

Use of Computer Information Technologies in the Training of Border Guards of Specialty "Telecommunications and Radio Engineering"

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Abstract: Experience shows that the use of computer and information technology in the study of border guard cadets of general technical disciplines increases the share of independent work and activation of cadets, has a positive effect on the formation of their technical thinking, and imagery of certain phenomena and processes in memory enriches the perception of educational material and its technical understanding. As practice has shown, this type of lesson as a practical lesson is a form of independent cadet activity. Performing a practical task, cadets actively operate with the acquired knowledge, skills and abilities, carry out search activities. The research was carried out on the example of conducting a practical lesson with border guards of specialty "Telecommunications and Radio engineering" using a graphical editor Microsoft Office Visio. The purpose of this lesson was to combine cadets' graphic work on the construction of basic electrical radio products on the plane using computer technology and maintaining active cadet intervention in the process of creating basic electrical circuits directly on the personal computer screen. The use of computer and information technologies in teaching of border guard cadets of general technical disciplines opens the possibility of using a personal computer as a means of improving the educational process in higher military education and the formation of technical skills, promotes the development of technical thinking, professional imagination.

Keywords: technical thinking, professional imagination, computer and information technologies, general technical disciplines, graphic editor Microsoft Visio, border guard cadet.

1. Introduction

Formulation of the problem. In recent years, the Ministry of Education and Science of Ukraine has taken a number of measures to create a new national legal framework for higher education. The state national program "Education. Ukraine of the XXI Century" is expected to improve the system of higher education, improve the quality of professional training. The XXI century outlined a new task of systematic renewal of education, the implementation of comprehensive changes not only in content but also in forms and methods of teaching. They are based, among other things, on modern computer and information technologies that can increase the efficiency of subjects and provide training for a specialist who can quickly acquire the necessary knowledge and perform complex analytical work "One of the main factors in the reliability of border protection has always been the level of its engineering and technical support" (Demyanyuk, Pidgaychuk, 2016). "Training of future border of engineers at the National Academy of the State Border Guard Service of Ukraine (NASBGSU) involves the formation of cadets not only high general educational, cultural level, but also quality professional knowledge

and skills" (Matokhniuk, 2006). Generalization of information about information competence of the individual gives grounds to define it as the orientation of the individual to ensure the effectiveness of life in the information society, which is an integral quality of personality, a holistic, dynamic system of personal abilities that allow consciously and creatively define and carry out their professional (professional) activities (Maksymenko, Matokhniuk, 2020).

When training highly qualified specialists for various types of military, engineering and science activities, it is necessary to ensure the appropriate level of their general technical training. This is due to the fact that general technical disciplines have ample opportunities to ensure the development of technical thinking, technical and spatial imagination, algorithmic culture, the formation of skills to establish cause-and-effect relationships, substantiate statements, model situations and more.

Modern means of computer technology allow implementing all the advanced pedagogical ideas, approaches, concepts that focus on the formation of creative personality, the development of personal mechanisms of adaptation to social conditions, willingness and ability to improve their professional activities. This is due to the fact that there is a real opportunity to build a learning process in the cadet-teacher system, where the mediator is modern means of computer information technology, which allows you to individualize learning and provide continuous feedback. Improving the quality of the educational process through the use of a personal computer for training has become one of the important areas in the study of general technical disciplines.

2. General Background of research

Analysis of research and publications. The problems of scientific substantiation of forms of education, which really have the opportunity to increase the effectiveness, efficiency of education and training, positive impact on personal development and professional development are given considerable attention by leading experts in pedagogy and psychology (Gushuley, 2000; Borovyk et al., 2020).

L. Borovik, K. Demyanyuk, L. Matokhnyuk, S. Pidhaichuk considered in their works the disclosure of the visual-content component of the model of professional imagination formation in frontier cadets, coverage of issues of teaching technical disciplines, which are a direct tool for development of cadets' professional imagination V. Shevchuk and others (Borovyk et al., 2020). In the works of K. Demyanyuk, L. Matokhnyuk it is noted that in the process of mental activity, with its technical orientation, there is a complex transformation of images and cadets form a technical imagination by creating, generalizing and operating technical images. It is these abilities that provide flexibility in the application of existing generalizations in the technical professional activity of a military specialist (Matokhniuk, Demyanyuk, 2019). At the present stage of development of science and technology has accumulated significant positive experience in the field of vocational training on the formation of general technical knowledge in different types of educational institutions" (Matokhniuk, Valchuk, Maksymenko, Palimaka, 2020).

