

**FORMATION OF GRAPHIC COMPETENCES OF FIRST YEAR ARCHITECTURE AND ART STUDENTS****Brednyova V.,**

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**Abstract.** The modern paradigm of the educational process development for the near future includes a type of education characterized by a significant amount of independent work and active involvement of students of creative specialties in scientific work, starting from the first year, which would be impossible without strong skills of individual graphic competence. The importance of graphic disciplines for the professional training of an architect, artist, and designer is fundamentally important because they expand the individual capabilities of future professionals. In the current conditions of development of the higher education system, graduates are required to have not only knowledge, skills and abilities in the professional field. Personal qualities such as independence, initiative, originality of thinking, sociability, ability to generate ideas, etc. are equally important. In our opinion, one of the current problems of teaching graphic arts disciplines is the reduction in the number of hours for their study, the lack of the necessary material base (computer labs, for example), which is quite relevant now, and so on. Mutually coordinated programs in certain graphic disciplines can play an important role here. The main approaches to the formation of graphic competencies and evaluation criteria of tasks are considered by the author on the example of long-term research in the process of teaching graphic disciplines to first- and second-year students, as well as teaching the discipline “Drawing” in the preparatory courses of the Center for Pre-University Training (CPT) at the Odesa State Academy of Civil Engineering and Architecture (OSACEA). The article is devoted to the study of the problem of forming graphic competencies of first-year students of architectural and artistic specialties as the basis of their professional technical literacy, as well as to the systematization and generalization of certain methodological approaches to teaching. The study used analytical methods of studying the literature on the methodology of teaching graphic disciplines to creative students, expert analysis of individual graphic works of students and students of the CPT, etc. The results of the research were tested in the educational process, which provides for the improvement and development of this topic in the future.

**Keywords:** graphic competencies, first-year students of architectural and artistic specialties, pre-university graphic training, geometric and projection drawing, evaluation criteria, technical literacy

**Relevance of the work.** In recent years, the range of tasks that can be solved by graphic methods has significantly expanded, so the role and importance of graphic disciplines that lay the foundations of spatial representation and contribute to the education of graphic culture in general has increased accordingly. Training competent creative professionals who have graphic literacy skills and are able to express their thoughts on paper, fostering the personal significance of learning, motivation and sustained interest in the process of acquiring graphic competencies is a very urgent problem, and therefore it is necessary to systematically update the existing methodological and methodological framework.

**Problem statement.** Professional competencies are objectively necessary knowledge and skills caused by modern requirements for the future practical activities of applicants. The main task of modern graphic education is to form the content and conditions of study that contribute to the progress of individual professional skills of students of creative specialties, as well as to improve approaches

to the methodology of teaching graphic disciplines and increase the motivation of studying in higher education institutions.

**The purpose of the article.** The main purpose of the article is to theoretically summarize the results of the study of the main approaches to the definition and content of the formation of graphic competencies for students of creative specialties in higher education institutions and to substantiate the factors of improving the quality of graphic education in general.

**The degree of study of the problem.** The problems of the content of graphic training and conditions for improving its quality in higher education have been considered by many researchers Birkovich T.I., Varivonchik A.V., Mazur, Brednyova V.P., Prokhorets I.M., Smychkovskaya O.M., Gladun O., Kosharskaya L. Levitsky A., etc. [1, pp. 103-113; 2, pp. 55-61; 6, pp. 227-233; 8, pp. 42-46; 12; 16; 21, pp. 326-331 and others]. The authors of these works, who represent Kyiv, Lviv, Odesa, Kharkiv schools of training specialists in creative specialties, emphasize that in higher education institutions the terms of studying basic graphic disciplines are periodically reduced, but the requirements for the formation of appropriate graphic skills in students are increasing. And if schools do not teach the basics of graphic literacy, i.e., there is no subject “Drawing”, then the necessary initial theoretical and practical knowledge and skills, according to teachers, should be learned by students on their own. The requirements for the execution and design of drawings, namely the definition of the concepts of “formats”, “scales”, “drawing lines - their characteristics and purpose in the drawing”, “drawing fonts”, etc. are quite difficult to understand individually for each student. In the works of scientists Prokhorets I.M., Mikhaylenko E.V., Huang X., Ball R., Wang W., Kuzmenko O.V., Reinsfield E., Udris-Borodavko N., Bordiichuk Ya. [3, pp. 167-173; 5, pp. 74-77; 9, pp. 565-586; 11, pp. 12-22; 17, 149-161; 23 pp. 256-266 and others] emphasize that teaching graphic disciplines is the most effective means of mastering and developing spatial thinking. The content of specialized graphic disciplines for future architects, designers and artists in accordance with the program requirements clearly outlines the educational aspects, the content of special knowledge, skills and sustainable skills and competencies that students must master during a certain period of study, as discussed in many sources [4, p. 152-160; 7, p. 122-126; 10, p. 36-47; 13; 19, p. 1827-1839]. These publications propose to pay attention to the timely development of elementary graphic competencies of students in higher education in the study of the basics of geometric drawing, namely dividing segments into  $n$  equal parts, drawing mutually perpendicular and parallel lines, dividing a circle into  $m$  equal parts or drawing regular polygons, etc. using a compass and ruler. Our study is based on the analysis of previous and current methodological and scientific literature from periodicals and monographs, where, along with the deep elaboration of many problems, there are some issues that require more detailed discussion.

