check for updates

# BUILDING A PROJECT CULTURE THROUGH RESEARCH AND INNOVATION TRAINING OF FUTURE PhDs IN UKRAINE

🆔 **Viktoriia Meniailo**[1+]
🆔 **Olexandr Gura**[2]

[1,2]*Zaporizhzhia National University, Department of Pedagogy and Psychology of Educational Activities, Ukraine.*
[1]*Email: meniailo16@gmail.com Tel: (+38)-097-543-03-73*
[2]*Email: guru11970@mail.ua Tel: (+38) -066-16-03-430*

*(+ Corresponding author)*

## ABSTRACT

Ever since the European model of training of PhD students has been introduced in Ukraine in 2016, the issue of finding effective forms and methods of doctoral studies has been raised in the national education system. The aim of this study is to present a strategy for creating a project culture in which PhD students develop and implement real projects and solve regional problems as a basis of their preparation for research and innovation activities. The main methods used in this study are the theoretical description of the program of research and innovation training of postgraduates using project-based learning and its application in practice. This program includes the following stages of project activities: preparatory, initiation, formation of the project team, analysis of the situation, development of the project concept, as well as: fundraising, implementation and concluding of the project. The effectiveness of training and its results were tested through empirical and statistical processing methods. The results of the experiments show the positive impact of the developed training program in building of the project culture and developing transferable skills of the future PhDs (instrumental, systemic, and interpersonal), as well as gaining of the pre-professional experience in the process of working on real projects. The study also reiterates the role and importance training in bringing effectiveness of research and innovation of postgraduates.

**Contribution/Originality:** The paper's primary contribution lies in finding a proposed curriculum for the training of the PhD students: implementation of research and innovation projects; formation of transferable skills; and involving of PhD-students in the solution of regional problems within the framework of the "third mission" of universities.

## 1. INTRODUCTION

A European model for nurturing PhD candidates through relevant educational and scientific programs was envisaged in 2016 in Ukraine, a signatory of the Bologna Declaration and a member of the EHEA. This model provided for the acquisition of necessary competencies through training though it was difficult to find effective forms and methods of postgraduate training in order to ensure qualitative preparation for research and innovation activities (Meniailo, 2018). It was also endeavored to form a dominant European project culture of future PhD in a modern technogenic society, whose development was characterized by volatility and constant movement (Krylov, 2015).

377

Project-based learning (PBL) requires project culture and implies mastery of theoretical aspects of technology in each project activity, project competencies, and practical experience in the design and implementation of projects. Consequently, the formation of European project culture would be the basis of research and innovation training of PhD, which will guarantee an increase in the productivity of these future research professionals.

Ukraine, like other countries, has survived the communist and post-communist eras and has long been in economic and political isolation from the West. This has made a negative impact on the quality of its national science, dominated by local, peer-reviewed research that was uncompetitive in European and global arena (Kwiek, 2018). Currently, Ukraine as an ERA participant, is trying to restore the international dimension of its science and increase the role of cosmopolitan institutions by imparting training to young scientists who aim to contribute significantly in global science. The performance of a modern international scientist is determined, first of all, by the amount of external financing that can be attracted to implement one's own research and innovation projects, and, next by mastering them through the foundations of a project culture as an obligatory component of training.

As the traditional forms of PhD training do not meet the expectations laid down in the current educational policy of European countries, this study explores the possibility of developing effective models for the formation of a new generation of researchers. A need has been felt to focus on the European format in the field of science, with innovative thinking, leadership, personal autonomy, professional success and self-realization, capable of developing transferable skills and accomplishing project activity in both scientific and social dimensions. The latter is conditioned by a new social agreement between authorities and universities that "in exchange for public funding, scientists and universities are obliged to take into account the needs of "users" of the economy and the public sphere" (Martin and Etzkowitz, 2000).

## 2. PROBLEM STATEMENT

The aim of this paper is to present a strategy to create a project culture in which PhD students develop and implement real projects and aim at solving regional problems. This also becomes a basis of their preparation for research and innovation activities. It motivates them to participate in domestic and international projects and programs and enhance transferable skills necessary for a successful professional career.

*The objectives* of this study can be stated as follows: to develop a strategy of research and innovation training for PhD students enabling them to use project-based learning; to design and describe a program for such a training in 5 stages; and, to make a statistical analysis of the results of the post-graduate students' survey .

## 3. LITERATURE REVIEW

The project-oriented approach, initially introduced in engineering and technical sciences, is currently successfully used in a variety of organizational, economic, social and managerial systems. It has been accepted as meta-technology (Janchenko, 2013) capable of increasing the efficiency of innovation in any field.

The essence of this approach is to clearly state the purpose and expected results of activities and determine a list of actions to be implemented. It is also important to distribute participants and resources and take into account possible risks. The project head also needs to continuously monitor progress and respond in a timely manner to emerging changes and deviations in order to achieve project goals within the established time, budget and by maintaining quality parameters. It is evident that in this case, the success and effectiveness of such type of purposeful activity increase several times (Agranovich and Moiseeva, 2008).

Modern examples of the use of Project-based learning (PBL) for research and innovation and the required training of specialists are widely represented in scientific papers. For instance, Gladkova et al. (2018) describe the use of Moodle for project management in modern higher education; Garcia-Agustin et al. (2015) reveal the peculiarities of a four-stage business development program for all college students, including bachelors, masters, and PhDs at the University of Jaume I (Spain); Ríos-Carmenado et al. (2015) describe the content of the innovative

educational program for the development of professional skills in project management in engineering higher education, introduced at the Massachusetts Institute of Technology (USA); the possibility of effective interaction in university-government-business triangle in the countries of northern Europe (Norway, Denmark, Sweden) has been analysed by Thune (2010); a social-networking innovative educational space aimed at developing students' generic and professional competences in the process of active PBL-based activity established at South Ural Energy Technical School (Yuzhno-Uralsk, Russia), has been considered by Dolgova et al. (2019).