Today, many information resources are accumulated in electronic form in higher military educational institutions, but the existing examples of the use of computer technology are presented in fragments, there is no clearly formed methodological system of practical application of existing developments.

The purpose of this work is the use of computer information technology in the study of border guard cadets of general technical disciplines to develop skills of graphic construction of models and rules of execution and reading of drawings in the field of electronics and telecommunications.

In the work of Gushuley J. M it is noted: "The interest of domestic teachers in technical training of schoolchildren increased in the early 90s. The main ways of studying technology in the practice of secondary schools have been identified. This approach to the organization of the educational process allows devoting 80% of time to productive work of students and creating favorable conditions for the implementation of basic tasks of labor training in education "Technology" (Gushuley, 2000). According to Trofimov Y. "History of psychology considers the formation of psychological categories and concepts throughout the existence of scientific psychology, the history of psychological research at different times in different schools and prospects for the development of psychology as a science", which indicates the features of interdisciplinary human-technical relations (Trofimov, 1989).

In "Psychology of Creativity" Roments V. presents an analysis of the formation and identification of creative abilities of man at different stages of his path to personal maturity (Romanets, 2000).

Summarizing the results of scientific research in the works of psychologists, it can be argued that the technical understanding of the educational material is formed in the process of solving technical problems. Curricula in the disciplines of the general technical cycle for border cadets are designed in accordance with the requirements of the Bologna Process, which in turn must be accompanied by appropriate methodological support with the introduction of new computer and information technologies. At the same time, the course material should be redistributed between the information bank of the discipline and the relevant textbooks. The progress of science and the oversaturation of its information field have led to the fact that the number of hours devoted to the study of general technical disciplines is steadily declining. Therefore, today we can talk about the study of these sciences only at the level of their conceptual apparatus. This, firstly, causes high requirements for

the correctness and expressiveness of the formulation of concepts and, secondly, requires a change in the technology of learning. There is a need to move from a sectoral form of teaching material (in which the material is taught in sections of this course) to concentric (in which new concepts and definitions are presented as they arise). However, the issue of practical recommendations for the application of the obtained new scientific results is not sufficiently covered today.

3. Methodology of Research

The experimental base was the National Academy of the State Border Guard Service of Ukraine named after Bohdan Khmelnytskyi. The research was conducted on the materials of the discipline "Engineering and Computer Graphics" using the graphic editor Microsoft Office Visio. The sample consisted of a total of 23 first-year cadets, future engineers - border guards. The study was conducted during the first year of study and assessed the level of technical thinking.

To achieve this goal, the following tasks are identified:

1. Conduct a theoretical analysis of the development of technical thinking in cadets by means of computer technology and their impact on the identity of a specialist border engineer.
2. Identify the features of the development of technical thinking in border cadets in the study of the discipline "Engineering and Computer Graphics".
3. Prove that as a result of using the graphic editor Microsoft Office Visio and the concentric method of teaching the discipline there were significant changes in the levels of development of technical thinking, which were measured.

A set of interrelated methods was used to solve the tasks and achieve the goal of the study.

To perform the first task, the scientific and methodological literature was processed and analyzed.

The second task involved comparison, generalization, systematization of experience in organizing the study of the discipline "Engineering and Computer Graphics".

To perform the third task, the Bennett test and the assessment of the reliability of the shift in the values of the level of technical thinking using the G - criterion of signs.

The purpose of the experiment: to analyze the levels of technical thinking before and after the experimental impact in a group of cadets of engineers after studying the discipline "Engineering and Computer Graphics" was using a graphical editor Microsoft Office Visio.

The hypothesis of the experiment is that the use of the graphics editor Microsoft Office Visio will promote the development of cadets' technical thinking, namely the ability to read drawings, understand the diagrams of technical devices and their work, solve the simplest technical problems. In addition, the electronic environment will provide the formation of such characteristics as the propensity to experiment, flexibility, coherence, structure, cognitive activity, independence, increasing interest in the discipline being studied. To confirm the hypothesis of the experiment, the following methods were used: Bennett's test and G - sign criterion.