It should be emphasized that competency-based education is aimed at the comprehensive acquisition of knowledge and methods of practical activity, thanks to which the applicant will successfully find himself in various fields of life in the future.

**The main part.** Graphic education is one of the most important areas of professional architectural and artistic activity. The graphic competence of applicants for creative specialties emphasizes the need for personal development in the conditions of training in modern higher education institutions, that is, the emphasis is shifted to skills, not just the availability of theoretical knowledge, which is a very important factor especially in distance learning [14, p. 175-180; 15, p.63-75; 18, p. 13-22; 20, p.317-325, etc.]. These publications emphasize the important role of independent learning of those requirements that are necessary when performing graphic tasks in professional disciplines already in the first year. The experimental basis of our study is the results of the author's observations in the process of teaching graphic disciplines at the Department of Descriptive Geometry and Engineering Graphics to first- and second-year students of architectural and artistic specialties (87 students), as well as an analytical review of graphic works by students of the Preparatory Courses of the Pre-University Training Center (PTC) of the OSACEA (46 applicants).

Let's consider the definition of the following graphic competencies proposed by us and the stages of their acquisition, which are important for first-year students of architectural and artistic specialties (Table 1).

The above Table 1 summarizes the author's long-term research results of the acquisition motivated students, and, from the point of view of didactics, this approach will contribute to the rapid of graphic competencies by first-year students during individual consultations, as well as during practical classes with students of the Preparatory Courses. Based on this, it can be argued that a positive solution to the problem of successful graphic training of students at the initial stage of education requires a clear organization of individual and independent work aimed at developing individual eye functions, observation and perception skills, professional motor skills, etc.

In our opinion, in the process of performing graphic tasks, it is necessary to constantly update them thematically, which significantly affects the formation and development of skills and graphic skills in achievement of the required level of quality in learning.

Table 1. Experimental definition of graphic competencies and the sequence of their acquisition by stages of acquisition

| Name of graphic competences                                                 | Stage N1 (content)                                                                                                                          | Stage N2 (content)                                                                | Stage N3 (content)                                                                                                 |
|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|
| Ability to use graphic theoretical knowledge                                | Familiarization with drawing instruments and methods of their use. Study of the basic requirements for the execution and design of drawings | Studying and solving geometric constructions with the help of drawing instruments | Studying and solving projection constructions on three projection planes and axonometric images of spatial objects |
| Ability to perform practical graphic exercises and individual tasks         | Individual graphic work based on methodological materials                                                                                   | Independent work on individual tasks                                              | Performing tasks under certain conditions on the formats                                                           |
| Ability to perform creative graphic tasks according to an individual option | Performing initial programmatic graphic tasks                                                                                               | Performing current graphic tasks                                                  | Development and implementation of individual creative thematic tasks                                               |

In the course of studying graphic disciplines, first-year students learn how to construct images of spatial objects on a plane, the rules of visual reproduction and reconstruction of the shape of a spatial object through logical analysis, i.e., it is a visual activity that operates with subject and conceptual meanings. All this creates the basis for the development of sustainable graphic literacy and creative capabilities in performing tasks in other disciplines, as well as in future professional specialties.

It is necessary to emphasize that, as a rule, first-year students of architectural and artistic specialties, who did not have pre-university graphic training, immediately show an insufficient level of certain graphic knowledge, abilities and skills, firstly, because over the last decade in many secondary schools the subject "Drawing" is not taught in schools. Based on this, it is necessary to pay attention to the importance of their prior independent acquisition of graphic competences or pre-university graphic training. So, in particular, the teaching of the discipline "Drawing" for entrants of architectural specialties at the preparatory courses of the Center for Pre-University Training (CPE) at OSACEA takes place with a training period of 32 weeks, evening form. Classes are held once a week (two academic hours). The current control takes place at each lesson due to the performance of

classroom tasks, and the final one is in the form of an attestation for five control papers. As shown in (Table 1), according to the Curriculum, the pupils are, firstly, tasked with acquiring stable graphic skills and consolidating the ability to work with drawing tools (Fig. 1), and secondly, developing their individual spatial ideas through careful study two basic sections "Geometric drawing" and "Projection drawing". The theoretical and practical material of these sections will definitely be needed when performing graphic works already in the first year in the first semester.

