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The role of project-based learning in the training of future officers

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O papel da aprendizagem baseada em projetos na formação de futuros oficiais

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El papel del aprendizaje basado en proyectos en la formación de futuros funcionarios

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Abstract: *The article aims to identify project technologies' effectiveness in forming future officers' professional competence. Testing and a formative experiment were used as the research methods. The study was conducted with cadets of military educational institutions. Each project consisted of organizational, motivational, research and final stages, which included reflection on the acquired knowledge. Typical trends in the transformation of professional competence in military education were identified. The project-based learning method has been found to contribute to forming the communicative, managerial, motivational, and cognitive components of future officers' professional competence. This method was least effective for forming the emotional and volitional components of future officers' competence. In general, the research hypothesis about the effectiveness of the project method in training future officers was partially confirmed. The hypothesis about the dependence of the effectiveness of the project method on the course of study in future officers' training was fully confirmed. The results can be used to improve the effectiveness of educational programs for training future officers. Further prospects for the research are to study the relationship between the project method's effectiveness and students' psychological characteristics.*

Keywords: *Learning methods. Military education. Professional training. Project-based learning. Project method*

Resumo: O artigo tem como objetivo identificar a eficácia das tecnologias de projeto na formação da competência profissional dos futuros oficiais. Testes e um experimento formativo foram usados como métodos de pesquisa. O estudo foi realizado com cadetes de instituições militares de ensino. Cada projeto consistiu em etapas organizacionais,

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motivacionais, de pesquisa e finais, que incluíram a reflexão sobre os conhecimentos adquiridos. Foram identificadas tendências típicas na transformação da competência profissional na educação militar. Verificou-se que o método de aprendizado baseado em projetos contribui para formar os componentes comunicativos, gerenciais, motivacionais e cognitivos da competência profissional dos futuros oficiais. Este método foi menos eficaz para formar os componentes emocionais e volitivos da competência dos futuros oficiais. De maneira geral, a hipótese de pesquisa sobre a eficácia do método de projeto na formação de futuros oficiais foi parcialmente confirmada. A hipótese sobre a dependência da eficácia do método de projeto no curso de estudo na formação de futuros oficiais foi totalmente confirmada. Os resultados podem ser usados para melhorar a eficácia dos programas educacionais de treinamento de futuros oficiais. Outras perspectivas para a pesquisa são estudar a relação entre a eficácia do método de projeto e as características psicológicas dos alunos.

Palavras-chave: Método de projeto. Educação militar. Métodos de aprendizagem. Treinamento profissional. Aprendizagem baseada em projetos.

Resumen: *El artículo tiene como objetivo identificar la eficacia de las tecnologías de proyectos en la formación de la competencia profesional de los futuros funcionarios. Como métodos de investigación se utilizaron pruebas y un experimento formativo. El estudio se realizó con cadetes de instituciones educativas militares. Cada proyecto constó de etapas organizativas, motivacionales, de investigación y finales, que incluyeron una reflexión sobre los conocimientos adquiridos. Se identificaron tendencias típicas en la transformación de la competencia profesional en la educación militar. Se ha descubierto que el método de aprendizaje basado en proyectos contribuye a formar los componentes comunicativos, gerenciales, motivacionales y cognitivos de la competencia profesional de los futuros oficiales. Este método fue menos eficaz para formar los componentes emocionales y volitivos de la competencia de los futuros oficiales. En general, se confirmó parcialmente la hipótesis de la investigación sobre la eficacia del método de proyectos en la formación de futuros oficiales. Se confirmó plenamente la hipótesis sobre la dependencia de la eficacia del método de proyectos del plan de estudios en la formación de futuros oficiales. Los resultados pueden utilizarse para mejorar la eficacia de los programas educativos para formar a futuros oficiales. Otras perspectivas de la investigación son estudiar la relación entre la eficacia del método de proyectos y las características psicológicas de los estudiantes.*

Palabras claves: *Aprendizaje en base a proyectos. Educación Militar. Entrenamiento profesional. Métodos de aprendizaje. Método del proyecto.*

1 INTRODUCTION

A critical factor in the effectiveness of defense structures is the training of qualified personnel, especially mid-level field commanders, who can make adequate decisions quickly. It became clear in Ukraine in 2014, but the problem of highly qualified management personnel has become more acute since February 24, 2022. The full-scale aggression of the Russian Federation has determined the need to restructure the training of future officers quickly. It became apparent that the quality education of military commanders should be based on modern, scientifically proven didactic principles.