4. Results of Research

In the conditions of the National Academy of the State Border Guard Service of Ukraine (NASBGSU) at the Faculty of Engineering and Technology students are provided with education in the specialty "Telecommunications and Radio Engineering". This educational program is focused on the formation of professional competencies of cadets in the field of electronics and telecommunications, which are aimed at the ability to solve specialized problems of design and operation of telecommunications systems and communications, as well as competencies needed to address pressing border protection at the tactical level. The emphasis is on the ability of cadets to perform development, technical design, operation and maintenance of electronic devices and telecommunications systems. Sectoral method of teaching, it is not hasty, but thorough - a classic method, the high efficiency of which is proven over time. At the same time, the advantages of the concentric method are: accelerated study by cadets of the lecture material of the course, necessary for practical classes at the initial stage of training; the ability to study the entire course while reducing the number of hours per discipline in the curriculum. However, there are disadvantages of this method: a) the need for students to memorize concepts and definitions, the content of most of which becomes clear only after a certain period of study; shallow study of the material and quickly "fading" knowledge that remains with the cadets.

The analysis of the current state of training of cadets in the conditions of NASBGSU shows that in recent years there has been a significant reduction in the number of teaching hours for the study of general technical disciplines. At the same time, the content of the traditional course of disciplines remained unchanged. Naturally, for the allotted number of hours it is impossible to provide a thorough study during lectures, practical and laboratory classes of this content. This reduction in teaching hours occurred in all disciplines of the general technical cycle. This has led to a significant increase in the amount of material for independent work of cadets, and in fact cadets are not able to perform such a volume.

Appropriate changes in the curriculum encourage the need to find ways to improve the quality of general technical training of border cadets. One of such ways is the use of modern computer and information

technologies in the teaching of general technical disciplines. We confirm L. Matokhnyuk's opinion that "professional training of military specialists in engineering specialties should be balanced, skillfully and carefully worked out at all stages of knowledge, should take into account the peculiarities of their training, so there is special attention of Ukrainian military psychologists to the training of future officers" (Matokhniuk, 2007).

In recent years, the use of a personal computer in the teaching of various subjects has become commonplace. It has become a powerful tool in the hands of scientists and allows you to solve complex problems, model and study various processes and more. With the advent of special software, a graphic editor there was a problem of developing new forms and methods of organizing the study of general technical disciplines.

Computers as teaching aids perform the following didactic functions: they are a visual means of presenting material. These are powerful electronic directories that contain a significant amount of information; they have a flawless design (color high-quality illustrations, hypertext help system, intuitive interface); include several types of help content (index, by context), which facilitates the rapid search for information; have animated examples; can have audio and video accompaniment; allow you to prepare visual classes, have the opportunity to update material from the Internet; is a powerful tool for solving practical technical problems. The use of graphic editors saves the time required for calculations, and this allows you to increase the number of tasks for self-solution, explore more complex models, analyze in-depth options and promote the development of practical skills.

All types of computer information technology have a fairly powerful arsenal of problem-solving tools, equipped with a large number of built-in functions, means of symbolic transformations, visualization, animation, graphic editors and more. They have a single purpose: to automate the process of solving technical problems and get the end result in numerical, formulaic, graphical forms, to free the user from unproductive time. Computer programs for educational purposes can be classified by types as follows: computer textbooks; subject-oriented environments (microworlds modeling programs, learning packages); laboratory workshops; simulator programs; control programs; directories, databases for educational purposes. These programs are primarily used by scientists and engineers to automate calculations and to visualize the studied processes. At the same time, many practicing teachers use computer support programs in teaching their disciplines. In the works of Borovik L., Demyanyuk K., Matokhnyuk L. it is established that "The combination of graphic work on the plane as a means of teaching engineering graphics with methods of using computer technology and maintaining active cadet intervention in the process of creating three-dimensional images directly on the computer screen contributes to the formation of professional imagination as a necessary intellectual quality at the stage of improving the professional and moral and psychological support of the future engineer" (Borovyk et al., 2020).