However, the closest to the objectives of our study is the social entrepreneurship model, developed at the University of Southern Indiana, USA, which looks the following way: Several groups of project participants are formed to identify problem areas in the region through excursions, meetings, etc., after which a three-stage process of project preparation takes place. The first is the generation of ideas and their selection; the second is the study and analysis of the situation; the third is the development of projects (Celuch et al., 2017). This model was the basis for the strategy of forming the European project culture of future PhDs at Zaporizhzhia National University (Ukraine).

At the same time, this study is based on the premise that any education is successful only when it is in demand by the society; when it meets the personal needs and characteristics of the student and provides practical training (Spirin et al., 2017; Koreshnikova et al., 2018; Dolgova et al., 2019) and opportunities of developing transversal skills (Valūnaitė et al., 2019).

## 4. MATERIALS AND METHODS

The study used a descriptive, empirical and statistical research design. Most of the data were obtained through a literature review. While applying the results of selected studies and describing modern effective teaching methods, we developed a strategy and program of research and innovation training of PhDs in the use of project-based learning and to put it into practice. The effectiveness of training and its results were tested through empirical and statistical processing methods.

The experiment was conducted during the 2018-2019 academic year. A group of 48 first-year PhD students at Zaporizhzhia National University from different branches of science and specialties participated in the experiment. A written survey was selected as the method of pedagogical diagnostics. At the beginning of the training, a specially designed questionnaire was introduced to postgraduate students containing a few questions: (i) what to expect about this program (Answer options: understanding of EU research principles; effective implementation of experience and ideas; project writing and implementation skills; teamwork experience; strategic planning) and (ii)what was their level of preparedness for the project activity (Answer options: completely unfamiliar; have a general idea of the project activity; attempted to participate in the project competition; have experience in the project implementation). The participants were asked to choose one of the above options as answer to each of these two questions.

At the end of the study, a second questionnaire was also carried out with the aim to obtain information, whether the previous expectations of graduate students have been met (possible answers to the items in the questionnaire were presented on an ordinal scale and formulated as : 5 − fully justified; 4 − justified in general; 3 − justified 50/50; 2 − partially justified; 1 − not completely justified). The questionnaire also tested and analysed the dynamics of their competences development. For this purpose, postgraduate students were asked to self-assess their progress in different types of competencies: instrumental, systemic, interpersonal. The competence classification was based on the Tuning Educational in Europe (2003). Possible answers, in this case, were: 5 − developed as much as possible; 4 − developed as a whole; 3 − partially developed; 2 − minimally developed; 1 − have not developed at all. The empirical data obtained were analyzed using descriptive statistics with aggregate figures, standard deviation and graphical visualization. The numerical data was processed using the software SPSS.v.20.

## 5. RESEARCH PROCEDURE

### 5.1. Strategy of Research and Innovation Training of PhDs

Project technology can be applied in all types, forms and methods in the organization of professional education, however, the greatest success of solving educational tasks is ensured by the preparation and inclusion of future specialists in real project activities. Therefore, we developed a strategy for the use of PBL, which included following types of training:

- Formal education: teaching the course «Basics of European Project Activities», which was developed within the framework of an international project EUROPROC (Jean Monnet module «European Project Culture» under the Erasmus+ program).
- Non-formal education: training sessions, workshops, organizational and activity games.
- Extra-curricular work: participation in meetings, round tables, conferences, contests, presentations.
- Fieldwork of project teams: at the place of project development and implementation.
- Independent study: analysis and processing of information, preparation of the project and reporting documentation.
- E-learning: introduction to additional training materials, test and individual tasks on the Moodle platform.
- Online communication: both between working group members and with those involved.
- Consultations: face-to-face and distance with teachers, mentors.
- Evaluation and self-evaluation, as well as reflection and self-reflection of the work performed.

In the modern conditions of innovative society, a university acts as an institutional basis and integrator of a regional ecosystem (Celuch *et al.*,2017). This means that its powerful human resources, including postgraduate students, can serve as a way to solve regional problems/needs. On the other hand, a university is an innovative educational institution that provides the transition from simple transfer of knowledge for students to the provision of access to the latest knowledge. Such access is provided by immersing graduate students in real-world situations that encourage them to research and expanding the frontiers of existing knowledge and practice (Thomas and Brown, 2011). This method of teaching in pedagogy has been termed as the "immersion method" (Serdyukov, 2008). Therefore, the real regional problems are becoming the basis for future postgraduate projects. The implementation of these projects contributes both to the development of the regional ecosystem and to the improvement of the PhDs training quality.

The basic stages of the project activity are a kind of cycle, which begins by involving project implementers into a problematic situation, getting aware of its significance, and ending with solutions of the problem and presenting results to the community (Sidenko, 2008).

### 5.2. Program of the Research and Innovation Training of PhD

Next step was defining and executing main stages of the organization of project activities of PhD-students in the process of their preparation for research and innovation activities. These stages were planned on the fact that mastering of innovations can be more effectively carried out through practical experience than ordinary passive training (Wagner, 2012). The completion has begun in the first semester of the first year of postgraduate study. Classes take place in interdisciplinary groups, as they pass immediately for graduate students of all specialties. Thus, from the first days of training, future PhDs acquire skills in an interdisciplinary context.

