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RESEARCH OF METHODOLOGICAL TOOLS FOR IMPROVING THE GRAPHIC ABILITIES OF FUTURE DESIGNERS AND ARCHITECTS**V. P. Brednyova,**vera2008@ukr.net, ORCID 0000-0002-3005-2384**A. O. Perperi,**a_perperi@ukr.net, ORCID 0000-0001-7112-6864**N. V. Sydorova,**sidorova@odaba.edu.ua, ORCID 0000-0003-2772-5653*Odesa State Academy of Civil Engineering and Architecture
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Abstract. At the current stage, higher education is moving to a new qualitative level, reflecting innovations in the professions of "Designer" or "Architect". Hence, the need for training highly qualified specialists in these fields is growing. Given modern concepts and innovative technologies that are evident in all spheres of human life, the requirements for the level of professional training of graduates of higher educational institutions, their self-education, the ability to think independently, optimize their activities, and make unconventional, non-trivial decisions have increased. The development of relevant high-quality graphic competencies and sustainable practical skills in the process of training future creative specialists is a pressing issue. For junior students, especially in design and architecture, freehand drawing remains a fundamental skill that requires systematic development through special techniques and exercises. The main goal is to "train the hand", develop an eye, a sense of proportion and confidence in line. The development of hand graphics is inextricably linked with classical graphic disciplines, primarily the following: "Sketchy Geometry", "Geometry of Images", "Font Graphics" or "Art of Font", "Accidental Font", "Typography", etc. The main results of the study of methodological tools for improving the graphic capabilities of future designers and architects are reviewed by the authors using extensive research in the process of teaching first-year or second-year students graphic disciplines at the Department of Descriptive Geometry and Engineering Graphics of Odesa State Academy of Civil Engineering and Architecture (OSACEA). The research used analytical methods to summarize expert assessments of graphic and individual, in particular competitive, student works, the results of hourly observations of the performance of tasks in classroom classes provided for by the curriculum, and conclusions from a critical comparative analysis of modern publications on the methodology of teaching graphic disciplines to students with a creative profile, etc. The research results were tested in the educational process, which provides for the improvement and development of this topic in the future.

Keywords: Descriptive Geometry, graphic disciplines, junior students of design and architecture majors, technical literacy.

Relevance of the work. Researches of contemporary problems of education of specialists in architectural and artistic specialties emphasize the relevance and significance of training based on professionalization. Training competent creative specialists who possess graphic literacy skills and are able to express their thoughts on paper, fostering personal significance of learning, motivation, and sustained interest in the process of acquiring graphic competencies is a very pressing issue, which requires the systematic updating of the existing methodological base.

Problem statement. The most important task of modern graphic education is to improve the content and conditions of learning that contribute to the development of individual professional skills in creative fields and increase motivation to study at Higher Education Institutions (HEIs). This article is devoted to the study of methodological tools for improving the graphic abilities of junior students of the specialties "Architecture" and "Design" as the basis of their professional and technical literacy.

The purpose of the article. The main goal of the article is to theoretically generalize the content of individual graphic disciplines studied in junior years, to substantiate the factors of increasing motivation for learning and, in general, to form indicators of individual graphic competencies in students of creative specialties.

The degree of study of the problem. The confident graphic competence of students in creative specialties emphasizes the need for personal development in the context of learning in modern higher education institutions, i.e., shifting the focus to skills rather than just theoretical knowledge, which is a very important factor, especially in distance learning. The content of specialized graphic disciplines for future architects, designers, and artists, in accordance with the requirements of the Curriculum, clearly defines the educational aspects, scope of knowledge, skills, and sustainable competencies that students must acquire during a specific period of study, that is discussed in many sources [1, pp.152–160; 3, pp.227–233; 6; 8, pp.42-46; 10; 11, pp.36-47; 18, pp.175–180; 22, pp.149-161; 27, pp.103-113 and others]. The authors of these works, who represent the Kyiv, Lviv, Odessa, and Kharkiv schools of training specialists in creative professions, emphasize that higher education institutions periodically reduce the duration and scope of study of basic graphic disciplines for various reasons, but the requirements for students to develop the relevant graphic skills are increasing. In publications [2, pp.74–77; 4, pp.122–126; 14, pp.12-22; 15; 19, pp.63-75; 21, pp.116-121; 24, pp.1827–1839; 25, pp.360-365, etc.] it is proposed to pay attention to updating the content and structure of modern architectural education, deepening the practical part of educational programs, and increasing personal motivation and sustained interest in the process of acquiring graphic knowledge and skills. Our research is based on a critical analysis and comparative assessment of modern methodological and scientific literature in periodicals and monographs, where, along with the in-depth development of many issues, there are certain issues that require more detailed discussion. [5, pp.215-227; 9, pp.565–586; 12; 20; 23, pp.13–22; 26, pp.317-325 and others].