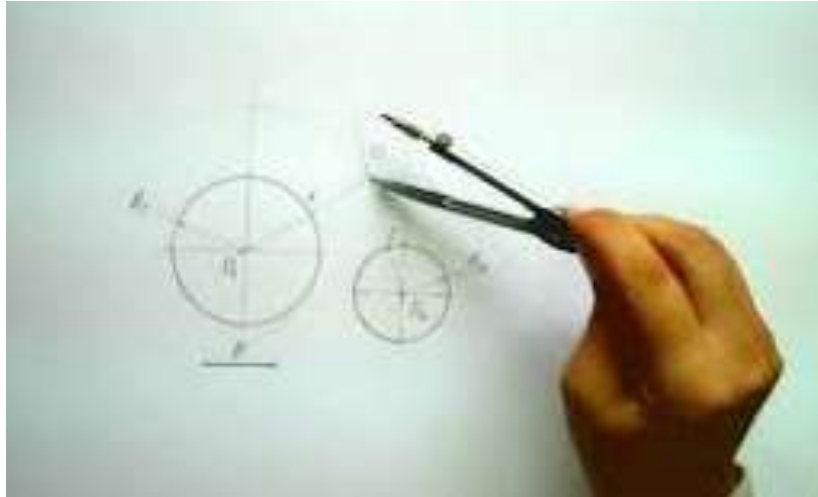


Fig. 1. Making constructions using a compass exercise from the section "Geometric drawing" from the topic "Conjugation"

Fig. 2 shows examples of graphic tasks from the section "Geometric drawing" by students of CPT, who have acquired a fairly high level of graphic competence, that is, during about two months of classes, they perform constructions with drawing devices with maximum accuracy and accuracy of work, because this depends on the correctness and the accuracy of the solution. The difference in the ratio of line thicknesses is clearly visible in the drawings, namely, for example, a thin solid line, according to the requirements, has a thickness of two to three times less than the main line, and is used to draw outline and dimensional lines, hatching lines, etc. A dashed line is used to draw axial and center lines. Linear dimensions are determined by dimensional numbers that are drawn according to certain rules above dimensional lines drawn parallel to the measured segment. Dimensional lines are terminated by arrows resting on outline lines drawn perpendicular to the measured segment, etc. These brief comments characterize examples of methodological features that are the basis of graphic competencies. To achieve a sufficiently high level of drawing performance, we have developed and applied a criterion-based grading system (Table 2) that works motivationally for all students, i.e., only after all fundamental comments have been eliminated and a certain graphic level has been achieved, a grade is given for the drawing. The final grade consists of five tests. In general, the final maximum grade is 100 points, that is, each test is evaluated with 20 points.

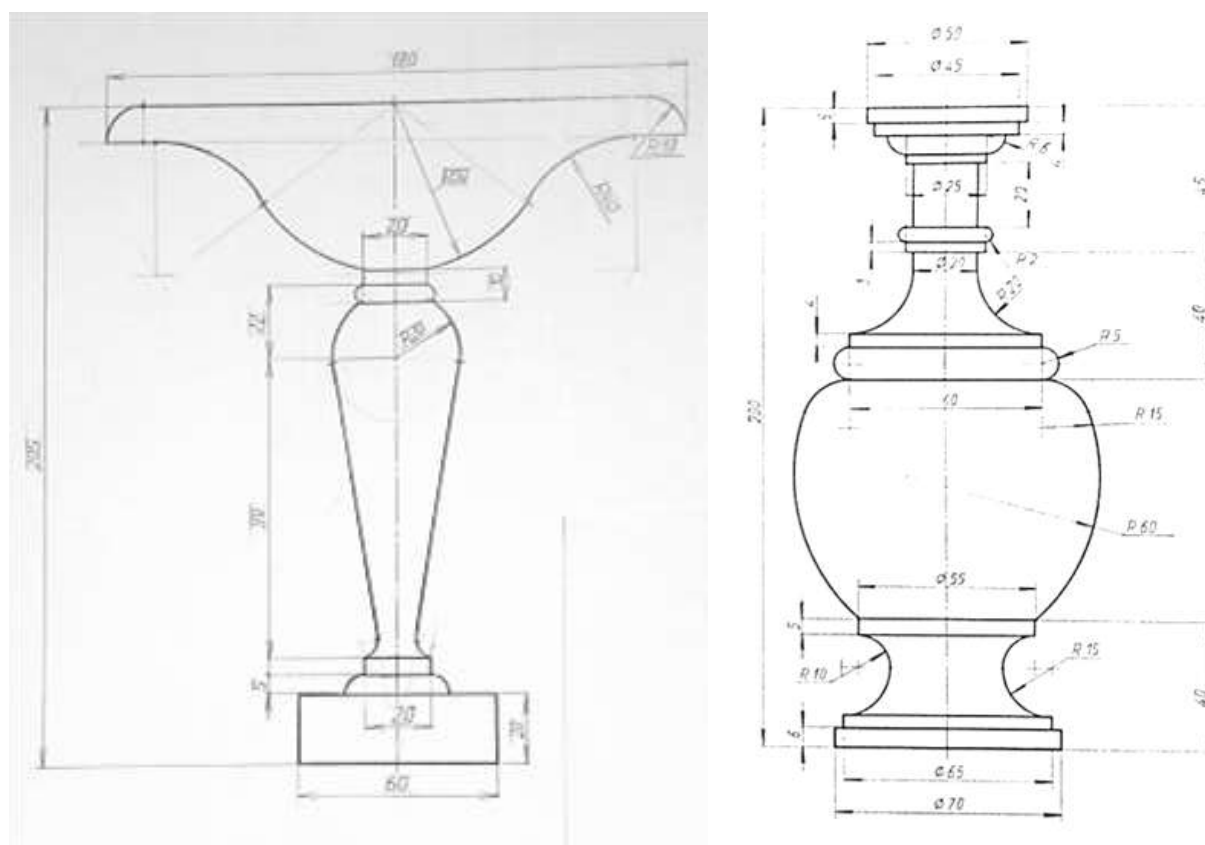


Fig. 2. Examples of completing graphic tasks from the section “Geometric chair”  
(test paper “Vase”)