The following were the stages of the project activities:

**Table-1.** Stages of the project activities.

| Tasks | Stage content | Results |
|---|---|---|
| *Stage 1. Preparatory* | | |
| Acquaintance of post-graduate students and the establishment of informal contacts between them | **Introductory training «Let's get acquainted»** is initially conducted, participation in which allows participants to establish informal relationships with each other and to receive more information about other members of the team, as well as to get the first experience of team and teamwork | PhD-students are familiar with each other and motivated to the project activities |
| Familiarization with the main concepts of the project, project activity, project culture | **Lecture-presentation «Project as an activity»**, which provides graduate students with theoretical ideas about the features of the project, project activity, project culture and is accompanied by the implementation of cognitive group exercises aimed at developing project thinking | |
| | **«Project/not a project» debate**, in which postgraduates are asked to bring their point of view to the subject of attributing/not attributing to the project certain activities proposed by the teacher. During the debate, PhD-students update their knowledge about the project activities, as well as form the ability to express and argue their own opinions, develop skills of public speaking, ability to listen to the opponent and conduct a discussion | |
| Formation of positive motivation for the implementation of the project activity | **Lecture «The project as a method, the content and the result of the PhD`s training»,** is devoted to the role and place of the project component in future professional and research and innovation activities and is aimed at creating a positive motivation for postgraduates to carry out the project activity as facilitating their professional development and develop as researchers, innovators, educators and developers of their own life strategy | |
| *Stage 2. Initiation of the Project* | | |
| Search of problems that need to be addressed at the university, community, and region level | **Scientific and practical events (round tables, seminars, conferences)** with the participation of representatives of administration of the university, state authorities and local self-government, enterprises, organizations, institutions, business structures, the main purpose of which is: analysis of existing problems and the search for solutions to them; presentation of new technologies, methods, strategies, products and services; establishment of new contacts and development of cooperation between different social groups; increase motivation of participants. During these events, graduate students have the opportunity to get acquainted with actual problems in specific sectors and to participate in discussing practical solutions to their problems. Participating in public events, they acquire active listening skills, ability to ask questions, conduct discussions, analyse and synthesize received information. The effective method for studying the real situation in the manufacturing sector is also visits to enterprises of the city and the region | Selected problems, that are proposed for decision |
| Identifying problems and selecting those that are proposed for decision in future projects | **«Identification of Problems» workshop**, which is conducted on the technology «World Café». During the event, postgraduates are generating and pre-selection of ideas/problems, analysing the need and the reality of their solution, assessing the cost-result ratio, and then presenting a range of issues that are proposed for future projects. Among the projects that were chosen for implementation by PhD-students, the projects of social orientation predominate, which correlates with the data of Celuch *et al.* (2017) where project team participants also predominantly chose social issues that are at the centre of public attention and are the most relevant to the needs of the region. The created pedagogical conditions promote the development of logical thinking, abstraction, creativity, ability to analyse and synthesize information, solve problems, work in a team, form leadership skills and skills of public speeches and presentations for postgraduates. The peculiarity of this stage is its strongly expressed motivational component since PhD-students independently choose the personally important problem for them (and its solution) in accordance with their interests, value orientations, professional goals. It is an independent choice that serves as an internal motive for increasing their motivation and developing creative abilities. During outlining the expected results of activity, there is an interest and a desire to implement the conceived, an aspiration for self-improvement and personal growth. | |
| *Stage 3. Formation of the project team and creation of the information resources* | | |
| Formation of the project team | **The formation of project teams** was implemented taking into account proposals by Thompson and Edwards (2009) and Thongpravati *et al.* (2016). It allowed postgraduates to reflect on their strengths and weaknesses, to critically evaluate the achievements and potential opportunities, as well as to determine what they want to achieve in the process of implementing the project on which they stopped their choices. In addition, mastering the methodology for writing a resume and preparing videos, postgraduates became very important self-presentation skills for a future profession. Based on the analysis of the submitted materials, the faculty members are formed by project teams, the main advantage of which is their high motivation, as | Project teams with organizational and functional structure |

| | | |
|---|---|---|
| | well as interdisciplinary character, which contributes to more creative problem solving. According Janis (2005) if the team members have too similar points of view, finding a common solution is easier, but in general, the effectiveness of such a group may suffer. At the same time, Basadur and Head (2001) prove that the more diverse the team is, the higher its innovative efficiency in solving the problems. It contributes to the heterogeneity of the project team that it includes representatives of the organization for whose needs it is planned to implement the project, as well as 1-2 PhD-students of senior courses who already have the experience of writing and implementing projects to provide advisory assistance in solving certain issues at different stages of work. This allows the latter to develop their leadership and organizational qualities, gain experience in managing project teams. We have taken this idea from the experience of the US Career Development Institute (Kupfer et al., 2016) | |
| Team coordination | **Teamwork training**, during which PhD-students perform group exercises and participate in an organizational-activity game for developing a collective project. These activities develop critical thinking, organizational and leadership skills, ability to generate ideas, resolve conflicts, manage change, work in a team and take responsibility for a common result | |
| Creation of the information resources | **Creation of the information environment**, where all information about the project will be accumulated, operational information exchange and ongoing control over the state of the tasks | Online project resources for team interaction and operational information exchange |
| *Stage 4. Analysis of the situation* | | |
| Analyse of the situation, which includes: collection of output data and analysis of the existing state; preliminary examination of the problem; identification of the need for change; definition of the main elements of the project: goals, objectives, results; basic requirements, restrictive conditions, criteria; level of risk; project environment, potential participants, time needed, resources, tools; submission of proposals, their approbation and examination; approval of the project concept (Agranovich and Moiseeva, 2008) | **Practical workshop «Problem Research Methods»**, in which postgraduates receive practical knowledge of research methods (collecting and studying qualitative and quantitative data) and establishing causal relationship by obtaining the necessary information from the teacher and performing group exercises on assimilation of the tools of LEAN-analysis (Holland, 2014) to identify and analyse problems. The second important task of this workshop is to train PhD-students in specific cases to analyse the beneficiaries of the project, determine their level of influence, as well as the opportunities and risks associated with them. Working on the solution of the proposed tasks, future PhDs acquire the ability to analyse and synthesize information, master the project techniques for analysing the situation and stakeholders, develop abstract and logical thinking, acquire teamwork skills | Description of the problems as a complete package of information and illustrative materials with relevant conclusions on the relevance and need for solving the problems |
| | **Field work directly at the place of implementation of the project.** Postgraduates study the chosen problem in the real-world situation, in particular: get acquainted with the requirements, goals, strategy of the organization development, study the necessary scientific literature, review the reporting, statistical information, materials of mass media and the Internet; identify beneficiaries and stakeholders, analyze their impact; establish business contacts, conduct meetings, monitor, questionnaires, sociological surveys, interviews; consider possible solutions to the problem and the risks that may arise during their solving. At this stage it is very important to be able to find, analyze and organize information, accumulates it on the created information resource of the project, conducts an individual diary allowing to reflect and correct its actions, and also helps in the future to determine the personal contribution of each participant of the project. During these actions, the teacher acts as an active observer: follows the study, summarizes the intermediate results, provides the groups with the necessary assistance, including remotely through the communication media. Through the research, PhD-students use quantitative and qualitative research methods, develop organizational and communication skills, learn to navigate in unfamiliar situations and changing circumstances. All information obtained during the fieldwork is summarized and systematized as a description of the problem | |
| *Stage 5. Development of the project concept* | | |
| Development of the concept of the project and its preliminary planning | **Workshop «Generation and evaluation of project ideas»**, where postgraduates exchange ideas on the solution of the above problems, evaluate them and select them using the gained knowledge. during this event, future PhDs not only develop their creative thinking and analytical skills, but also learn how to act as experts and conduct an examination of proposed ideas | PhD-students, are familiar with the main project technologies involved in the |