Ukraine's military education system is still under the influence of outdated pedagogical dogmas. Still, it is gradually being transformed with the best practices of the world's higher military education institutions (Uvarkina, 2022). A significant trend in military education is the digitalization of various aspects of professional training (Holth, Boe, 2019). This approach demonstrates the importance of considering modern society's requirements in the organization of the educational process. The use of problem-based learning (Johansen et al., 2021), project-based learning (Bhinder & Protsenko, 2022) and the research method (Andreas, 2022) in military education are especially effective in the training of future military personnel.

The effectiveness of the project-based method in professional training is a proven fact (Chen & Yang, 2019). Such research usually focuses on the impact of the method on student performance, professional and personal development (Lotsman *et al*., 2022), and the effectiveness of project-based learning for the formation of students' motivational spheres and self-regulation (Shin, 2018; Sohmen, 2020).

The project-based method can increase learning productivity through the active exchange of knowledge between students (Almulla, 2020).

The problem of implementing the project-based method in higher education has been studied many times in scientific research. At the same time, the use of projects for training military specialists has been studied little. In particular, the issues of developing and testing specific didactic programmers of project-based learning, depending on the year of study of cadets of military educational institutions, need further clarification. This research focuses on solving current social, theoretical, and practical problems.

The study aims to identify the effectiveness of using project technologies for the formation of future officers' professional competence.

Research objectives:

to determine the specifics of the development of components of future officers' professional competence depending on the course of study;

develop and test a system of project-based learning as a means of training future officers;

to determine the impact of project-based learning on the formation of various components of cadets' professional competence.

2 LITERATURE REVIEW

The project method is aimed at creating a specific product by students based on clear guidelines, i.e. a specific task setting (Guo et al., 2020). The basis of this method is students' independent work The use of projects in learning involves the active position of students and their autonomy, research activities, precise goal setting, productive communication, and focus on internship (Kokotsaki *et al.,* 2016). Other researchers share similar views (Krajcik & Shin, 2014), emphasizing that an essential aspect of project-based learning is summarizing and presenting the results. Evaluation of project results requires a clear system of criteria (Efendi, 2023). It is essential to focus the project method on the needs of students (Kiong *et al*., 2022). Depending on the specifics of the learning activity, different types of projects are distinguished: research, creative, role-playing, informational and practice-oriented (Tadeush, 2017).

One of the main advantages of the project method is its focus on developing teamwork skills (Viro *et al*., 2020). Project-based learning involves group differentiation by functional roles, such as critics and analysts (Ivanova et al., 2021).

The positive impact of projects on the development of a student's personality has been scientifically proven. For example, the project method develops critical thinking and the ability to formulate questions (Sasson *et al.,* 2018), determines the productive transfer of acquired practical skills to real life (Hasni *et al.,* 2016), and develops students' leadership skills (Tyurina *et al.,* 2022).

However, despite the positive aspects of using the project method, there are a few problems with its practical implementation. These difficulties relate to feedback, goal setting by students, adequate mastery of the theoretical content of the course, and the integrity of the educational process (Markula, Aksela, 2022). The use of so-called driving questions, i.e., questions that stimulate students' cognitive activity, is problematic as well, as about half of the teachers surveyed simply ignore this aspect of project design (Haatainen, Aksela, 2021). There are difficulties with the implementation of critical analysis of the project problem (Mentzer et al., 2017). It's difficult to assess the effectiveness of the project method due to a lack of clear criteria for distinguishing project-based learning from other educational tools, such as problem-based learning (Condliffe *et al*., 2017).