Conducting classes in general technical disciplines, in particular in the discipline of "Engineering and Computer Graphics" (ECG), the teacher aims not only to prove the material, but also to develop students' observation, attention and concentration, to teach initiative and perseverance, develop an understanding of the importance of teamwork and respect for their peers. The discipline "ECG" creates a basis for the integration of knowledge in close connection with computer science, so an effective means of this process is computer support for the teaching of general technical disciplines. The teacher's task is to prove that computer software is a tool that requires cadets to have appropriate general technical training: knowledge of engineering graphics; formation of applied skills; ability to formalize applied problems in the form of technical models; ability to interpret the obtained results; availability of skills to build and study models of real practical tasks.

One of the most common tools for creating a variety of diagrams, drawings, drawings, network models, graphs, charts is a graphical editor Microsoft Office Visio. The Visio package was created by ShapeWare Corporation and is used to draw technical diagrams and charts on personal computers. Due to the easy-to-learn interface and application of the basic principle of MS Windows - drag and drop (move and release), the graphic editor Microsoft Visio is widely used when studying cadets-border guards of general technical disciplines.

One of the standard programs for Windows is Visio, so the technology, menu content, composition of toolbars, the purpose of the main «hot keys» is similar. This editor has a user-friendly and easy-to-learn interface, requires relatively little computer resources, includes a wide range of effective tools for cadets to work with vector images and has excellent capabilities for including Visio objects in electronic documents.

The Visio package allows keeping the uniform technology in the approach to preparation of the visual large-format documentation (posters, drawings), schemes for performance by cadets of the explanatory note of the course project or the diploma work. In a Visio document, cadets also insert any learning material created in other standard programs (text, pictures, photographs, formulas, diagrams, diagrams), and then combine them into a single scheme. Cadets quickly build diagrams using the editor's built-in stencils library, which focuses on a variety of applications. From the library, the cadet selects the desired stencil, transfers the necessary blocks from it to his document, and then reproduces them, scales, moves, connects with lines and arrows, provides inscriptions. In addition, in Visio cadets create author's stencils, templates of entire documents, which allow the cadet to expand the library according to their needs, to create their own libraries.

It should be noted that the main types of classes in general technical disciplines are: lectures, seminars, group exercises and classes, laboratory and practical classes, independent classes under the guidance of a teacher, course and diploma works (projects), tests, consultations, independent and individual work of cadets.

The learning environment, which can be defined as "a set of those who teach and those who are taught", to some extent performs several functions: first, it gives the cadet the necessary theoretical knowledge (lectures); secondly, forms and develops skills important for the future specialty (this is facilitated by practical, laboratory classes, various types of regulated independent work: calculation and graphic works, calculation and practical works); thirdly, lays the foundation for the necessary skills inherent in professional activities (term papers, thesis design); fourth, develops professionally important personality qualities (independence, professional communication, general culture, intellect, technical thinking, technical imagination, creativity, etc.).

The purpose of practical classes in the discipline "ECG" is a detailed study of theoretical issues, as well as improving skills in accordance with state standards and rules of drawing, perform and read the basic, structural, functional electrical diagrams and symbols of elements to them. In these classes, cadets, first of all, consider such tasks that allow you to more fully and deeply reveal the essence of the basic patterns and relationships in the formation of their technical skills. Thus, in a practical lesson on "Rules of execution and reading of electrical schematics using a graphical editor Microsoft Office Visio" cadets perform an individual task to draw a schematic electrical diagram of the receiver. Using multimedia software, the teacher has the opportunity for students to focus on explaining the interface of the graphics editor (Figure 1).