| | **Practical workshops «Theoretical and practical aspects of the project activities».** During these studies, postgraduates learn to master the basic project technologies (using real cases of successful projects) and apply them to develop the concept of their own projects | development of the concept of the project, as well as advanced information, communication and organizational competencies |
|---|---|---|
| | **Design of the concept of the projects**. The project teams themselves work on the design of the concept of the projects in the established form, using the guidance provided by the system Moodle, and the assistance of mentors and course teachers. For more effective interaction with consultants, it is advisable to approve a schedule of full-time consultations | Developed project concepts |

## 6. RESULTS AND FINDINGS

### 6.1. Fundraising and Project Development

The main tasks of postgraduates at this phase– are: presentation and advertising of the project, the search for sources of financing, development of a detailed project application in accordance with the requirements of the customer or the terms of the competition. In order to fulfill the first task, the university organizes the competition-presentation of the developed projects «Epicentre of Youth Initiatives», before which PhD-students have the training «Art of Presentation», during which participants were getting acquainted with the system of creating effective presentations, which will be useful not only for the creation of electronic content for accompaniment of public speeches, but also for the production of promotional mock-ups for the dissemination of information about the project (handbill, poster, flyer). Representatives of the university's administration, regional authorities and local self-government bodies, organizations where the projects are planned, successful businessmen and business leaders who can act as potential investors or project customers, charitable foundations and organizations, mass media, etc. are invited to this presentation. The mandatory condition is the presence of the heads of the structural subdivisions of the university: the project department, the international department, the research department, the technology transfer center, the business incubator which can provide effective informational, consulting, methodological assistance in choosing the optimal strategy, receiving financial and institutional support depending on the type of project. The participation in this event gives PhD-students the opportunity to develop their communication and presentation skills, as well as establish personal contacts with representatives of different circles and sectors that can provide effective assistance and/or be interested in implementing the projects presented.

In the presence of a real customer and/or a sponsor of the project, relevant contracts for the execution of works, protocol on the contract price, technical specification, a calendar plan are concluded with them. It should be noted that not all projects need external financing. In such cases, it is sufficiently approved by the two sides work plan with indication of the expected results. All necessary documents for participation in the competition or conclusion of an agreement with the customer are developed by the project teams on their own, using the existing teaching materials in the Moodle system and being in constant contact with the teachers and mentors, as well as the employees of the relevant departments of the University for obtaining the necessary assistance.

At the same time, postgraduates receive theoretical training in planning and design in the framework of the course «Basics of European Project Activities». For them, practical seminars are held, during which the PhD students, on case studies of successful projects, learn to develop application forms, plan work, allocate resources, anticipate risks, compile cost estimates, execute contracts, prepare another project documentation. All classes are held in the form of cooperative learning activities (Jonson, 2006) in small groups. The feeling of group membership allows PhD-students to experience significant intellectual and emotional support, to realize the aspirations for communication and interaction, to overcome emerging difficulties, which facilitates more effective knowledge acquisition and the formation of new skills and abilities during training. At the same time, on the recommendation

of Ríos-Carmenado *et al.* (2015) analog or comparative methods are used to establish a mapping of different project situations and to come up with new findings, as well as debates and exercises in which postgraduates are required to observe and analyse facts that will help them better link theory to reality.

Consequently, the results of this phase are: defined customer and/or grantor, or sponsor of the project; developed application form and other project documentation, contract with a customer (if necessary); PhD-students have practical skills in presenting and advertising their own ideas, finding resources for their implementation, as well as the ability to develop application forms of projects, plan work and allocate resources, draw up contracts and other supporting documents, work independently and as part of project teams.

