample may be required. In this study, the sample of 70 people is similar in terms of selection criteria and therefore not diverse. The participants in the experiment were students who were studying in a master's program in project management. Of course the larger the sample, the higher the probability that it will be representative of the population.

The study was conducted in accordance with all methodological requirements. A sample of 70 people is not fully representative to generalize the results of the study to the entire field of research, and the obtained results of the study are relevant to the population. In particular, increasing the number of participants in the experiment is a perspective for further research.

As part of the quantitative study, a procedure for ranking the behavioral competencies of project

managers was developed, as well as conclusions about the importance of each of the characteristics of the sample. The questionnaire, which was developed for the conducting an empirical study, consisted of sixty questions related to the research problem, as well as additional questions related to the training of respondents.

Most of the questions referred to different project competencies, which respondents were asked to rate from 1 to 10 (1 is the most important competence, 10 is the least important). Competencies have been adapted from IPMA's list of competencies and include: leadership, motivation, self-control, assertiveness, relaxation, openness, creativity, results orientation, efficiency, consultation, negotiation, conflict and crisis, reliability, values orientation and ethics.

4. RESEARCH RESULTS

Project development and implementation is not limited to the study of one project methodology. When developing projects, most tasks are aimed at forming the behavioral competencies of students.

At the same time, teachers provide only consulting support, placing the responsibility for the results of the project on the project teams of students.

In this case, there is learning (English learning) [16], which means the process and result of acquiring individual experience and relatively constant changes in behavior that occur as a result of practice.

Learning knowledge and skills in project management will be understood as the process and result of changing student behavior, aimed at forming a set of values and competencies that contribute to the mastery of professional needs, fulfillment of their purpose and requirements for the project specialist.

Behavioral learning competence in project management in general is the formation of behavioral skills in the student, which is fully consistent with iterative learning [17]. Iterative learning with constancy, both external conditions and goals characterize the learning curves.

Learning curves are graphs of the level of learning over time or the number of repetitions used to quantify learning. Quantitative experimental data indicate that the most important general pattern of iterative learning is the slow-asymptotic nature of these curves [17].

The student can learn competencies in project management in different ways: on their own experience, the experience of other teachers and

students or in combined learning in the first and second way (Fig. 2).

During the educational process and the learning process, a natural question arises: “Will the student have time to master professional competencies in order to perform the functions assigned to him in the future project, or is it necessary to allocate additional resources?”.

The answer to this question will allow you to reasonably decide whether the educational program meets the needs of employers or not.

First of all, it is necessary to determine and then plan the number of hours that can later be used for teaching and learning and their proportions in the educational program. But, as you know, in the curriculum time is limited.

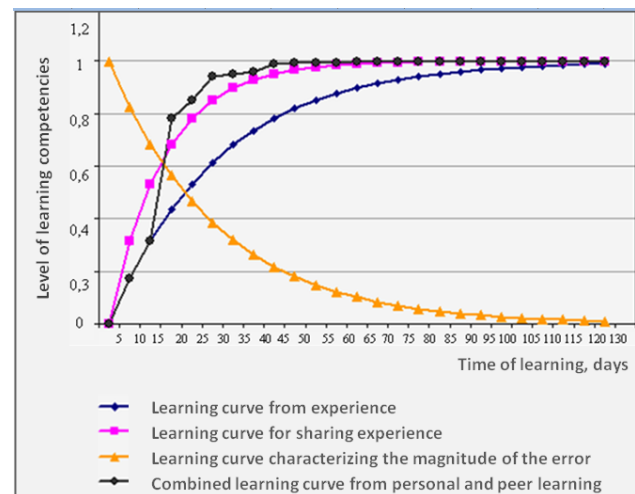


Fig. 2. Learning curves

Source: compiled by the [17]

The maximum time that can be allocated for training, called the reserve ($\tau_{reserve}$). Reserve time is determined for a specific educational process of the educational establishment, taking into account its specifics, for example, the curriculum.