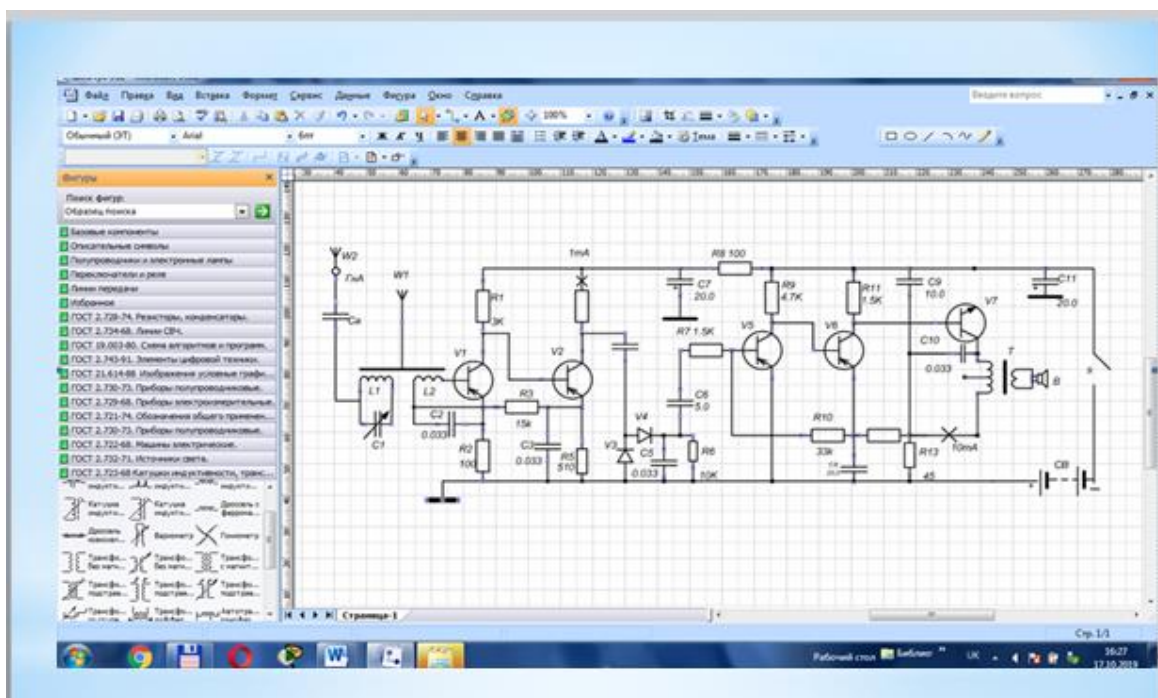


Figure 1. Schematic electrical diagram of the receiver

It also allows the teacher to spend training time sparingly, to develop cadets' technical thinking, observation, attention and concentration, which is a key component of acquiring technical skills important for the qualities of the future border guard.

Diagrams and charts in the Microsoft Office Visio graphics editor are visually created by cadets on a sheet of paper of appropriate size, displayed in one of the Visio work windows, and which they save in drawing files. Cadets build any scheme when using the Visio template and the information from the corresponding template is automatically saved in the drawing file. In addition, each drawing file has its own set of stencils, which contains a description of all the elements that cadets use in their scheme. By default, the drawing file is assigned a VSD extension. The main part of the schemes cadets create using the technology of "dragging" the mouse stencils (graphic images of circuit elements according to the requirements of the State Standards of Ukraine) from the library to the desired location of the scheme. Cadets cross out non-standard figures with the help of the selected pointer on the toolbar. They then connect the shapes with lines or automatically (by calling ready-made connectors from the library) and enter text into them using a set of fonts that are part of Windows. Thus, to create a scheme, cadets turn to a library of stencils or templates and use drawing pointers.

In-depth study by cadets-border guards of the State Standards of Ukraine (SSU) on construction of schemes, images of radio engineering elements and study of the principle of their work on real objects with the use of

virtual measuring devices prepares the future border guard for conflict-free entry into the world of information computer technologies work, bring it closer to research. Cadets acquire skills in the use of modern measuring instruments and complexes, design and research of electrical circuits of radio products, their components in software environments. It is possible to conduct a deeper analysis of the data and a qualitatively new development of methods and laws of radio engineering. In a short period of time, cadets can creatively test, comprehend and learn important for understanding the laws, associatively connect a real radio device and its model analogues. The future border guard officer should not only be well versed in modern computer and information technologies, but also apply them in his professional activity. Confirmation of the research is the work of R. Silin, V. Hayetsky "SolidWorks Education Edition software covers a significant part of training courses in the training of mechanical engineers, which allows you to build a learning process in the form of continuous computer training at a high level" (Trofimov, 1989).

The pedagogical study, which was conducted in the study group during the study period, studied the effectiveness of the graphical editor Microsoft Office Visio and its impact on the level of technical thinking. According to the results of the pilot study, a group of 23 cadets was selected. Bennett's test was used to assess the level of development of technical thinking. It is necessary to check whether the shift of values of indicators of level of development of technical thinking at cadets is reliable. The evaluation results are presented in table 1.