The main part. Graphic competencies are objectively necessary knowledge and skills required for the practical activities of future designers and architects. Our research is related to the scientific and research work "Improvement of the organization of the educational process using distance learning methods and teaching methods for graphic disciplines for students of construction and architectural-art specialties based on a competency-based approach," which has been carried out at the Department of Descriptive Geometry and Engineering Graphics of the Odessa State Academy of Civil Engineering and Architecture (OSACEA) for many years. The ability to execute drawings and solve various practical technical problems is only possible based on the theoretical principles, concepts, and methods of representing geometric problems studied in Descriptive Geometry. In the study of methodological means of improving students' graphic skills, the empirical base consisted of 125 first- and second-year students of the Institute of Architecture and Art. Summarizing the materials of the authors' experimental studies, which consisted of systematic observation of the educational process, analytical comparison of students' results, and personal conclusions of teachers, generalized results were obtained regarding the characteristics of priority motivational factors, which are presented in the table.

In our opinion, the data presented in the table raises certain methodological considerations for teachers because, first, it is important not to overload younger students, but rather to engage and motivate them to learn. Secondly, it is necessary to seek different differentiated and individual approaches to improve the quality of teaching graphic disciplines. The generalized coefficient k is the average indicator for the group as the ratio of the number of hours missed to the number of students in the group. It shows the level of student interest in achieving high academic performance in this discipline

It should be noted that second-year students have a higher k index, i.e., the percentage of missed classes is higher, although their interest in future professional activities is significantly higher than that of first-year students.

Table

CHARACTERISTICS OF PRIORITY MOTIVATIONAL FACTORS IN THE STUDY OF DESCRIPTIVE GEOMETRY BY JUNIOR YEAR STUDENTS

	Characteristics of the motivational factor	Group No.1 (22 students)	Group No.2 (14 students)	Group No.3 (35 students)	Group No.4 (23 students)	Group No.5 (11 students)
1	Desire to learn (%)	50	60	55	50	45
2	Desire to improve skills (%)	15	10	8	10	13
3	Competition among classmates (%)	13	7	10	5	12
4	Interest in future profession (%)	12	8	5	25	25
5	Contact with the teacher (%)	10	15	7	10	5
6	Generalized coefficient k	4.26	1.82	3.72	6.00	8.18

Notes. 1. Groups No. 1–3 are first-year students, No. 3 and 4 are second-year students.

2. Statistical data obtained as expert assessments from a comparative analysis of the educational process separately for each group.

Let us consider some of the topics and tasks that junior students of the Architecture and Design specialty study and perform while studying the following discipline, as examples that illustrate the importance and necessity of studying the discipline "Descriptive Geometry".

We emphasize that the main tasks of descriptive geometry include studying the basic concepts, methods, and rules for constructing images of spatial forms on a plane; developing spatial thinking; consolidating methods and algorithms of graphic actions for solving various applied metric and positional problems on a plane; developing and improving graphic skills for creating spatial images of objects based on the analysis of their images etc.

Many students find it difficult to comprehend the academic information in this discipline. The reasons for these difficulties include a lack of understanding of the purpose and objectives of studying the discipline, as well as a low level of school preparation. In addition, the difficulties are also related to the special combination of logical thinking and spatial imagination. The combination of these two abilities forms a new level of thinking—spatial thinking, which makes it possible to manipulate images in space, without which any creative activity is impossible. In order to recreate spatial images of objects, determine their relative positions and sizes, model and study various

technical forms and structures, it is important to know, for example, the classification of surfaces (pyramid, prism, cone, cylinder, sphere, torus, etc.), since understanding the shape of an object is based on breaking it down into its constituent parts and sequentially drawing those parts. The construction of projections of the intersection line of surfaces plays an important role in representing the sequence in which images are rendered and how the visibility of surface elements is determined. (Fig. 1) shows two examples of such graphic work.