In general, the exponential learning curve, provided that each student learns only from their own experience (Fig. 2), is described by the dependence [17, p. 10]:

$$x(\tau)_{own} = x_{max} + (x_{initial} - x_{max}) \cdot e^{-\gamma \cdot \tau}, \quad \tau \geq 0, \quad (1)$$

$$x_{max} \geq x_{initial},$$

$$x_{l_own} = x_{max} + (x_{initial} - x_{max}) \cdot e^{-\gamma \cdot l}, \quad (2)$$

$$l = 0, 1, 2, \dots, l^*,$$

where $x(\tau)_{own}$ is the type of function that demonstrates the acquired level of competencies of

students in the learning process at a time τ in their own experience, the value is dimensionless; x_{l_own} is the type of function that shows the acquired level of competence of the student at iterate l learning on their own experience, the value is dimensionless; x_{l_own} is serial number of the iteration from the beginning of training; $x_{initial} \geq 0$ is the initial value of the function which is characterized by some initial level of belonging to the professional competencies of the student before learning; $x_{initial}$ corresponds to the score of the entrance professional exam, the value is dimensionless; x_{max} is the maximum value of belonging to professional competencies in project management of students ($x_{max} \rightarrow 1$ and describes the limit of learning competencies in project management, as a set of competencies that characterizes 100% mastery of the educational program), the value is dimensionless; γ is learning speed, some non-negative constant that determines the rate of change of the learning curve (γ has the inverse dimension of time or number of iterations); τ is learning time.

The learning curve on the student's own experience is a monotonically increasing function.

However, if we are talking about the magnitude of the error that occurs in the learning process of students, caused by insufficient knowledge of competencies (hereinafter simply “errors”) in learning from personal experience (and in other ways of learning), it decreases monotonically (Fig. 2).

The magnitude of the error in the learning process on their own experience is determined by the formula [17]:

$$x(\tau)_{error_own} = x_{max_error} + (x_{initial_error} - x_{max_error}) \cdot e^{-\gamma \cdot \tau}, \quad (3)$$

under $x_{initial_error} \succ x_{max_error}$,

where $x(\tau)_{error_own}$ is the type of function that shows the level of error of the student at the time of learning τ competencies in their own experience, the value is dimensionless; $x_{initial_error} \geq 0$ is the initial level of student error before learning the competencies of the educational program, the value is dimensionless; x_{max_error} is the final level of error of the student ($x_{max_error} \rightarrow 0$), the value is dimensionless.

From formula (1) we obtain the dependence for determining the learning time τ only on our own experience:

$$\tau = \frac{1}{\gamma} \cdot \ln \left| \frac{(x_{initial} - x_{max})}{x(\tau)_{own} - x_{max}} \right|, \text{ [days]}, \quad (4)$$

In the process of mastering the educational program by students, there is also learning by sharing experiences. Students and teachers, observing each other's activities (as successes and difficulties) also gain experience. The “transmitter of experience” can be the teacher and those students who are the most bearers of competencies in project management, for example, such students who are already working on projects and are practicing project managers.

In order to reflect this effect, we will describe the “experience” gained by the student, not only as the sum of his own actions, but also the actions of other students and teachers [17].

The exponential learning curve only in the exchange of experience after a series of mathematical transformations of the formula presented in the publication [17] and bringing it to the form of formula (1) has the form (see Fig. 2):

$$x(\tau)_{exp} = x_{max} + (x_{initial} - x_{max}) \cdot e^{-\gamma \cdot \sum_{i=1}^N \xi_{iz} \cdot \tau}, \quad (5)$$

where $x(\tau)_{exp}$ is the type of function shows the acquired most desirable level of competencies at the time of learning τ only when exchanging experience (the reference is 100 % mastery of competencies in project management defined in the educational program) at the time of learning only when exchanging experience, the value is dimensionless; $\{\xi_{iz} \geq 1\}$ is constants that determine the effectiveness of the transfer of experience from the z -th participant of the learning process to the i -th; $i, z \in N$; N is composition of the student group. The method of determination is described in [17].