Table 1. The results of the study of the level of technical thinking at the beginning and end of the experiment in the educational group of cadets according to the method of Bennett

№ s/n	Start	End	Offset
1	26	28	2
2	30	33	3
3	33	33	0
4	28	30	2
5	24	28	4
6	27	27	0
7	26	27	1
8	25	24	-1
9	24	26	2
10	20	19	-1
11	26	27	1
12	28	33	5
13	27	26	-1
14	29	30	1
15	27	26	-1
16	23	23	0
17	39	42	3
18	30	33	3
19	34	36	2
20	36	36	0
21	38	39	1
22	42	42	0
23	44	44	0

We formulate statistical hypotheses:

H_0 : The shift towards a higher level of technical thinking of cadets in the group is accidental;

H_1 : The shift towards a higher level of technical thinking of cadets in the group is not accidental.

In order to accept one of the hypotheses, we first count the number of positive, negative and zero shifts in the group (Table 2).

Table 2. Calculation of the number of positive, negative and zero shifts in the group

Landslides in groups	Group
Positive	19
Negative	3
Zero	1
Sum	23

We take into account only positive and negative shifts. In this case, the number of values of participants in the group will decrease by the number of rejected zero offsets. Thus, for the p_0-p group the number of cadets

is $n=22$. The typical shift is positive. Atypical shift is negative. Negative shifts 3, therefore $G_{em} = 3$ (number of negative shifts). According to the table of critical values we determine the critical values of the criterion of signs G_{kp} .

$$G_{em} = \begin{cases} 6, & \text{if } p \leq 0,05 \\ 5, & \text{if } p \leq 0,01 \end{cases}$$

Draw the appropriate values on the axis and draw a conclusion (Figure 2).

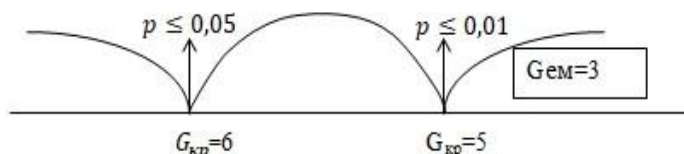


Figure 2. The rule of acceptance and rejection of the statistical hypothesis

If $G_{em} \leq G_{kp}$, then the shift in the typical direction can be considered reliable. So if $G_{em} < G_{kp}$, then the hypothesis H_1 accepted, and the hypothesis H_0 deviates. The shift towards a higher level of technical thinking in the group is not accidental, i.e. it is reliable. This confirms the feasibility of using a graphical editor Microsoft Office Visio in the educational process of cadets of future border engineers.

5. Conclusions

During classes with cadets-border guards in the discipline of general technical cycle, first of all, there is an urgent need to introduce computer technology in the training practice of cadets. It contains extremely large technical and operational capabilities and carries an incomparable, compared to the technical means of training used until recently, didactic teaching material, which can and should be implemented in the educational process of border cadets. Secondly, the real effectiveness of scientific and technological progress (and the widespread use of personal computers is one of its most striking manifestations) depends crucially on the training of military personnel at the level of modern requirements. Thirdly, as proved in practice, the benefit of general technical knowledge is not only in understanding and knowing the laws of the real world, but also in the possibility of their direct application in the study of other sciences and in their daily professional activities when dealing with reading, execution and correction of drawings of samples of radio products and their elements, as well as units of armaments and military equipment.

The use of computer and information technologies in the study of general technical disciplines by border cadets opens the possibility of using a personal computer as a means of improving the educational process in a military school, the formation of technical skills, promotes technical thinking and professional imagination. The use of the graphic editor Microsoft Office Visio is the basis for the formation of a new type of thinking in border cadets - computer. Not only the concept of thinking, but also the idea of other mental functions: perception, memory, imagination, imagination, emotions, etc., is subject to rethinking.

When using computer and information technologies, as practice shows, the perception of educational material improves due to its various didactic capabilities, namely: clarity, graphics and special effects, multimedia technologies, aimed at improving the quality of education of border guard cadets and, as consequence, to increase the competitiveness of military schools.