The main components of future officers' training are the aim and purpose of the educational programme and its every course; scientifically based knowledge; practical knowledge; theoretical and practical use of the acquired knowledge with further reflection (Hedlund, 2019). An important condition for the training of future officers is to ensure the logic of the material presentation, consider the specifics of professional training, implement the principle of comprehensiveness, and strengthen

interdisciplinary links (Kolisnyk *et al*., 2020). All these components are closely interrelated and determine the didactic effect.

The use of the project method helps to increase the cadets' active participation in the educational process (Geir, Rino Bandlitz, 2020) and is effective in teaching philological disciplines in military educational institutions (Dragomir et al., 2019). The implementation of the project method in future officers' training involves the division into argumentative, search, technological and final stages (Bhinder, Protsenko, 2022).

The analysis of theoretical sources proves that the problem of the project method in higher education is quite relevant. There are theoretical studies that examine the specifics of using projects in future officers' training. At the same time, further study of the problem requires organizing, conducting, and analyzing the data of formative experiments.

3 METHODS AND MATERIALS

3.1 RESEARCH STAGES

The experiment took place between November 2022 and April 2023 and involved the implementation of an experimental programme based on a theoretically grounded project method to develop future officers' professional competence. In the samples, 3-4 projects were implemented in accordance with the topics of the silabus and the curricula of a particular specialty. The topics of the projects were chosen in accordance with the content of the curricula. Each project included an organizational stage – choosing a topic, informing students about the specifics of the activity; motivational – stimulating cognitive activity, setting up problem situations; research – a thorough study of the topic, practical implementation of project tasks, communication with the teacher; presentation of results; summing up the results with mandatory reflection. These stages overlapped in the educational process. The experiment plan included primary diagnostics (november 2022) and secondary diagnostics (April-May 2023) in the experimental and control groups. Quantitative analysis, data interpretation and summarization were carried out in May-June 2023.

The experimental impact was aimed at future officers' professional competence. The theoretical analysis allowed us to identify the following structural components of cadets' professional competence: motivational, cognitive, communicative, managerial, emotional, and volitional (Biliavets, 2017). It should be noted that we have proposed the allocation of the emotional and volitional components of professional competence as an important psychological component for the successful implementation of professional activities.

3.2 RESEARCH TOOLS

Based on the literature review, through testing, we have identified a set of methods aimed at diagnosing the indicators of future officers' professional competence (Kokun et al., 2012). The methodology for assessing communicative and organizational aptitudes by V. V. Sinyavskyi and B.A. Fedorishyn is aimed at studying the communicative and managerial components. T. Ehlers' methodology for diagnosing personality motivation for success allowed us to find out the indicators of the motivational component of professional competence. The use of a questionnaire for studying volitional self-control was aimed at testing the emotional and volitional component of cadets' professional competence. The tests for checking the cognitive component were created based on the content of particular courses and the specifics of the cadets' training in general. The validity and reliability of the selected methods were verified by their repeated use, as well as by expert evaluation (test for determining the cognitive component).

The sample was formed based on students of the following higher education institutions of Ukraine: Lviv State University of Life Safety (Lviv), Bohdan Khmelnytskyi National Academy of the State Border Guard Service of Ukraine (Khmelnytskyi), Kharkiv National University of Internal Affairs (Kharkiv). The different specializations of the educational institutions allow us

to increase the representativeness of the research conducted. The following samples were created to test the hypothesis and achieve the research goal: a control group of first- and second-year students (88 people); an experimental group of first- and second-year students (92 people); a control group of graduate students (79 people); an experimental group of graduate students (85 people). The total number of participants in the formative experiment was 344 cadets. The authors of the article were the experimenters.

Data collection and implementation of the experimental strategy were carried out through direct communication. The students from the research samples took the experimental tasks quite responsibly. Occasional conflict situations within the samples were recorded. No confrontations with the experimenters were observed.