It follows that the learning time τ only on the experience of other participants in the learning process is equal to:

$$\tau = \frac{1}{\gamma \cdot \sum_{i=1}^N \xi_{iz}} \cdot \ln \left| \frac{(x_{initial} - x_{max})}{x(\tau)_{exp} - x_{max}} \right|, \text{ [days]}, \quad (6)$$

The curve of combined learning (see Fig. 2) is described by a discrete sequence of learning from personal experience and learning from the experience of other participants in the educational process:

$$x(\tau)_{comb} = \sum_{l_1} \left(x_{max} - \left(x_{initial_l_1} - x_{max} \right) \cdot e^{-\gamma \cdot \tau_{l_1}} \right) + \sum_{l_2} \left(x_{max} - \left(x_{initial_l_2} - x_{max} \right) \cdot e^{-\gamma \cdot \sum_{i=1}^N \xi_{iz} \cdot \tau_{l_2}} \right), \quad (7)$$

where $l_1 = 1, 3, 5, 7, \dots, l_1^*$; $l_2 = 2, 4, 6, \dots, l_2^*$; $x(\tau)_{comb}$ is the type of function that shows the acquired level of competence in project management in combined learning on their own experience and the experience of other participants in the educational process on iterations l_1 , l_2 , the value is dimensionless. Combined learning occurs when alternating iterations of learning on their own experience (l_1) and on the experience of other students (l_2) or vice versa; $x_{initial_l_1}$, $x_{initial_l_2}$ is the initial level of acquisition of competencies in project management before the beginning of the iteration, corresponds to the initial level of professional competencies in project management, if the training did not take place or the final level of learning in the previous iteration of another type of training; τ_{l_1} , τ_{l_2} is the duration of the iteration of learning, respectively, when learning from their own experience and the experience of other participants in the educational process (classmates, teachers) in combined learning.

The blended learning curve has a different stepwise form depending on the number and time of each iteration. For example, the duration of each iteration may be equal to the duration of the semester.

The time of combined training can be determined graphically by the required level of training according to needs $x(\tau)_{comb}$. “Level of learning” $x(\tau)_{comb}$ sets the educational program, curriculum, requirements for the preparation of the master's thesis, as a sufficient threshold for training for the professional activities of the project manager. For example, the university may decide that in order to perform the functions of a project manager, it is sufficient for the graduate to master the competencies at a sufficient level on a national scale of at least 60 points in each discipline of the curriculum, or on the ECTS scale – “E”, i.e. $x(\tau)_{comb} = 0,6$.

The learning time determined by formulas (4), (6), (7) for each specific student should be less than the reserve time. Otherwise, the student will not be

able to master the necessary competencies and, thus, will not fulfil the curriculum ($\tau_{reserve} \geq \tau_{own}, \tau_{exp}, \tau_{comb}$). The speed of learning γ is usually considered only qualitatively. However, let's try to quantify it, based on the following considerations.

Speed, as we know, is determined by a simple formula $v = \frac{s}{\tau}$, where s is the distance travelled, and τ is time.

For our case, we will take the “learned” competencies in project management from the initial to the mastered level by the student $x(\tau)$ (when learning one of the three above methods, $x(\tau)_{own}$, $x(\tau)_{exp}$, $x(\tau)_{comb}$), namely, $x(\tau) - x_{initial}$ and τ is the time of learning.

Thus, the speed of learning will be equal to the difference between the mastered and the initial levels of competence, divided by the time of learning:

$$\gamma = \frac{x(\tau) - x_{initial}}{\tau}, [1/\text{day}], \quad (8)$$

It is difficult to determine the speed of learning γ for each applicant with different methods of learning, but it is possible according to the statistics of his previous learning. However, the use of the average value is of interest and greatly simplifies the calculation process.

The average learning speed (γ_{aver}) is calculated by the formula:

$$\gamma_{aver} = \frac{x(\tau)_{aver} - x_{initial_aver}}{\tau_{aver}}, [1/\text{day}], \quad (9)$$

The experts determine students “learning” of project management professional competencies $x(\tau)_{aver} - x_{initial_aver}$ and the average learning time τ_{aver} .

The learning curves from the content point of view are explained as follows: at the initial stage of the educational process, students easily gain experience, learning is fast and the level of errors is rapidly reduced. Subsequently, students learn project management competencies, and learning is slow.