In Fig. 3 selectively shows examples of the final control work **No. 5** from the second section “Projection Drawing”. For these tasks, students received the corresponding maximum points according to the criteria from Table 2, since the task was correctly “read”, the images are proportionally and compositionally correct and constructed with all auxiliary lines preserved, thin hatching lines are correctly applied in views and in rectangular isometry, the dimensions are correct, etc. The tasks of the second section not only help to consolidate graphic skills, but also have a significant impact on the development and improvement of spatial representation.

In an experimental manner, the author, at the suggestion of successful students, provides an opportunity to try to use a graphic editor that they own to perform certain tasks. Fig. 4 with a preliminary task in the notebook and Fig. 5 show examples of such tasks on the topics a) “Composition of geometric shapes” and b) “Construction of views and sections of a geometric shape with a cutout”. In the first year of studying the discipline “Descriptive Geometry”, these knowledge and skills will be in great demand.

Table 2. Evaluation criteria for graphic exercises and tasks of students of preparatory courses of the Center for pre-university training

| Requirements for performance and completion of tasks                                                                                                                                              | Basic level<br>(grade 10-12)                                                                                                       | Average level<br>(grade 13-17)                                                                                                | High level<br>(grade 18-20)                                                                                                                 |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Initial exercises are performed in a notebook (notebook paper is required) within the set time limit. All auxiliary lines of constructions and designations of characteristic points must be kept | Exercises and tasks are performed with errors, poorly, not in a timely manner                                                      | Exercises and assignments are completed with minor errors, of sufficient quality, in a timely manner                          | Exercises and tasks are graphically executed with high quality, solutions are given quite correctly and in a timely manner                  |
| All subsequent tasks are performed on formats for a certain period of time                                                                                                                        | Assignments are completed with errors that have not been eliminated after comments, of poor quality, not in a timely manner        | Tasks are completed with minor errors after repeated control, of sufficient quality, in a timely manner                       | The tasks on the formats are performed graphically qualitatively, correspond to the individual version quite correctly, in a timely manner  |
| Final control work №5 (A3 format)                                                                                                                                                                 | Assignments were completed with significant errors that were not corrected after comments, of poor quality, not in a timely manner | Assignments completed with minor errors, in accordance with all basic requirements, of sufficient quality, in a timely manner | The task is performed graphically qualitatively, the solution is given quite correctly in size and rational composition, in a timely manner |

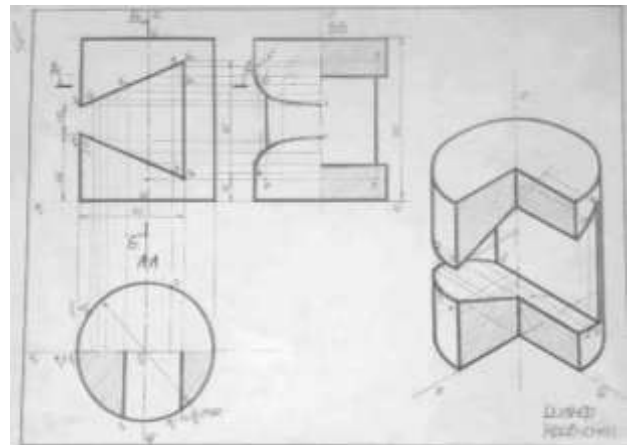
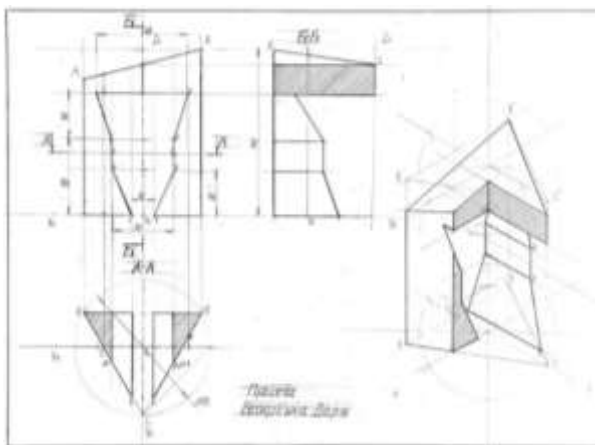


Fig. 3. Final control work from the section "Projection drawing":  
a) "Trihedral prism", b) "Cylinder"