Data were analyzed by calculating the percentages and Student's t-test using SPSS.22 software. The Kolmogorov-Smirnov test was used to determine the correctness of the significance criteria. To unify the data obtained, the levels of the studied characteristics were reduced to a scale: high, above average, average, and low.

Ethical criteria were met by ensuring confidentiality, humanism, and a positive perception of the individual. All the students gave consent to participate in the research programme.

4 RESULTS

The data obtained during the formative experiment are presented in Table 1 and Table 2. Let us analyses the dynamics of each component of the professional competence of first- and second-year students-future officers.

Table 1 – Changes in the formation of components of future officers' professional competence under the influence of the experimental programme (1-2 years of study)

Components of professional competence	Levels of competence formation	Number of students surveyed							
		Control group				Experimental group			
		Before influence		After influence		Before influence		After influence	
		%	Quantity	%	Quantity	%	Quantity	%	Quantity
Communication component	Low	3,41	3	5,68	5	6,52	6	5,43	5
	Average	36,36	32	35,23	31	32,61	30	11,96	11
	Above average	38,65	34	37,51	33	38,04	35	31,52	29
	High	21,58	19	21,58	19	22,83	21	51,09	47
Management component	Low	2,27	2	2,27	2	4,35	4	4,35	4
	Average	44,32	39	42,05	37	44,57	41	32,61	30
	Above average	36,36	32	38,63	34	33,7	31	26,08	24
	High	17,05	15	17,05	15	17,38	16	36,96	34

Motivational component	Low	2,27	2	2,27	2	3,26	3	3,26	3
	Average	54,55	48	54,55	48	53,26	49	50	46
	Above average	37,5	33	38,63	34	38,05	35	40,22	37
	High	5,68	5	4,55	4	5,43	5	6,52	6
Cognitive component	Low	21,58	19	11,36	10	22,83	21	4,35	4
	Average	44,32	39	28,41	25	57,61	39	7,61	7
	Above average	21,58	19	45,45	40	21,74	20	34,78	32
	High	12,52	11	14,78	13	13,04	12	53,26	49
Emotional and volitional component	Low	6,82	6	6,82	6	5,43	5	5,34	5
	Average	35,23	31	31,81	28	35,87	33	33,7	31
	Above average	40,9	36	44,32	39	40,22	37	41,31	38
	High	17,05	15	17,05	15	18,48	17	19,65	18

Source: Developed by the authors (2023).

At the beginning of the study, first- and second-year students had average and above-average indicators of communicative skills. A high level was recorded in about a fifth of the respondents. The low level is represented minimally. No significant changes were recorded in the control sample after implementing the project-based learning programme. Repeated diagnostics in the experimental group of future officers showed that the number of people with average scores decreased by 20.65%. The percentage of people with high indicators of communicative skills increased by 28.26%.

The cadets' managerial component is somewhat less developed than the communication component. At the same time, there is again a predominance of average and above-average levels. In the control group, the indicators remained statistically stable after implementing the project technology. In the experimental group, the proportion of cadets with a high level of organizational skills increased by 19.58%, while the number of students with average decreased by 11.96%, and those with the above-average level decreased by 7.62%. The results indicate the project method's effectiveness in forming the communicative and managerial component of cadets' professional competence.

High and low levels of the motivational component are minimal. About half of the studied cadets showed the average level, and 40 % – the above-average level. Changes in the control and experimental samples after the experiment are insignificant (2-3 %). The results obtained prove the lack of effectiveness of the developed programme regarding the formation of the motivational component.

The first- and second-year cadets have medium levels of the cognitive component, i.e., basic knowledge of the speciality, as this knowledge only forms at the beginning of studies. Positive changes were recorded in both groups. In the control group, the low level decreased by 10.22%, the average level by 15.91%, and the above-average level increased by 23.87%. In the experimental group of future officers, low values decreased in 18.48% of students, average values decreased in 50.06%, above average values increased in 13.04%, and high values increased in 40.22%. Consequently, the experimental group performed better. It can be concluded that project-based learning has a practical impact on acquiring ideas about professional activities by future officers.