Criteria for project success, which are traditionally highlighted by the authors in project management [18, 19] have some differences. According to the results of the comparative analysis, all the authors, to whom the above references are given, unanimously indicated a consistent focus on the result and quality of the project product as a

condition for the success of the project. Close requirements include “compliance with the budget and deadlines” [20, 21] and “satisfaction of all stakeholders” [22].

For future project managers, it is important, first of all, to correctly determine their propensity for a particular area of project activity. In this regard, it is recommended to pay considerable attention to the choice of the topic of the future master's thesis of the student [23, 24]. Because the first project always affects the professional life of its developer and determines his future career growth.

The teacher's role is to help students understand their inner calling by asking the right questions.

Here, the teacher should be a coach who is willing to listen carefully and understand, rather than demanding answers and scaring with bad grades.

Analyzing the formation of professional competencies of future project managers we may say that all researchers identify in the structure of professional competence technical tools that involve the acquisition of relevant professionally relevant knowledge and skills [25]. However, the lack of behavioral competencies hinders the development of human potential.

Because education is a powerful way to create a socio-cultural face of man as his personality [26, 27]. However, in order for learning with interactive methods not to turn into ineffective entertainment, precise planning and evaluation of results is needed. In the case of a one-time interactive assessment, the assessment can be limited to questionnaires and analysis of the results, but in the case of assessment of the entire discipline assessment will consist of current control, assessment of individual student work and final control.

4. EXPERIMENT AND RESULTS

To achieve this goal, the method of PBL was used, when students in the first semester determine the topics of future master's project. It provides opportunities to explore and combine theory and practical action to transform the environment through projects. PBL methods better prepare students to solve complex problems on their own, prevent social passivity and confusion in today's information-filled world. Stages of the creative process of preparation for future master's project are given in Table. 1.

Table 1. The structure of the development of their own project by students

Component of the work	Characteristics
INTRODUCTION	
Characteristics of the problem and relevance of the study	Generalized characteristics of the problem situation in view of social needs; symptoms and causes of the existing situation. Problem formulation. Arguments on the social significance, theoretical and practical importance of this study (relevance)
The purpose of the project	The goal must be quite meaningful, realistic, achievable, focused on a practical solution to the problem
1. DESCRIPTION OF THE PROBLEM AND THE REAL OBJECT OF THE RESEARCH	
1.1. Exposition of the research problem Critical analysis of the problem, its causes and consequences, the degree of severity, etc.	Critical analysis of the problem, its causes and consequences, the degree of severity, etc. Review and analysis of domestic and foreign sources of information in order to study the degree of development of the problem in the literature, the main unresolved issues, in particular from the standpoint of the development of project management methodology and programs in Ukraine
1.2. General characteristics of the organization (enterprises, institutions, etc.)	General characteristics of the object of the real world, on the basis or example of which the study is performed – organizations (enterprises, institutions, etc.), where the internship took place
2. JUSTIFICATION OF PROJECT CONCEPT	
2.1. Formation of the project plan taking into account alternative ways of achievement of the results	Formation of the project plan and research of alternative ways of achievement of the desired result with a choice of a basic variant of the project
2.2. Conceptual essence of the project	Definition of the purposes, tasks, criteria of success, the basic stages, restrictions, requirements concerning resources, the budget and team of the project. Description of project product quality criteria

Continuation of Table 1

Component of the work	Characteristics
2.3. Project analysis and decision on project acceptance	Technical, economic, financial, commercial, ecological, social, institutional, risk analysis of the project. Evaluating the effectiveness of the project and making an investment decision
3. PROJECT DEVELOPMENT AND PLANNING	
3.1. Project structuring	Detailed project planning based on the development of basic tree structures (WBS, OBS, RBS, CBS), matrix of responsible executors, CTR-dictionary
3.2. Formation of basic planning decisions and project documents	Network, calendar, resource planning and development of relevant project documents (network schedule, calendar plan, resource information, budget, etc.)
4. REALIZATION OF PROJECT	
4.1. Project monitoring and control	Construction of a system for project monitoring and control processes
4.2. Case-example of operational project management	In the process of operational project management when detecting deviations of the project from the basic plan to provide proposals for a project solution to overcome the crisis
4.3. Project management at the closure phase	Determining the features of project closure management. Reporting documents on the conformity assessment of the project product

Source: compiled by the authors

On the basis of Dnipro University of Technology (before restructuring Dnipropetrovsk' Regional Institute of Public Administration) and Ukrainian State University of Science and Technologies (before restructuring Dnipro National University of Railway Transport named after Academician V. Lazarian) during 2020-2021 academic year. An experimental study was conducted on the growth of behavioral competencies of project managers, formed on the example of two groups of 35 people each. In the process of project-based learning, students had the opportunity to show their inclination to a particular area of project activity. The study involved 70 students: 34 men and 36 women (total age of the subjects 23-35 years).