Of great importance in further studies in senior courses and professional activities is the study of the sections “Shadows in orthogonal projections” and “Construction of perspective images” (fig. 2).

The list of examples of topics and assignments could go on, but it is clear that in order to complete a drawing on any of the topics discussed, one cannot do without the knowledge, skills, basic definitions, concepts, laws, and rules provided by descriptive geometry. Consequently, graphic training and the ability to read and execute drawings are important components for students of creative specialties.

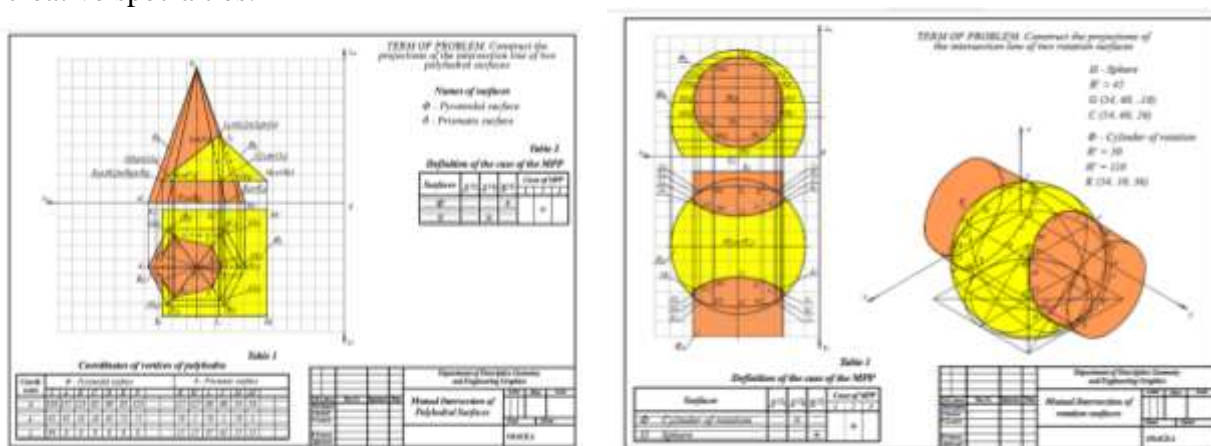


Fig. 1. The construction of projections of the intersection line of surfaces: *a*) Construction of projections of the intersection line of two polyhedral surfaces; *b*) Construction of projections of the intersection line of two surfaces of revolution

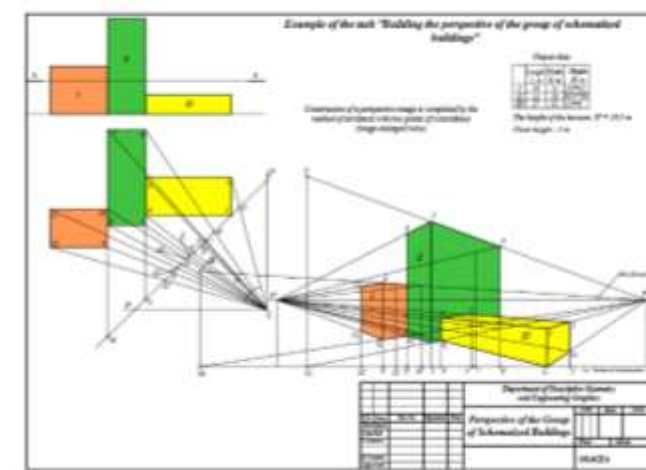


Fig. 2. Example of the task "Constructing the Perspective of Spatial Forms Using the Architects' Two-Point Vanishing Point Method"

To improve the graphic skills of future architects and designers, scientific and methodological literature suggests using various methodological techniques that allow for the development of well-

rounded specialists. Thus, to integrate and consolidate skills, it is recommended to apply practical methods individually, for example, from simple to complex, integrating “manual” and “digital” work in parallel, but with an emphasis on manual graphics, the improvement of which is inextricably linked to graphic disciplines. The foundation for further development of individual graphic skills in junior students of creative specialties can be laid through regular training in hand positioning and working with drawing instruments using specific graphic exercises and assignments [7; 13; 16; 17, etc.]. This individually differentiated approach takes into account the individual characteristics and pace of development of each student for more effective diagnosis and development of their competencies.