## 6.2. Project Implementation

The main tasks of next phase are theoretical and practical preparation of postgraduate students for the implementation of the project and its direct implementation. This phase is the most responsible in terms of clearly fulfilling the tasks and obtaining the planned results. Therefore, while working on a project that takes place in the field at the place of its implementation, it is necessary that each project team and all its participants clearly understand their roles and tasks in the project. In this regard, the information resource of the project necessarily hosts all the necessary information on the composition of the project teams, the calendar plan of work, responsible for specific areas of work and individual activities, the schedule of consultations, etc. Such information contributes to the improvement of the organization of the project activity and the awareness of each person of the responsibility for the work performed by other project participants.

Prior to the start of the project, the third series of practical seminars is held for postgraduates, during it, working in small groups, they become acquainted with the methods of project management, control forms and criteria for evaluating the quality of their implementation. Also, it is very appropriate at this phase to conduct the "Leadership and Team Management" training, during which the postgraduates students evaluate their leadership potential, analyze their own leadership and management style, master the tools of team management, disassemble the principles of behavior in different situations, and work out the acquired skills in role-playing games and group exercises. The next, most important part of this phase is, in fact, the fieldwork of the project teams for the implementation of the project, in which process self-actualization of postgraduate students occurs, that is, inclusion in active, socially and personally significant activities that allows them to show acquired knowledge, skills, develop their professional and personal qualities, to realize their own «self». During the project, PhD-students carry out informational, research, practical-oriented activities, as well as establish and/or develop professional contacts with external agents to solve real problems. During this process, project participants are enriched with external knowledge to create and disseminate new knowledge, acquire new professional and personal qualities, expand their capacity to build new relationships with different communities, local and regional organizations, government bodies, etc.

In addition, they monitor progress, intermediate quality control and regulation of key project indicators, make changes in the process of operations, correct the sequence of operations, solve emerging problems and conflicts. The main form of the organization of pedagogical support during this period is the consultation, the content and organizational structure of which is determined in accordance with the objectives of a specific stage of the project implementation, which ensures the quality of the project activities of postgraduates.

The results of the phase are the executed projects, as well as graduate students who possess knowledge of the basic principles of project management, theoretical and practical knowledge, skills and abilities in terms of project management principles, as well as leadership, communication and organizational qualities, ability to critique and self-criticism, ability to work in a team, solve problems and conflict situations.

*6.3. Concluding*

The objectives of this phase are focused on the preparation of reporting documents for the project, the evaluation and self-assessment of the project participants, the implementation of collective project self-reflection and the reflection of the work.

The registration of the accounting documentation is carried out by the participants of the project groups independently in accordance with the requirements of the grant program or the contracting authority; in so doing, they use the methodical materials placed in the system Moodle. However, the evaluation of the project's success is carried out not only by the grantor/employer on the basis of the submitted reports, but also by expert teachers and PhD-students themselves. Such a collective expert assessment allows eliminating subjectivity, however, it does not give a complete pedagogical effect of the activity; for this, it is necessary to give each participant a chance to reflect on what he has personally participated in the project, what he succeeded in and what is not, and what it is connected with (lack of understanding, lack of information, inadequate perception of his possibilities, etc.).

One of the effective forms of summarizing and conducting reflection is the final conference, during which postgraduates present the results of the project activity and demonstrate its final product. In the course of the report, discussions are held on the content, forms and methods of work, their orientation towards the target group; analyse how and how best to solve the project's tasks; which contributed to the work on the project, what feelings they had in the process of work, what experience has been acquired and how it can be used in future professional activities.

## 7. DISCUSSION AND ANALYSIS

The results of the post-graduate survey conducted at the beginning of the experiment have shown that 54.2% of the postgraduate students have only a general idea of the project activity, 39.58% are completely unfamiliar with it, and only 6.25% have experience of preparing project applications that, unfortunately, were not successful Table 2, Figure 1.

**Table-2**. Evaluation results of initial readiness of graduate students to project activity.

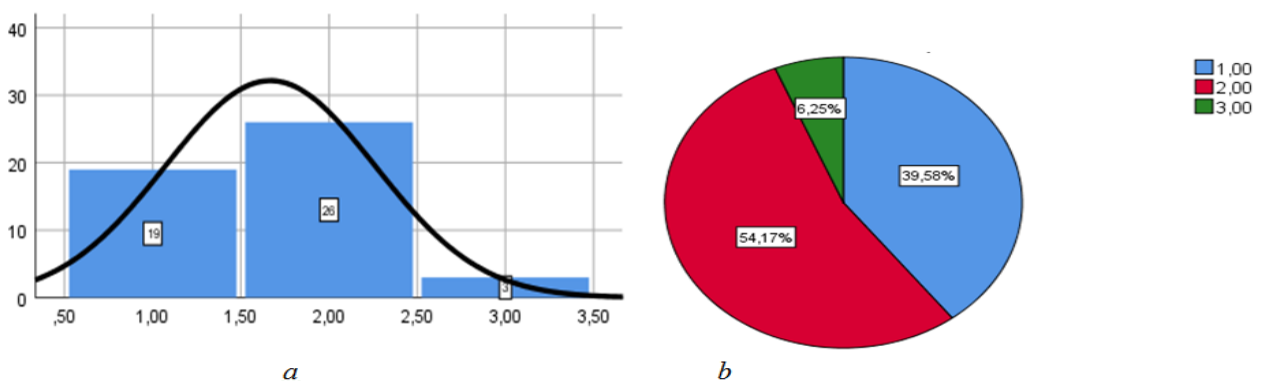| Options | Value | Frequency | Percentage | Aggregate figure | Standard deviation |
|---------|-------|-----------|------------|------------------|--------------------|
| Completely unfamiliar | 1 | 19 | 39.58% | 1.67 | 0.59 |
| Have a general idea of the project activity | 2 | 26 | 54.17% | | |
| Attempted to participate in the project competition | 3 | 3 | 6.25% | | |
| Have experience in the project implementation | 4 | 0 | 0 | | |



**Figure-1**. Evaluation results of initial readiness of graduate students to project activity (*a* – frequency histogram; *b* – percentage distribution diagram).