At the first stage of the study, each group member was given questionnaires to assess their own behavioral managerial competencies.

The research methodology is aimed at studying the strengths of managers, consisting of the following stages:

1. Preliminary testing before learning to assess their own behavioral managerial competencies.
2. Practical cases for project tasks.
3. Final testing and interview with the expert commission after graduation.

Theoretical and practical classes on project tasks were selected so that students could demonstrate the full range of behavioral competencies, their ability to professional project activities and their propensity to a particular subject area in the field of project management. The topics

of the practical tasks that were performed were also coordinated with the commercial projects of the organizations where the students underwent internships and could start their professional activities.

Assessment of the formation of project skills in students was conducted on the basis of behavioral competencies of project managers. Competencies were taken from the list of behavioral competencies of the project manager according to IPMA and included the following qualities: self-government, personal integrity, personal communication, relationships and interaction, leadership, teamwork, conflicts and crises, ingenuity, negotiation and results orientation. Based on the obtained data, personal profiles were built and the group profile of the team was calculated. In the study, the weights for all ten behavioral competencies of project managers were the same. The change in behavioral competencies of managers before and after training in the first group (Dnipro University of Technology) is shown in Ukrainian State University of Science and Technologies) in Fig. 4.

The analysis of the obtained data allows us to state that after undergoing project-oriented training the results changed in favour of a significant increase in project competencies. It is also important to note that the subject area of previous basic education (bachelor's degree), age and gender did not affect the results of the development of project management competencies