Here are a few more examples of improving the graphic abilities of future designers and architects by teaching graphic disciplines "Art of Font", "Accidental Font", etc. at the Department of Descriptive Geometry and Engineering Graphics of OSACEA. Thus, in the process of studying the discipline “The Art of Font” students develop skills in the competent use of knowledge about the principles of font design and font composition, as well as the determination and enhancement of the emotional significance of information using fonts of different styles. Students learn theoretical and practical knowledge about the laws of font construction and the peculiarities of using font graphics in their future professional activities, and acquire skills in artistic and graphic activities. Thus, in the process of studying the discipline “The Art of Font” students develop skills in the competent use of knowledge about the principles of font design and composition, as well as in determining and enhancing the emotional significance of information using fonts of different styles. Students gain theoretical and practical knowledge about the laws of font construction and the peculiarities of using font graphics in their future professional activities, as well as acquire skills in artistic and graphic activities.

Fig. 3 shows examples of student graphic assignments (selectively) from the discipline “Art of Font” completed in accordance with this curriculum.

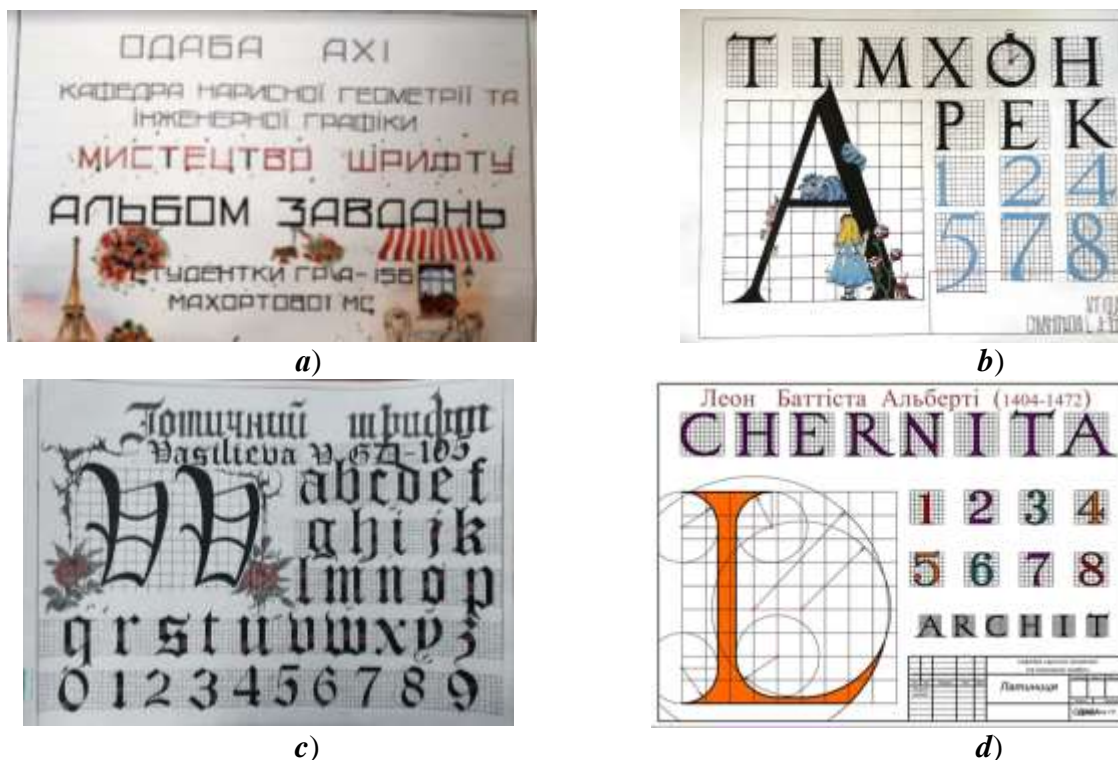


Fig. 3. Examples of student graphic tasks (selectively) from the discipline "Art of Font":
a) Title page, b) Antiqua font c) Gothic font d) Latin font

