

**RESEARCH OF THE FACTORS OF INCREASING THE GRAPHIC  
COMPETENCES OF FIRST-YEAR STUDENTS**<sup>1</sup>**A.O. Perperi,**

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**Abstract.** At the present stage of development and reform of the education system, there are constant changes in Higher Education Institutions (HEI), in the organization and content of the entire educational process. In general, higher education is focused on the formation of future specialists with universal competencies that are necessary in the European space in any future professional activity, therefore, it, along with other factors that characterize the innovative potential of an individual, is one of the indicators of his competitiveness in market conditions. A multi-level training system, the implementation of a competence-based approach is necessary to search for new approaches to the organization of training, which can be based on the use of innovative educational technologies. The relevance of this study is confirmed by the fact that there is a significant need to improve the graphic professional competencies of students of architectural and construction specialties.

Theoretical knowledge and graphic skills are needed in almost all areas. *Engineering graphics*, especially its first theoretical part - *descriptive geometry* - is the grammar of graphic language. It has a broad property of «interdisciplinarity», i.e. this is where students first get acquainted with graphic language and methods of drawing and reading pictures, algorithmization of theoretical and applied problems, acquire a high level of graphic skills that will be required in subsequent semesters in other disciplines and in future practice. Without knowledge and taking into account such factors, it is difficult to imagine competent architects-designers and civil engineers who are able to create new projects of modern machines, buildings and structures.

The teaching of any discipline for junior students has its own specifics - freshmen need some period of adaptation to their new learning system, in which they do not just «teach» as in school, but need to «learn». In addition, you need to plan your free time and get used to the new social environment, and, most importantly, from the beginning of the study the student must clearly understand the purpose and objectives of a discipline, its relationship with his future career and more. In our opinion, in the formation of stable graphic qualities of each student should certainly play a role independent work under the guidance of the teacher, ie requires additional contact time for consultations, where the student must learn to acquire and improve skills of independent knowledge acquisition.

In the process of studying graphic disciplines at the Department of Descriptive Geometry and Engineering Graphics of the Odesa State Academy of Civil Engineering and Architecture, freshmen learn to construct images of spatial objects on the plane, practice graphic skills with drawing tools, learn the rules of form reconstruction, algorithms for solving any practical tasks, and gain abstract thinking skills

Our many years of teaching experience show that those students who have an insufficient level of spatial representation and, in general, graphic skills, immediately feel lagging behind and certain difficulties not only in the first year. In the future, they have, as a rule, a decrease in the assimilation of special disciplines and the quality of calculation and graphic and course work,

course projects. We emphasize that we most often, almost always, used student-centered learning: in lectures and practical classes, in the implementation of individual graphic tasks, as well as in counseling, independent work of students, etc.

The main concept of the purpose of the research is based on the comparative results of an analytical review of the methodological and practical aspects of graphic education. The article discusses the results of many years of systematic research on the problem of improving the quality of graphic competencies using the annual semester monitoring of the progress of first-year students in architectural and construction specialties. Professional graphic training of future specialists in modern conditions is an urgent task, since in matters of architectural design and urban planning, as well as for civil engineers, graphic literacy is paramount. Using the method of content analysis, the authors formalized the graphic information into quantitative statistical indicators. It can be stated that the problems of the formation and improvement of graphic professional competencies of graduates of the architectural and construction direction require further research.

**Keywords:** graphic disciplines, freshmen students of architectural and engineering field of study, graphic competences.

**Formulation of the problem.** In the changed modern conditions, the methods of teaching descriptive geometry and engineering graphics, worked out for decades, are not effective enough. The academic volume of disciplines, previously designed for a sufficiently large number of hours, for the study of graphic disciplines take on the form of truncated and logically incomplete. It is difficult to provide serious practical training with so many hours devoted to the study of graphic disciplines, so the task is to improve both the descriptive geometry course itself and the teaching methodology within the existing time constraints.

**Analysis of recent research and publications.** As you know, at the present time, in almost all spheres of life, it is necessary to maintain a dialogue with any drawing or graphic scheme, this is especially characteristic of the creative professions of an architect, designer, artist or engineer. An analysis of the latest research results [2, p.44-48; 5, p.27-28; 6, p.80; 9, p.21-22] shows that the implementation of the competence-based approach in the higher education system necessitates the search for new methods for organizing training [1, p.22-38; 3; 4, p.49-50; 7, p.38-42; 8, p.188-193; 12, p.202-204; 14, p.317-325 etc.]. It is based primarily on the use of innovative educational technologies and contributes to the improvement of the quality level of education in general. Improving the mechanism of interaction, individual and differentiated approaches during classroom lessons, identifying factors affecting the activation of educational and cognitive activity, contribute to an increase in interest, motivation and, accordingly, the quality of education, which was paid attention to by many researchers [10, p.131-134; 11, p.17-21; 13, p.53-55; 15, etc.].