The results of the emotional and volitional components are similar to the results of the diagnostics of the previous parameters, namely,

average, and above-average indicators dominate. After implementing the formative impact, no significant changes were recorded in both study groups.

Table 2 – Changes in the formation of components of future officers' professional competence under the influence of the experimental programme (final year of study)

Components of professional competence	Levels of competence formation	Number of students surveyed							
		Control group				Control group			
		Before influence		Before influence		Before influence		Before influence	
		%	Quantity	%	Quantity	%	Quantity	%	Quantity
Communication component	Low	24,05	19	24,05	19	21,18	18	7,06	6
	Average	26,58	21	26,58	21	28,24	24	17,65	15
	Above average	45,57	36	45,57	36	45,88	39	49,41	43
	High	3,8	3	3,8	3	4,7	4	24,7	21
Management component	Low	1,27	1	1,27	1	2,35	2	1,18	1
	Average	16,46	13	13,92	11	17,65	15	18,83	16
	Above average	53,16	42	50,63	40	52,94	45	51,76	44
	High	29,11	23	34,18	27	27,09	23	28,23	24
Motivational component	Low	0	0	0	0	1,18	1	1,18	1
	Average	55,7	44	51,9	41	52,94	45	29,41	25
	Above average	44,3	35	48,1	38	43,53	37	49,41	42
	High	0	0	0	0	2,35	2	20	17
Cognitive component	Low	8,86	7	2,53	2	9,41	8	9,41	8
	Average	22,78	18	13,92	11	24,7	21	23,53	20
	Above average	49,37	39	43,04	34	47,06	40	51,77	41
	High	18,99	15	40,5	32	18,83	16	18,83	16
Emotional and volitional component	Low	24,05	19	22,78	18	20	17	17,65	15
	Average	36,7	29	37,97	30	37,65	32	40	34
	Above average	7,59	6	7,59	6	11,76	10	11,76	10
	High	31,66	25	31,66	25	30,59	26	30,59	26

Source: Developed by the authors (2023).

The results of the formative experiment on the sample of future officers in their final year of study are presented in Table 2. The cadets mainly showed higher-than-average indicators of communicative skills. Low and average indicators are approximately equal. After the experiment, the indicators of the control sample remained practically unchanged. In the experimental sample, after implementing the project-based learning programme, low values decreased in 14.12% of cadets and medium values in 10.59% of the students. A high level was observed in one-fifth of the respondents after the programme implementation, proving the project method's effectiveness.

In the sample of graduates, high and above-average indicators of the managerial component of future officers' professional competence prevail. In the control and experimental samples, the indicators of organizational skills did not change significantly after the project-based learning programme.

The average and above-average levels prevail in the studied samples of graduate cadets. After the formative experiment, the results in the control sample did not change. In the experimental group, the share of the average level decreased by 23.53%. High levels of motivation to succeed increased in 17.65% of students. The results indicate the effectiveness of the project method for developing the motivational component of the graduate student's professional competence.

The most pronounced are the above-average indicators of the cognitive component in the study sample of military graduates. High indicators in the control sample increased by 21.51 % after the experiment. In the experimental sample, the results did not change significantly. In other words, the project method did not stimulate the improvement of the academic training of graduate students. At the same time, traditional educational forms have demonstrated effectiveness.

Average and high indicators of professional competence's emotional and volitional components prevail. After implementing the experimental programme of project-based learning, the results did not change significantly.

To clarify the results obtained, the Student's t-test was used. Using the Kolmogorov-Smirnov criterion justifies the expediency of calculating this particular statistical procedure. The results of the calculation are presented in Table 3. As seen, statistically significant differences were recorded in the experimental group of 1–2-year cadets regarding communicative and organizational skills and the cognitive component. In both control groups, statistically significant changes were found only in the cognitive component. In the experimental group of final-year students, statistical changes were found in terms of communicative skills and motivation to succeed.