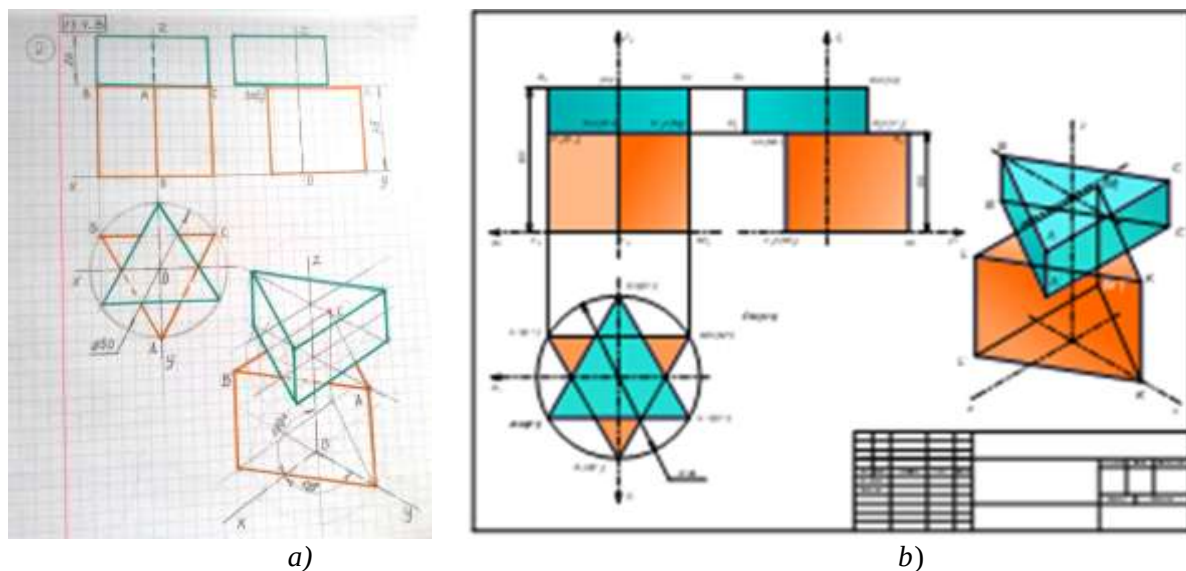


Fig. 4. Task "Composition of geometric shapes":  
a) preliminary development in a notebook, b) execution on a format using the ArchiCAD program

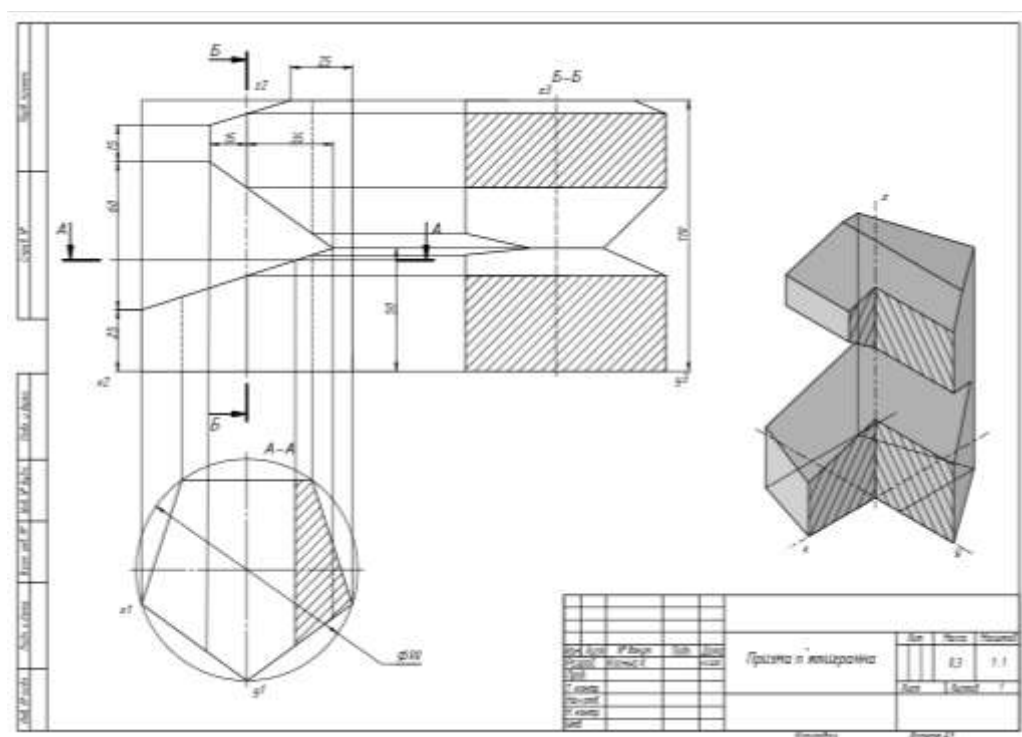


Fig. 5. The task "Construction of views and sections of a geometric figure with a cutout" using Autodesk Inventor Professional 2025

To summarize the above material, we emphasize that initially, as a rule, classes are held in the classroom with almost 100% attendance. The students are generally very interested and motivated, complete all classroom and homework assignments on time, probably with some mistakes, but the work is also usually done on time. Most likely, this is because, first, it is something new for them, they may not have heard of it, and, second, they understand that this knowledge and skills will be very important for them in their future studies. Even in remote classes, attendance was also close to 95%. All assignments they completed were sent to Classroom in a timely manner and were graded out of 20 points for almost every test.