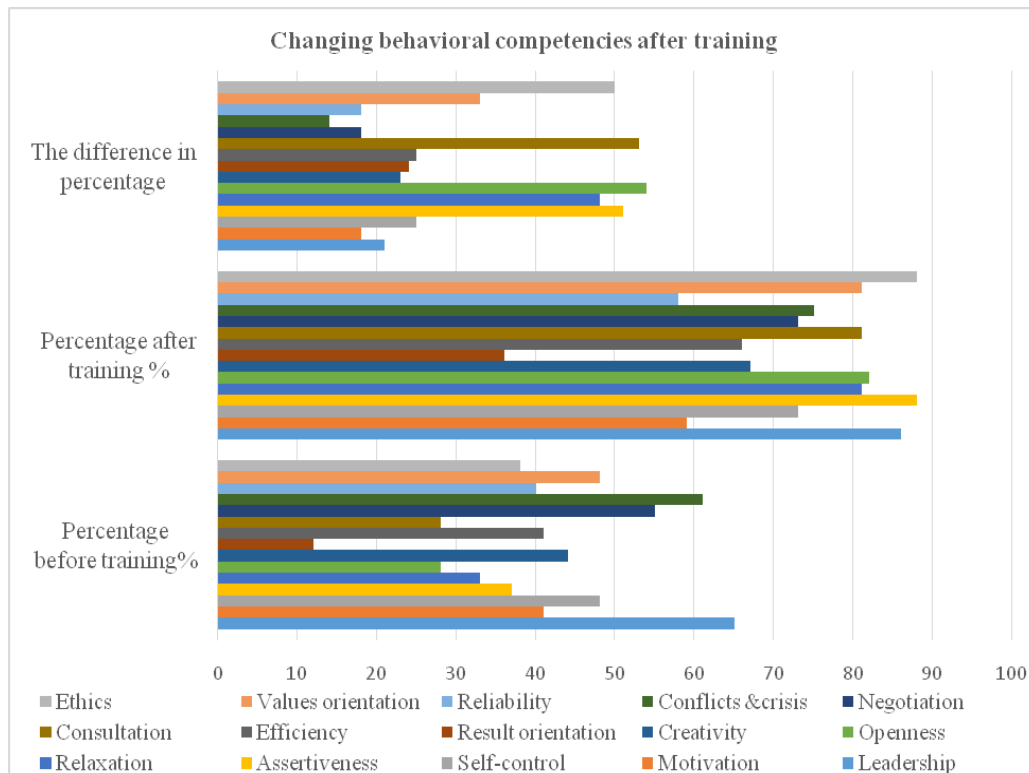


Fig. 3. Changing the behavioral competencies of managers in Dnipro University of Technology students
Source: compiled by the authors

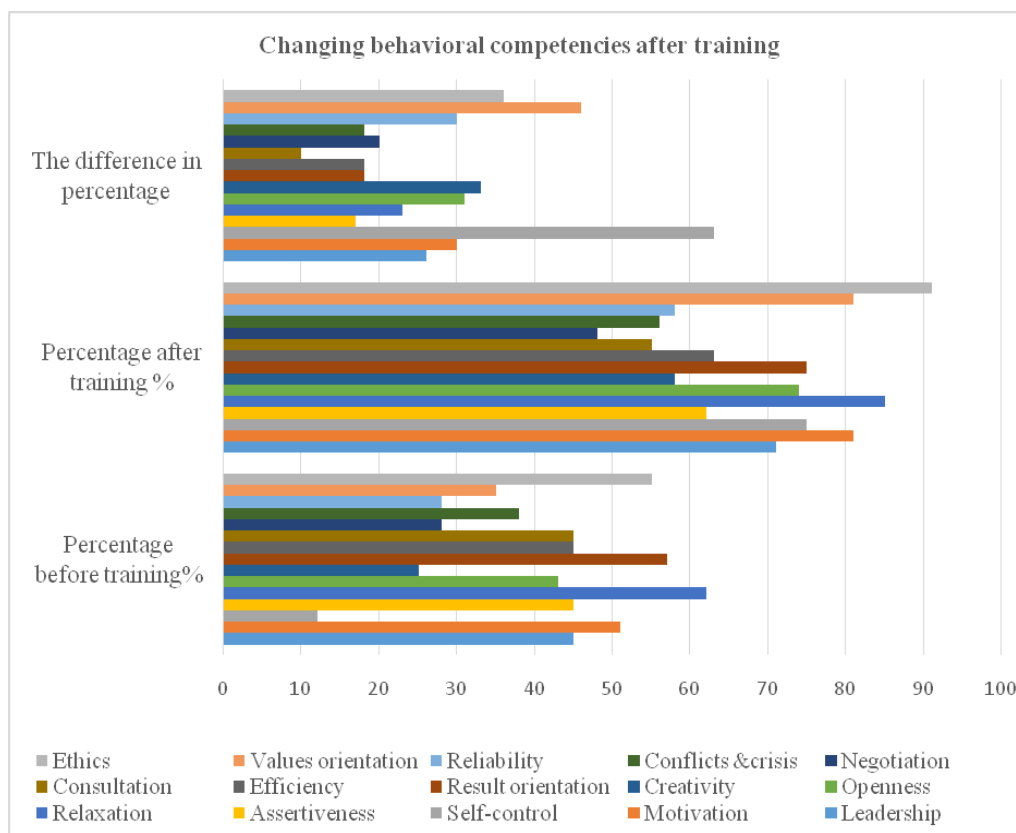


Fig. 4. Changing of behavioral competencies of managers in students of Ukrainian State University of Science and Technologies
Source: compiled by the authors

Even considering that any method has a degree of error, we can assume that the study showed significant results of professional growth of students after project-oriented training. Thus, according to the results of the study, it can be argued that a person's desire for a particular subject activity can be successfully used in the training of project management. At the same time, the using of natural inclinations and talents of students creates a productive project environment to achieve positive learning outcomes.

The skill of understanding their aspirations and natural abilities should become one of the most important elements of the behavioral competence of project managers, which they should use in future professional activities.