Table 3- Student's t-test value of future officers' professional competence (based on the results of the formative experiment)

Components of professional competence	**Student's t-test**			
	Control group (1-2 years of study)	**Experimental group (1-2 years of study)**	**Control group (final year of study)**	**Experimental group (final year of study)**
Communication component	1,347	2,939**	1,232	2,454*
Management component	1,544	2,278*	1,338	1,229
Motivational component	1,694	1,113	1,667	2,333*
Cognitive component	2,349*	3,012**	2,448*	1,239
Emotional and volitional component	1,775	1,299	1,322	1,561

Source: Developed by the authors (2023).

Hence, the developed project-based learning programme demonstrated partial effectiveness in influencing the professional competence of future officers.

5 DISCUSSION

The results obtained allow us to confirm the improvement of the main components of professional competence. As we can see while studying at military education institutions, the managerial component is strengthened, but the indicators of communication skills are somewhat reduced. This situation can be explained by the directive nature of the military speciality and the focus on rigid ways of behaving with subordinates. The motivation to succeed maintains stability while studying at military educational institutions. Indicators of the cognitive component of professional competence improve during studying at the educational institution. Future officers' emotional and volitional indicators improve in graduate cadets compared to the beginning of their studies. It can be said that traditional forms of education positively impact the preparation of future processes, but this process is significantly extended.

Testing the effectiveness of the project-based method in training future officers has yielded mixed results. In the first years of study, project-based learning effectively forms communicative, managerial, and cognitive components. At the same time, the sample of final-year students shows a positive impact of projects on the indicators of the communicative and motivational components of cadets' professional competence. The experimental programme did not demonstrate effectiveness in developing the emotional and volitional component, which is consistent with the results of other researchers (Tyurina et al., 2022).

Let's analyse the results obtained in the context of the findings of other researchers. The problem of forming theoretical knowledge in project-based learning has already been studied by researchers (Markula , Aksela, 2022). However, the effectiveness of the project method in forming motivation cannot be unequivocally stated (Sohmen, 2020). The positive impact of the method on increasing cadets' active participation in learning has not been proved either (Geir, Rino Bandlitz, 2020). The effectiveness of using the project method to develop self-regulation has not been confirmed (Shin, 2018). The specifics of professional training in military educational institutions can explain the contradictory results.

It is advisable to determine the specifics of the implementation of the project method in accordance with theoretical sources. We found the importance of clear evaluation criteria manifested in summing up the results (Efendi, 2023). In addition, we tried to consider students' needs through introductory conversations (Kiong et al., 2022). We agree with the statement about presenting results in project-based learning (Krajcik & Shin, 2014) and the importance of reflection in military training (Hedlund, 2019). The division of working group participants according to functional roles was productive (Ivanova et al., 2021). Our study used the typical stages of the project method in military education (Bhinder, Protsenko, 2022).

The results generally confirm the feasibility of using the project method in training future officers. At the same time, analyzing theoretical sources will improve the developed didactic programmes.

5.1 LIMITATIONS

Potentially, more accurate results can be obtained by using an expanded set of diagnostic methods to study the components of professional competence. The experimental use of projects may differ from the results of their implementation in some educational conditions.

6 CONCLUSION

The relevance of the problem of using the project method in the training of future officers is determined by the social significance of effective military training, insufficient theoretical development, and practical

orientation of the study. Theoretical generalizations are made based on a formative experiment and two empirical sections. During training, the managerial component of professional competence improves, but the communication component worsens. The cognitive and emotional-volitional components of future officers' professional competence develop during professional training. The motivational component remains stable. For first-year students of military educational institutions, the project-based learning method contributes to the formation of communication skills, organizational skills, and academic knowledge.

For final-year students, the project positively affects cadets' professional competence's communicative and motivational components. The project method is the least effective for forming cadets' professional competence's emotional and volitional components. The results obtained create a basis for optimizing educational programmes for future officers. The project method is appropriate for forming future officers' communication managerial skills, which can be recorded in the relevant software. The data on the levels of future officers' professional competence and the partial effectiveness of project-based learning will allow for individualizing the educational approach. Further prospects for research are to study the relationship between the use of the project method and the psychological and social characteristics of future officers.

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