Thus, pre-university training can act as an element of a holistic system of continuing education, the content of which is to organize the graphic preparation of high school students for studying in a higher education institution, which contributes to their career guidance.

Based on the theoretical information briefly presented above, which should be possessed by applicants entering our Academy for creative specialties for their future successful studies, we note how much graphic competence they must acquire in a short time with the help of teachers of the relevant departments.

The basic graphic discipline for students of architectural and artistic specialties is Descriptive Geometry. Its founder, the French geometer Gaspard Monge (1746-1818), emphasized that this science has two main goals: 1 - the ability to accurately represent three-dimensional spatial objects on a drawing, i.e. on a plane with only two dimensions. From this point of view, it is a graphic language that an engineer, architect, designer, or artist needs to create their projects; 2) it is a means of seeking truth, of finding possible ways to move from the unknown to the known. This science is suitable not only for developing intellectual individual abilities. The purpose of the discipline is also to develop abstract and logical thinking, spatial imagination, the ability to analyze and synthesize spatial forms and relationships based on graphical models of space, which are practically realized in the form of drawings.

When studying any discipline, a student first acquires knowledge, then develops skills and abilities through exercises, and finally applies the knowledge gained. Fig.6 selectively shows examples of variants of final graphic tasks from special sections of first-year students in the discipline "Descriptive Geometry" on the topics *a*) "Building a perspective image of a group of schematized buildings using the method of architects with two points of coincidence" and *b*) "Building an axonometric image of a group of spatial objects. Rectangular isometry", the purpose of which is to test the level of graphic competencies acquired during the semester.

As practice shows, the most motivated students demonstrate a fairly high level of success. The Department of Descriptive Geometry and Engineering Graphics of OSACEA annually holds a traditional Olympiad in descriptive geometry among freshmen, to which successful students are invited. The number of participants in the Olympiad each year is more than 100 students of all specialties of the Academy. We would like to emphasize that our many years of experience in holding this event shows that it has a very positive impact on students' interest and motivation to study this discipline.

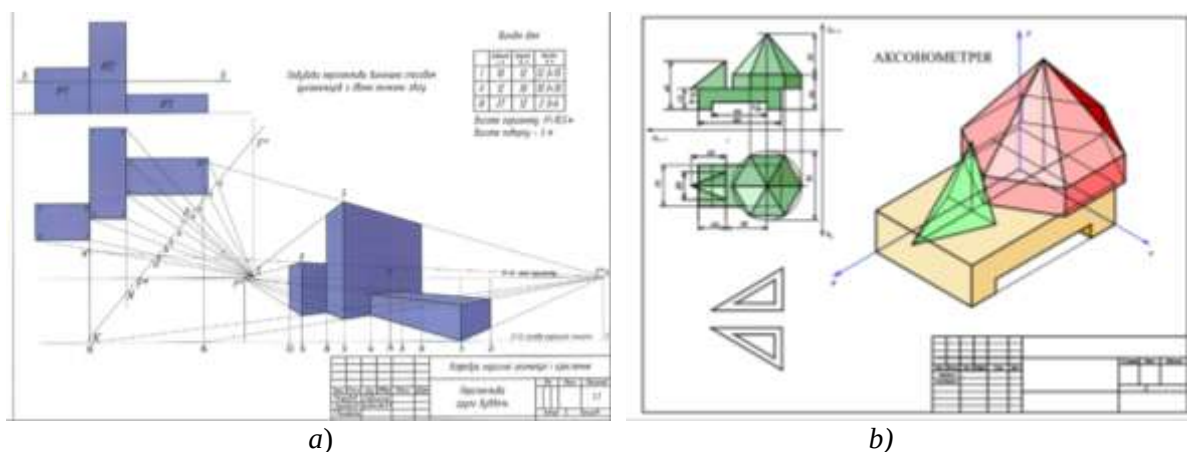


Fig. 6. Examples of variants of educational tasks in Descriptive geometry:  
*a*) "Construction of a perspective image of a group of schematic buildings by the method of architects with two points of coincidence", *b*) "Construction of an axonometric image of a group of spatial objects. Rectangular isometry "



Graphic competence emphasizes the need for personal development in the context of studying in modern higher education institutions, i.e., a shift in emphasis to skills, not just knowledge and theoretical approaches to teaching.