This disappointing data can be explained by the fact that the universities of the post-Soviet countries only 5% of academic hours are spent on projects (Agranovich *et al.*, 2003) due to the fact that the project method was not used as an independent one in Soviet pedagogy, since, according to the then authorities, he did not give the opportunity to master the system of knowledge in the field of specific disciplines.

The results of the answers to the question "What are the expectations of the postgraduate students to participate in this program?" are presented in the Table 3 and on the Figure 2.

**Table-3**. Assessment of the previous expectations of the postgraduate students from passing the program of study.

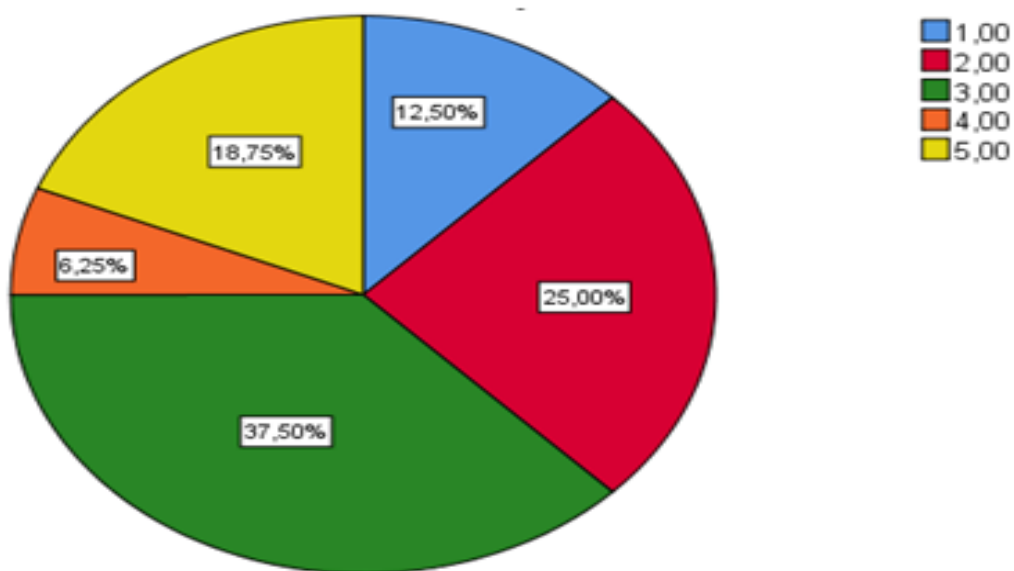| Options | Scale | Frequency | Percentage |
|---|---|---|---|
| Understanding of EU research principles | 1 | 6 | 12.50% |
| Effective implementation of experience and ideas | 2 | 12 | 25.00% |
| Project writing and implementation skills | 3 | 18 | 37.50% |
| Teamwork experience | 4 | 3 | 6.25% |
| Strategic planning | 5 | 9 | 18.75% |
| Other | 6 | 0 | 0.00% |



**Figure-2**. Assessment of the previous expectations of the postgraduate students from passing the program of study.

Figure 2 shows, that 37.50% of postgraduate students seek to develop their project writing and implementation skills; 35% of respondents put their ideas into practice; 18.75% of experiment participants want to master strategic planning; more to understand the principles of scientific activity in the EU – 12.5%. 6.25% of postgraduate students want to gain teamwork experience.

"Did your expectations for this course come true?" – We have asked the participants of the study experiment and have gotten the following answers, the distribution of which is presented in Table 4 and Figure 3.

**Table-4**. Evaluation results of meeting the expectations of graduate students after completing the program.

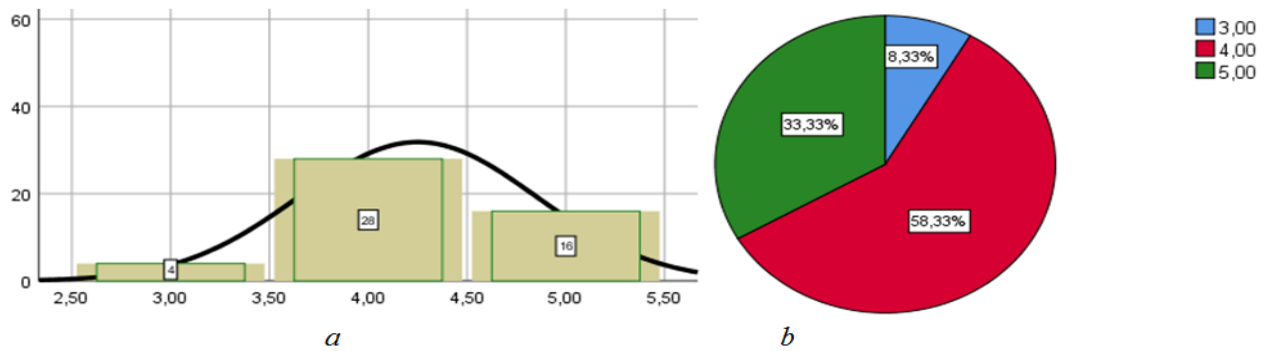| Options | Value | Frequency | Percentage | Aggregate figure | Standard deviation |
|---|---|---|---|---|---|
| Not completely justified | 1 | 0 | 0.00% | 4.25 | 0.60 |
| Partially justified | 2 | 0 | 0.00% | | |
| Justified 50/50 | 3 | 16 | 8.33% | | |
| Justified in general | 4 | 28 | 58.33% | | |
| Fully justified | 5 | 4 | 33.33% | | |

**Figure-3**. Evaluation results of meeting the expectations of graduate students after completing the program ($a$ − frequency histogram; $b$ − percentage distribution diagram).