Taking into account the requirements of State Standards, the purpose of modern vocational education is to prepare a highly qualified, comprehensively developed personality of a border guard, capable of active social adaptation in society. To achieve the above goal, there must be changes in the system of knowledge transfer and the formation of practical skills and abilities of border guard cadets.

References

1. Borovyk, L., Matokhniuk, L., Demyanyuk, K., Shevchuk, V., Pidhaichuk, S., Danylenko, O., Halimov, A., Bloschynskyi, I. (2020). Formation of Professional Imagination in the Process of Implementation of Technical Disciplines with the Aid of Modern Information Technologies. *Postmodern Openings*, 11 (3), 20-40. <https://lumenpublishing.com/journals/index.php/po/article/view/2801/2515>
2. Gushuley, J. M. (2000). General technical training of students in the process of labor training: didactic aspect. For order. GV Tereshchuk. Ternopil: TSPU [Zagal'notekhnichna preparation of students is in the process of labor studies: didactics aspect]. P.312. <https://nenc.gov.ua/doc/autoref/Gusulei.pdf>
3. Demyanyuk, K. D. & Pidgaychuk, S. Y. (2016). Proektuvannya zakhysnoyi bronii avtomobilyav inzhenernyi prohrami Solid Works [The design of protective armor in computer-aided design system solidworks], Collection of scientific papers of the National Academy of State Border Guard Service of Ukraine. *Military and Technical Sciences*, 3 (69), 269-281. https://nadpsu.edu.ua/wp-content/uploads/2018/11/sbirnik_3_2016_vtn.pdf

4. Maksimenko, Yu. B., Matokhniuk, L. (2020). Conceptual model of information competence of personality // Maksimenko, Yu .B., Matokhniuk, L. // Ukrainian Theoretical and Methodological Socio-Humanitarian Journal. Psychology and society. Vip. №3, 82-104. <http://journals.uran.ua/index.php/1810-2131/issue/viewIssue/13095/6907>
5. Matokhniuk, L. (2006). Formation of psychological readiness of future border engineers for professional activity: Author's abstract. dis ... cand. psychol. Science: 19.00.07 / Matokhniuk, L; Nat. acad. State. border. service of Ukraine named after B. Khmelnytsky. - Khmelnytsky, 20 p. <https://cutt.ly/2kuT4zx>
6. Matokhniuk, L. (2007). "Characteristics of the professional activities of border guards", Modern information technology and innovative teaching methods in training: methodology, theory, experience, problems: a collection of scientific papers, Vol. 14, 341-347. http://dspace.pdpu.edu.ua/bitstream/123456789/4151/1/aref_Matokhniuk_L_%D0%9E.pdf
7. Matokhniuk, L., Demyanyuk, K. (2019). Formation of spatial imagination in cadets of engineering and technical direction. Psychology of consciousness: theory and practice of scientific research : Abstracts of the III international scientific-practical conference (November 21, 2019, Kyiv) / Resp. ed. O.B. Drobot; National Aviation University, Faculty of Linguistics and Social Communications - Kyiv, 207 p. <http://kpppo.nau.edu.ua/files/Konfer22019.pdf>
8. Matokhniuk, L., Valchuk, O., Maksymenko, Y., Palimaka, D. (2020). Information analysis technologies for the study of social processes in the regions. Modern approaches of socio-economic development of regions: theory and practice. Monograph. Opole: The Academy of Management and Administration in Opole, p. 240-249. https://www.wsia.opole.pl/wp-content/uploads/2020/05/ebook_nowoczesne_podejscie_spoleczno-gospodarcze.pdf
9. Romanets, V. A. (2000). Psychology of creativity. [Psychology of Creativity]: Lybid. https://chtyvo.org.ua/authors/Romenets_Volodymyr/Psykholohiia_tvorchosti/
10. Silin, R. I., & Harzhevsky, V. A. (2010). SolidWorks in training young engineers [SolidWorks in training young engineers]. Ukraine: KhNU. Efficiency (Computer Design and Technical Documentation), 46-49. <http://ojs2.khnu.km.ua/wp-content/uploads/2020/10/kpd.pdf>
11. Trofimov, Yu. L. (1989). Technical creativity in CAD (psychological aspects) - Kiev: Technology. [Technical creation in CADD (psychological aspects)]. R. 196. [in Ukrainian] <https://search.rsl.ru/ru/record/01001455675>