It should be noted that in the process of professional training of applicants for architectural and artistic specialties, research work is an integral component, which is organically inherent in the educational and creative activities of future specialists. Thus, in Fig. 7 shows an example of an individual research assignment in the first year of the discipline "Descriptive Geometry" on the topic "Construction of projections of the intersection line of two polyhedral surfaces", in which, on the author's recommendation of the supervisor, a visual image in rectangular isometry was independently constructed using a graphic editor. The use of research activities is also due to the problem of mastering the culture of scientific research. In our opinion, visibility is an essential factor for sustainable assimilation of educational material, therefore, studying the forms of simple geometric figures (prism, pyramid, cone, cylinder, sphere) contributes to the accumulation of graphic primitives in the memory of students, which allow the creation of graphic models in the future.

Acquiring appropriate graphic skills requires a rather serious and motivated attitude to learning, especially considering the complex surrounding circumstances. Table 3 shows the results of our study of the current performance of first-year students of architectural specialties in the first semester in the discipline "Descriptive Geometry". The current tasks of the first semester contain additional exercises that focus students' attention on important methodical rules, repeat a set of methodical principles and algorithms in the students' practical work, or fix a certain stage of task performance, which is generally designed to develop students' creative abilities. With the help of the method of expert evaluations, an analysis of graphic control tasks was performed according to the relevant educational programs for each specialty during the semester with control of attendance at classes and scheduled consultations. It should be emphasized that the results were summarized by groups No. 1 - architectural group A -1 (one), No. 2 - group of GD, graphic designers (three groups), No. 3 - group of OM, fine arts (one).

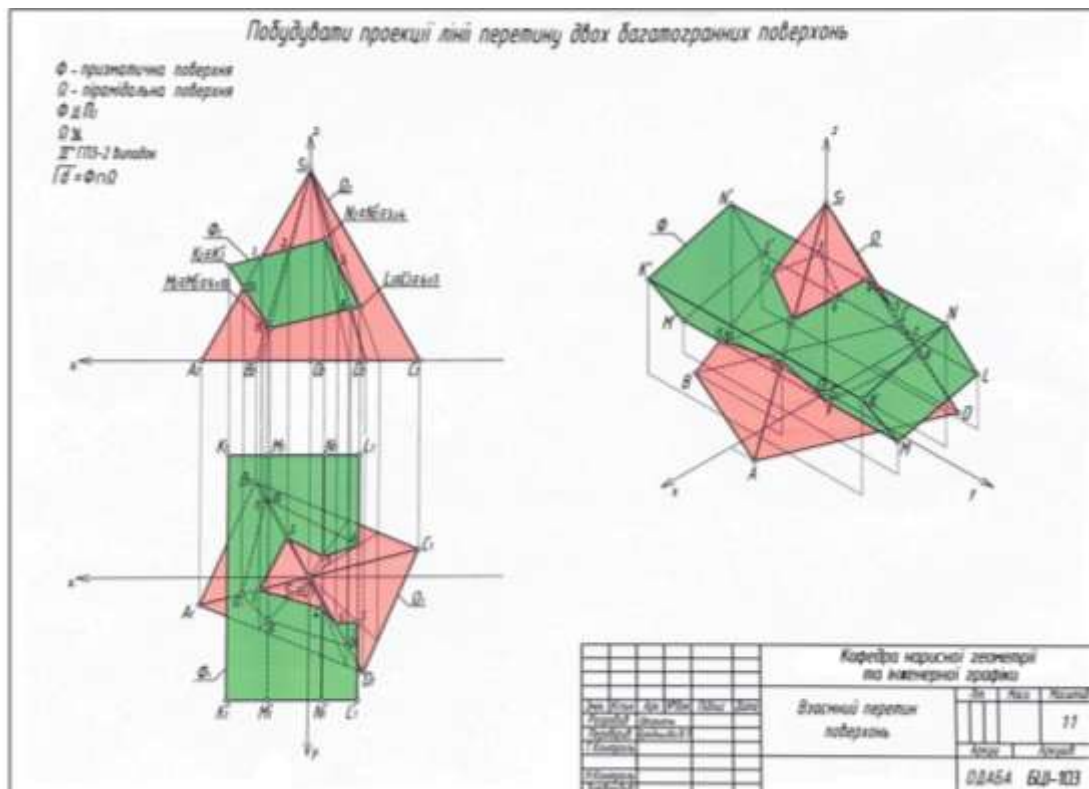


Fig.7. An example of an individual scientific task in sketch geometry on the topic "Construction of projections of the line of intersection of two polyhedral surfaces"

Table 3. Comparative analysis of the results of the current performance of first-year students of architectural specialties in the first semester

| Requirements for performance and execution of tasks | Group N1                         | Group N2                         | Group N3                        | Notes                              |
|-----------------------------------------------------|----------------------------------|----------------------------------|---------------------------------|------------------------------------|
| Number of students in the group                     | 24                               | 48*                              | 15                              | *Three groups<br>Total 87 students |
| Attending practical classes                         | 85%<br>80%**                     | 75%<br>60%**                     | 100%<br>95%**                   | **Online classes                   |
| Attending consultations                             | 75%<br>60%**                     | 60%<br>40%**                     | 95%<br>90%**                    | **Online classes                   |
| Current performance                                 | A – 38%<br>B, C – 46%<br>D – 16% | A – 46%<br>B, C – 42%<br>D – 12% | A – 53%<br>B, C – 40%<br>D – 7% |                                    |

It is characteristic to note that the beginning of the classes took place in the classroom, and then the training was transferred to a distance form, which also affected the current quality of success in some groups. Monitoring of observations of students' success depending on attendance at practical classes and consultations showed its obviousness and certain dependence on attendance. The OM group scored high not only in current performance, but also in final performance - only 6% received a grade of D, because there was almost 100% class attendance. It is also possible, by comparing the data presented in Table 3, to determine a relatively better success rate and greater interest and motivation in the education of design students and artists.