As can be seen from Figure 3 almost 90% (58.33% − "justified in general" and 33.33% − "fully justified") of those surveyed have fulfilled their previous expectations.

The results of the survey, have demonstrated a positive dynamic also of the development of their instrumental, system and interpersonal competences Table 5 and Figure 4.

**Table-5**. The results of postgraduate survey on progress according to the type of acquired competences.

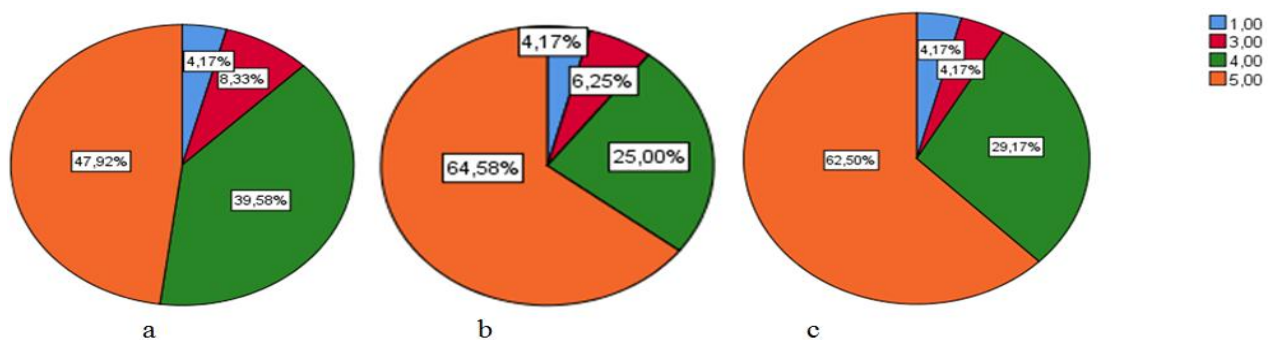| Types of competencies | Progress in appearance of acquired competencies | | | | | Aggregate figure | Standard deviation |
|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | | |
| **Instrumental**: the ability to develop project applications, accompanying documents to them, to search for grants for the implementation of research and innovation projects; the ability to find and analyse information, solve problems, make decisions | 2 4.17% | 0 0.00% | 4 8.33% | 19 39.58% | 23 47.92% | 4.27 | 0.94 |
| **System**: the ability to plan and manage projects, adapt to new situations; development of personal qualities: initiative, creativity, independence, responsibility | 2 4.17% | 0 0.00% | 3 6.25% | 12 25.00% | 31 64.58% | 4.46 | 0.94 |
| **Interpersonal**: the ability to work in a team, in an interdisciplinary context, the ability to establish contacts, to receive positive feedback, create conditions for collective search, joint activity, the ability to critique and self-criticism | 2 4.17% | 0 0.00% | 2 4.17% | 14 29.17% | 30 62.50% | 4.45 | 0.92 |



**Figure-4**. The results of postgraduate survey on progress according to the type of acquired competences ($a$ − instrumental, $b$ − system, $c$ − interpersonal).

According to the type of competencies acquired using the Likert scale (1 – have not developed at all, 2 – minimally developed, 3 – partially developed, 4 – developed as a whole, 5 – developed as much as possible) postgraduates have estimated their own personal progress as «developed as a whole» and «developed as much as possible» from 87.5% to 91.6% of the respondents, which confirms both the effectiveness of the developed technology and the project conclusion by TEE (2003) regarding PBL as the most effective method of forming transferable skills.

An important result of the program is also the projects developed and implemented by PhD-students. Among the projects that have been developed and implemented by postgraduate students of the Zaporizhzhia National University, the projects of social orientation predominate: «Communicating Without Limits», «Children's smiles», «Feel the Taste of Native Language», «Social Coworking», «Sling-Yoga Classes for Young People With Disabilities», «Successful Youth», «Academy of Professions», «Tourist Student Bureau», «Clean Air», which correlates with the data of Celuch *et al.* (2017) where project team participants also predominantly chose social issues that are at the centre of public attention and are the most relevant to the needs of the region.

Thus, having mastered the basics of the project culture, future PhDs have received the practical knowledge and skills necessary for planning their own research and innovation activities in different social and cultural conditions. They also learned how finding ways to solve problems regardless of the situation; implement the developed strategies and obtain predictable results. This also becomes a basis of their preparation for implementation of research and innovation projects, including international, aimed at solving significant scientific, social, cultural, ethical and other problems. At the same time the postgraduates developed their transferable and socio-personal competencies and learned how to more effectively implement the analytical, organizational and management functions.

## 8. CONCLUSION

1. This study describes the strategy and program of the research and innovation training of PhD using project-based learning. It has been applied through the development and implementation of real projects aimed at solving regional problems.

2. The results of an empirical study conducted through a written survey of PhD-students have shown significant progress in shaping the project culture of future PhD.

3. The proposed PhD training program may be recommended by higher education institutions, as it allows future PhDs: a) to master the basic principles of designing and implementing innovative projects, while ensuring the independent initiation of projects, leadership and complete autonomy during their implementation; b) to gain pre-professional experience in the process of working on real projects aimed at solving topical regional problems; accordingly, receive a sense of satisfaction from professional success and professional ability, awareness of personal prospects for professional growth and future self-realization; c) to develop transferable skills and personal qualities: teamwork, communication, leadership, responsibility, creativity, ability to solve problems and resolve conflicts, which are the main features of an innovative specialist of the XXI century.

## REFERENCES

Agranovich, B.L., A.I. Chuchalin and M.A. Solov'ev, 2003. Innovative engineering education. Engineering Education, 1: 11–14.