**The purpose of our study** is to analyze various factors of improving the quality of student performance and rank them in general in terms of the significance of the influence of each. Based on the example of studying graphic disciplines by introducing some elements of innovative technologies, a criterion system for assessing the quality levels of academic performance among freshmen students of the architecture and construction specialties was tested.

**The basic material and its results.** Taking into account current trends, a higher education teacher should not only be a translator of scientific knowledge, he should also be able to choose the optimal strategy, i.e. teach using modern educational technologies. The innovative nature of educational technologies used in the process of organizing training in higher educational institutions, in modern conditions, is becoming one of the reasons for competing since it will improve the quality of training for future graduates. In turn, improving the quality, efficiency of education, its continuous and innovative nature, the presence of various forms of interactive technologies contributes to the motivation and activity of young people in acquiring new

knowledge, skills and competencies. An innovative approach in the higher education system can include two *varieties* - *internal innovations* for any discipline (for example, new methodological complexes), and *general* methodological innovations, characterized by the introduction of non-traditional approaches into the educational process technologies (for example, the development of graphic competences for non-standard application tasks, etc.)

The methodology of the research was based on the method of content - analysis of existing information of scientists for the last five academic years, as well as the results of their own long-term researches with the help of factor analysis at the Department of Descriptive Geometry and Engineering Graphics of the Odesa State Academy of Civil Engineering and Architecture. Taking into account the specifics of the process of teaching graphic disciplines, we noted the following conditions for intensifying the educational process, first of all, due to the variety of teaching methods and educational-methodical complexes, which increase the information content of each practical lesson. This requires active individual participation of students during class time and their sustained motivation to learn. Graphic disciplines «Descriptive Geometry» and «Engineering Graphics», respectively, for freshmen students of architecture and construction specialties are studied within one academic year. An integral part of innovation in the modern educational process is the active introduction of computer technology, which certainly contributes to the intensification of the process of assimilation and creative application of knowledge, increases the level of motivation of students and pushes them to conscious actions, opening up new opportunities for their own growth.

It is logical to go from practical experience to theoretical awareness, not the other way around. According to the Curriculum, each student must submit an Album of Drawings for the exam or test, which reflects the individual's practical level of his graphical competences. Experimental studies of the current and final control of students' knowledge and skills were carried out using the *criterion system for assessing the quality levels* of academic performance developed at the department. The total number of students shown in the tables is averaged (results are given in terms of one year).

The following Table 1 and Table 2 contain a comparative characteristic of the quality of academic performance of students of the first year of architectural and construction specialties: for five years, the experimental monitoring of the quality of current and final knowledge control in the traditional system of education («1») and with the help of application of innovative methods («2»). The research base consisted of eight groups of architectural students and five groups of freshmen construction students. Every year, within the framework of the departmental research topic «Improving the organization of the educational process with the help of distance learning and methods of mastering graphic disciplines ...», the authors analyzed the performance of graphic tasks in the classroom, the volume and quality of tasks) according to the traditional system, as well as using various innovative means, including noting the increased interest of students in quality work, the openness of individual competitions for solving problems, tracking current progress, and much more. When comparing the given data in Tables 1 and 2, it should be noted that the qualitative results of the second semester are generally higher than those of the first semester, which proves the validity of the influence of the factors we investigated.

Obviously, this is facilitated, firstly, by the presence of already acquired individual graphic competencies, and secondly, by the interest in professional learning outcomes, although the content of graphic tasks is more complex and voluminous. Undoubtedly, the results of the study were influenced by the motivation of students; their desire to acquire stable graphic skills, therefore, the organization of independent work under the guidance of a teacher played an important role in this. Innovations do not appear unexpectedly, they are the result of systematic scientific research, generalization of the teacher's practical experience. Based on the theoretical understanding of the considered problems of graphic education of students of basic architectural

and construction specialties, from our point of view, it can be emphasized that quality is a priority principle of education.

Table 1 Comparative Table of Achievement Quality in the discipline «Descriptive Geometry» among freshmen students of architectural specialty

№	Volume of graphic tasks	Amount of students		Ongoing control (quality of success)		Final control (quality of success)		Notes
		1	2	1	2	1	2	
1	Term I: ALBUM OF DRAWING S	90 (100%)	25 (28%)	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	1st term: exam
				(62 stud. - 68,9%)	(19 stud. - 76%)	(72 stud. - 80%)	(22 stud. - 88%)	
2	Term II: ALBUM OF DRAWING S	90 (100%)	28 (31%)	<i>Medium, D</i>	<i>Medium, D</i>	<i>Medium, D</i>	<i>Medium, D</i>	2nd term: exam
				(28 stud. - 31,1%)	(6 stud. - 24%)	(18 stud. - 20%)	(3 stud. - 12%)	
1	Term I: ALBUM OF DRAWING S	60 (100%)	16 (27%)	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	1st term: exam
				(22 stud. - 36,7%)	(11 stud. - 68,8%)	(44 stud. - 73,3%)	(14 stud. - 87,5%)	
2	Term II: ALBUM OF DRAWING S	60 (100%)	19 (32%)	<i>Medium, D</i>	<i>Medium, D</i>	<i>Medium, D</i>	<i>Medium, D</i>	2nd term: credit
				(38 stud. - 63,3%)	(5 stud. - 31,2%)	(16 stud. - 26,7%)	(2 stud. - 12,5%)	
1	Term I: ALBUM OF DRAWING S	60 (100%)	19 (32%)	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	2nd term: credit
				(42 stud. - 70%)	(16 stud. - 84,2%)	(52 stud. - 86,7%)	(17 stud. - 89,4%)	
2	Term II: ALBUM OF DRAWING S	60 (100%)	19 (32%)	<i>Medium, D</i>	<i>Medium, D</i>	<i>Medium, D</i>	<i>Medium, D</i>	2nd term: credit
				(18 stud. - 30%)	(3 stud. - 15,8%)	(8 stud. - 13,3%)	(2 stud. - 10,6%)	