The final analysis of the results of the conducted research unequivocally showed that the qualitative study of graphic disciplines is possible on the basis of a comprehensive approach to the educational process. Our long-term experience shows that first-year students can gain deeper knowledge only if they are highly motivated, have systematic individual work and gain more detailed knowledge on their own. Thus, the graphic competences acquired in the process of studying sketch geometry will allow you to realize your creative potential in a wide variety of directions.

**Conclusions from the conducted research.** The formation of graphic competence, mastery, artistic skills, and a sense of harmony begin with pre-university professional training (art school, art circles, preparatory courses, etc.). It is known that graphic professional competence is an integral characteristic of a person, which combines the presence of knowledge, skills and abilities in graphic disciplines that ensure effective performance of professional activities. Graphic images are also one of the most important means of learning about the environment and creatively relating to it. Graphic training, including, teaches to operate with terminology and concepts related to the visualization of information. Working with graphics most effectively develops visual thinking, which is very important in any creative process, because any new solution is first imagined in the form of a picture, scheme or model, that is, in the creation of spatial images of reality (in the process of construction, transformation, improvement of any object or phenomenon).

Let us emphasize that the issue of graphic training of students in today's difficult conditions has been repeatedly discussed at scientific and methodical seminars and many international conferences. The prospects for further research are, in our opinion, the search for various ways of improving students' graphic competence and introducing them into the educational process. In the process of studying graphic disciplines, students are given an attitude towards the development of both spatial

perception and logical mental activity, and in the future they can be provided with interdisciplinary connections of related departments and the use of a system of professionally oriented tasks in the educational process. This whole complex of geometric and graphic training gives an opportunity to be successful in the future.

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## ФОРМУВАННЯ ГРАФІЧНИХ КОМПЕТЕНТНОСТЕЙ СТУДЕНТІВ ПЕРШОГО КУРСУ АРХІТЕКТУРНИХ І ХУДОЖНІХ СПЕЦІАЛЬНОСТЕЙ

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**Анотація.** Сучасна парадигма розвитку освітнього процесу на найближче майбуття включає в себе такий тип навчання, який характеризується значним об'ємом самостійної роботи та активним залученням студентів творчих спеціальностей до наукової роботи, починаючи вже з першого курсу, що було б неможливо без стійких навиків індивідуальної графічної компетентності. Значення графічних дисциплін для професійної підготовки архітектора, художника та дизайнера є принципово важливим, тому що вони поширюють індивідуальні можливості майбутніх фахівців. У сучасних умовах розвитку системи вищої освіти до випускників висувуються вимоги, пов'язані не тільки зі знаннями, вміннями та навичками у професійній сфері. Не менш важливе значення відіграють такі особистісні якості, як самостійність, ініціативність, оригінальність мислення, комунікабельність, здатність генерувати ідеї тощо. Одними із сучасних проблем сьогодення викладання графічних провідних дисциплін є, на наш погляд, зменшення кількості годин на їх вивчення, відсутність необхідної матеріальної бази (комп'ютерних класів, наприклад), що є зараз досить актуально,

та ін. Велику роль тут можуть відіграти взаємоузгоджені програми з окремих графічних дисциплін. Основні підходи до формування графічних компетентностей і оціночні критерії завдань розглянуті автором на прикладі багаторічних досліджень у процесі викладання студентам першого-другого курсів графічних дисциплін, а також викладання дисципліни «Креслення» на підготовчих курсах Центру довузівської підготовки (ЦДО) в Одеській державній академії будівництва та архітектури (ОДАБА). Стаття присвячена дослідженню проблеми формування графічних компетенцій студентів- першокурсників архітектурних і художніх спеціальностей як основи їх професійної технічної грамотності, а також систематизації та узагальненню окремих методичних підходів до навчання. У дослідженні були застосовані аналітичні методи вивчення літератури з методології викладання графічних дисциплін здобувачам творчого профілю, експертний аналіз графічних індивідуальних робіт студентів і слухачів ЦДО, тощо. Результати досліджень апробувалися у навчальному процесі, що передбачає удосконалення і розвиток цієї тематики в подальшій перспективі.

**Ключові слова:** графічні компетентності, студенти-першокурсники архітектурних і художніх спеціальностей, довузівська графічна підготовка, геометричне і проєкційне креслення, критерії оцінювання, технічна грамотність.