Agranovich, V.B. and A.P. Moiseeva, 2008. Social project management [Project Management in the Social Sphere]. Tomsk, Russia: Izd-vo TPU.

Basadur, M. and M. Head, 2001. Team performance and satisfaction: A link to cognitive style within a process framework. The Journal of Creative Behavior, 35(4): 227-248.Available at: https://doi.org/10.1002/j.2162-6057.2001.tb01048.x.

Celuch, K., B. Bourdeau, M. Khayum and L. Townsend, 2017. The role of the university in accelerated learning and innovation as a regional ecosystem integrator. Journal of Research in Innovative Teaching & Learning, 10(1): 34-47.Available at: https://doi.org/10.1108/jrit-10-2016-0009.

Dolgova, V.I., V.A. Belikov and M.V. Kozhevnikov, 2019. Partnership as a factor in the effectiveness of practice-oriented education of students. International Journal of Education and Practice, 7(2): 78-87.Available at: https://doi.org/10.18488/journal.61.2019.72.78.87.

Garcia-Agustin, P., M. Beas and M. Ripolles, 2015. UJI EMPREN: How to enhance entrepreneurship from the universityside? INTED. 9th International Technology, Education and Development Conference. pp: 7070–7078.

Gladkova, M., O. Vaganova and M. Kutepov, 2018. The use of design educational technologies in the educational process of the university [Application of Design Educational Technologies in the Training Process of the Higher Educational Institution]. Baltic Humanitarian Journal, 2(23): 209-212.

Holland, D., 2014. Lean success methodology: How to make lean solutions stick! , Bloonmigton: Xlibris Corporation.

Janchenko, I.V., 2013. Pedagogical value of project activity in the formation of career competence of future university graduates. Young Scientist, 2(49): 422-424.

Janis, I.L., 2005. Groupthink: The desperate drive for consensus at any cost. In J. Sharfritz, S. Ott, Y. Suk Jang.Classics of Organization Theory. Belmont: Thomson Wadsworth. pp: 185-192.

Jonson, P.A., 2006. Project-based, cooperative learning in the ingeneering classroom. Journal of Professional Issues in the Ingeneering Education and Practice, 132(2): 8–11.

Koreshnikova, Y., A. Zakharov and F. Dudyrev, 2018. Differences in general education in vocational and high schools: Characteristics of teachers and teaching practices in Mathematics. Educational Studies, 2: 228-253.Available at: https://doi.org/10.17323/1814-9545-2018-2-228-253.

Krylov, D.A., 2015. The technology of forming the design culture of the future teacher. Bulletin of the ChPU. Pedagogical Sciences, 3(87): 137–143.

Kupfer, D.J., A.F. Schatzberg, L.O. Dunn, A.K. Schneider, T.L. Moore and M. DeRosier, 2016. Career development institute with enhanced mentoring: A revisit. Academic Psychiatry, 40(3): 424-428.Available at: https://doi.org/10.1007/s40596-015-0362-5.

Kwiek, M., 2018. University in an age of change: Institutions and academic personnel in the mind of voluptuous competition. Kyev (Ukraine): Taxon. pp: 474.

Martin, B. and H. Etzkowitz, 2000. The origin and evolution of the university system. SPRU Electronic Working Paper Series, No. 59.

Meniailo, V., 2018. Analysis of the current state in innovative research training of PhD students in Ukraine. Advanced Education, 5: 101-106.Available at: https://doi.org/10.20535/2410-8286.131958.

Ríos-Carmenado, D.L.I., F.R. Lopez and C.P. Garcia, 2015. Promoting professional project management skills in engineering higher education: Project-based learning (PBL) strategy. International Journal of Engineering Education, 31(1): 184-198.

Serdyukov, P., 2008. Accelerated learning: What is it? Journal of Research in Innovative Teaching, 1(1): 35–59.

Sidenko, A.S., 2008. Pedagogical workshop: From theory to practice of project-oriented learning. Innovative Projects and Programs in Education, 1: 103–112.

Spirin, E.A., D.A. Kazimov and S.A. Mulikova, 2017. The development of informational educational environment of the university as a condition for improvement of educational-methodical work. Bulletin of the Novosibirsk State Pedagogical University, 7(4): 26-39.Available at: http://dx.doi.org/10.15293/2226-3365.1704.02

Thomas, D. and J.A. Brown, 2011. New culture of learning: Cultivating the imagination for a world of constant change. Lexington, KY: Soulellis Design.

Thompson, B. and H. Edwards, 2009. Preparing graduate student for industry and life long learning: A project based approach. World Conference on Computers in Education. pp: 292–301.

Thongpravati, O.N.N.I.D.A., A. Maritz and P.A.U.L. Stoddart, 2016. Fostering entrepreneurship and innovation through a biomedical technology PhD program in Australia. International Journal of Engineering Education, 32(3): 1222-1235.

Thune, T., 2010. The training of "triple helix workers"? Doctoral students in university–industry–government collaborations. Minerva, 48(4): 463-483.Available at: https://doi.org/10.1007/s11024-010-9158-7.

Tuning Educational in Europe, 2003. Gonzalez, J., Wagenaar, R. (Eds), Finale Report. Phase One. University of Deusto, University of Groningen.

Valūnaitė, O.G., A. Puksas, D. Gulbinskienė and L. Mockienė, 2019. Student experience on the development of transversal skills in university studies. Pedagogy, 133(1): 63–77.Available at: https://doi.org/10.15823/p.2019.133.4.

Wagner, T., 2012. Educating the next steve jobs. The Wall Street Journal, April 13. Available from https://www.wsj.com/articles/SB10001424052702304444604577337790086673050.