CONCLUSIONS AND PROSPECTS OF FURTHER RESEARCH

Complaints about the quality of Ukrainian education often contain statements about the lack of connection between educational institutions and project management in practice. Indeed, the scale of project management implementation in Ukraine's economy does not yet meet its urgent needs. This is due to the lack of an intermediate link between what is expected in practice in the economic environment and what is happening in reality in the field of project management. It should be noted that educational institutions do not have the tools, motivation and finances to implement projects in the real world. Lack of funding and administrative overload constantly leads to multitasking of teachers, which does not allow focusing on market needs. Project-based learning is a path that provides opportunities to combine theory and practice to build the country's modern economy.

The method of iterative learning was further developed in the work by applying it to assess the learning time of professional competencies in project management in different ways of learning: on their own experience, the experience of other teachers and students or combined learning in the first and second way. The proposed mathematical method of calculating the time of students' training in project management competencies allows to calculate, whether the applicant, if he is included in the group, will have time to learn a reference set of professional competencies, such as those laid down for mastering the educational program.

An experimental verification of the possibilities of applying project-based learning to the acquisition of project competencies by students through the development and implementation of their own projects was carried out.

A study of the practical skills of students after training showed that the results have changed in favor of a significant increase in project competencies. Thus, it can be considered that understanding their aspirations and natural abilities should become one of the most important elements of the behavioral competence of project managers, which will be used in future professional activities.

This research is the basis that can help future managers make the right career decisions if they have not yet determined which subject area of project management to choose. It will also help those who doubt the right choice of career path, help to reload the desired goals, results and way of thinking.

In the future, the authors plan to continue studying the processes of development of project competencies, namely, to explore the possibilities of integrating the practice of self-improvement into project management.

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Проблеми та шляхи вдосконалення проєктно-орієнтованого навчання в Україні

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АНОТАЦІЯ

Проектне навчання – це навчальний процес, орієнтований на студента, який надає можливість досліджувати та поєднувати теорію та практику. Це дослідження має на меті вивчити відповіді студентів після їхньої участі в проєктному навчанні та визначити навички, які учні вдосконалили після проходження процесу проєктного навчання, використовуючи його 4 етапи. Проведено експериментальну перевірку можливостей застосування проєктного навчання для набуття студентами проєктних компетентностей шляхом розробки та реалізації власних проєктів. Всього в дослідженні взяли участь 70 студентів, які навчалися на факультетах менеджменту за освітньою програмою «Управління проєктами». Результати показали позитивну реакцію студентів щодо їхнього досвіду участі в проєктному навчанні, яке поєднувало елементи теорії та практики. Крім того, результати цього дослідження показали, що проєктно-орієнтоване навчання позитивно впливає на розвиток поведінкових компетенцій учнів та їх подальшу професійну орієнтацію. Студенти відповіли, що завдяки проєктно-орієнтованому навчанню вони вдосконалили свої навички мислення, навички вирішення проблем, отримали відчуття самореалізації, а також навички командної роботи. У роботі отримав подальший розвиток метод ітераційного навчання шляхом застосування його для оцінювання професійних компетенцій з управління проєктами різними способами навчання: на власному досвіді, досвіді інших викладачів і студентів або комбіноване навчання першим і другим способом. Запропонований математичний метод розрахунку часу засвоєння студентами компетенцій проєктного менеджменту

дозволяє розрахувати, чи встигне абітурієнт, якщо його включити до групи, засвоїти еталонний набір професійних компетенцій, як тих, що закладені в освітню програму. Наукова новизна дослідження полягає у застосуванні проектно-орієнтованого навчання для засвоєння учнями проектних компетенцій. Результати дослідження підтверджені у ході експериментальної перевірки впливу проектного навчання на студентів під час розробки та реалізації власних проектів. Практична цінність дослідження полягає у допомозі педагогам, які здійснюють освітню діяльність, покращити якість навчання. Дослідження показало, що проєктне навчання є ефективним методом для засвоєння учнями проектних компетенцій. Стаття може зацікавити педагогічних працівників, які здійснюють освітню діяльність, вчених і практиків з проектного менеджменту.

Ключові слова: проєктне навчання; ітераційне навчання; проєктні компетенції; навчальний процес; проєктний менеджмент; проєктні менеджери

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