Table 2 Comparative table of quality of success in the discipline «Engineering Graphics» among freshmen students in the engineering (building) specialty

№	Volume of graphic tasks	Amount of students		Ongoing control (quality of success)		Final control (quality of success)		Notes
		1	2	1	2	1	2	
1	Term I: ALBUM OF DRAWING S	60 (100%)	16 (27%)	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	1st term: exam
				(22 stud. - 36,7%)	(11 stud. - 68,8%)	(44 stud. - 73,3%)	(14 stud. - 87,5%)	
2	Term II: ALBUM OF DRAWING S	60 (100%)	19 (32%)	<i>Medium, D</i>	<i>Medium, D</i>	<i>Medium, D</i>	<i>Medium, D</i>	2nd term: credit
				(38 stud. - 63,3%)	(5 stud. - 31,2%)	(16 stud. - 26,7%)	(2 stud. - 12,5%)	
1	Term I: ALBUM OF DRAWING S	60 (100%)	19 (32%)	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	<i>Good, well done, A, B</i>	2nd term: credit
				(42 stud. - 70%)	(16 stud. - 84,2%)	(52 stud. - 86,7%)	(17 stud. - 89,4%)	
2	Term II: ALBUM OF DRAWING S	60 (100%)	19 (32%)	<i>Medium, D</i>	<i>Medium, D</i>	<i>Medium, D</i>	<i>Medium, D</i>	2nd term: credit
				(18 stud. - 30%)	(3 stud. - 15,8%)	(8 stud. - 13,3%)	(2 stud. - 10,6%)	

**Notes:** 1. The total number of students shown in the tables is averaged (results are given in terms of one year). 2. Column «1» shows the results of training in the traditional system; in column «2» - training using innovative approaches. 3. A, B, D - student progress assessment for a semester on ECTS

**Conclusions and prospects for further development.** The need to improve teaching technologies, including through the introduction of new teaching technologies into the educational process, is caused by the current socio-economic conditions and is aimed at improving the quality of training of specialists. The focus is on the student acquiring knowledge through activities in the context of the future profession. The rating system is a comprehensive assessment of the quality of students' academic work. It increases the motivation of students to

master educational programs, creates an incentive to increase the intensity of work, since there is a differentiated assessment of the student's work. The teacher, on the other hand, needs to plan more time to control the independent work of students, to coordinate and direct this work. The results of experimental studies of the authors presented in this work prove the relevance of certain methodological factors that affect the sustainability of motivation in the qualitative study of graphic disciplines.

The discussion of the assessment criteria and the results of the graphic competencies of students is systematically carried out at numerous internal and external scientific seminars and conferences. In conclusion, we emphasize that research in the direction of an active search for new forms of improving the organization and management of the educational process in higher education is very relevant. It can be stated that the problems of the formation of graphic professional competencies of graduates of the architectural and construction profile require additional research.

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### ДОСЛІДЖЕННЯ ФАКТОРІВ ПІДВИЩЕННЯ ГРАФІЧНИХ КОМПЕТЕНТНОСТЕЙ СТУДЕНТІВ-ПЕРШОКУРСНИКІВ

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**Анотація.** В статті розглядаються результати багаторічних систематичних досліджень проблеми підвищення якості графічних компетентностей з використанням щорічного семестрового моніторингу успішності студентів першого курсу архітектурно-будівельних спеціальностей. Професійна графічна підготовка майбутніх фахівців в сучасних умовах є досить актуальною задачею, тому що у питаннях архітектурного проектування і містобудування, а також для інженерів будівельних спеціальностей графічна грамотність має суттєве значення. У роботі проаналізовані фактори удосконалення графічних навиків і, в цілому, графічної культури студентів з урахуванням диференційного підходу до організації та проведення аудиторного контактного часу викладач-студент. За допомогою методу контент-аналізу авторами була формалізована зібрана графічна інформація у кількісні статистичні показники. Можна констатувати, що проблеми формування і удосконалення графічних професійних компетенцій здобувачів архітектурно-будівельного напрямку потребують подальших досліджень.

**Ключові слова:** графічні дисципліни, студенти-першокурсники, архітектурно-будівельні спеціальності, графічні компетенції.