It is important to note that *accidental fonts* are fonts used to create visual emphasis and attract attention. Knowing accidental fonts opens up new opportunities for experimentation and creating unique visual images. They will help you go beyond the usual fonts, expand your creative potential, create a unique style, and add originality to your projects. Fig. 4 shows examples of student graphic tasks (selectively) from the discipline "Accidental Font", completed in accordance with this Curriculum.



a)



b)

Fig. 4. Examples of student graphic tasks (selectively) from the discipline "Accidental Font":
 a) Title page, b) current works

Incorporating fonts into a composition is a very common and quite difficult task. Fonts are a unique art form. First, they are symbolic in nature, and second, font compositions are read in a specific order, line by line, from top to bottom and left to right. This makes the composition of fonts with images very specific, distinguishing it from most types of decorative and figurative art. The construction of font composition is facilitated by the fact that fonts and ornaments are two-dimensional and flat in nature. By finding a common rhythm, similar plasticity, and color saturation for letters and images, a specialist can achieve a fusion of font and ornament into a single image.

Fig. 5 shows examples of student graphic tasks on the topic "Font Compositions".



Fig. 5. Examples of student graphic tasks on the topic "Font compositions"

From the authors' point of view, most students are actively engaged in class and at home, demonstrating creativity and a desire to improve their graphic skills. Control measures are a necessary element of feedback: current control is carried out during practical classes in the form of a survey, checking the student's readiness to perform and step-by-step processing of control works, and the final control is carried out in the form of a test.

For almost 10 years, our Department has been participating in the PANGRAM International Student Competition in Typography and Calligraphy, organized by the Kharkiv State Academy of Design and Arts (KSAAD). More than 500 graphic works created by students from more than 200 educational institutions, both domestic and international, take part in it. An international jury composed of prominent international experts evaluates the graphic works. Every year, the works of our junior students majoring in architecture, design, and art, under the guidance of the department's teachers, receive diplomas and certificates. Fig. 6 shows examples of such works in various categories.



a)



b)



c)

Fig. 6. Examples of student graphic competition works in the categories a) Lettering, b) Calligraphy, c) Art Alphabet

Conclusions. Prospects for Further Research. Graphic professional competence is an integral characteristic of a person that combines knowledge, abilities, and skills in graphic disciplines that ensure effective performance of professional activities. Graphic training also teaches how to use terminology and concepts related to information visualization. Working with graphics most effectively develops visual-figurative thinking, which is very important in any creative process, because any new solution is first imagined as a picture, diagram, or model, that is, in the creation of spatial images of reality (in the process of constructing, transforming, or improving an object or phenomenon). We emphasize that the issue of graphic training and methodological tools for improving students' graphic abilities in today's difficult conditions has been repeatedly discussed at scientific and methodological seminars and many international conferences. In our opinion, the

prospects for further research are to find different ways to improve students' graphic competence and introduce them into the educational process.

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ДОСЛІДЖЕННЯ МЕТОДОЛОГІЧНИХ ІНСТРУМЕНТІВ УДОСКОНАЛЕННЯ ГРАФІЧНИХ ЗДІБНОСТЕЙ МАЙБУТНІХ ДИЗАЙНЕРІВ ТА АРХІТЕКТОРІВ

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Анотація. На сучасному етапі вища освіта переходить на новий якісний рівень, що відображає інновації в професіях «Дизайнер» або «Архітектор». Отже, зростає необхідність в підготовці висококваліфікованих спеціалістів у цих галузях. З огляду на сучасні концепції та інноваційні технології, що очевидні в усіх сферах людського життя, зросли вимоги до рівня професійної підготовки випускників вищих навчальних закладів, їхньої самоосвіти, здатності самостійно мислити, оптимізувати свою діяльність, приймати нетрадиційні, нетривіальні рішення. Розвиток відповідних високоякісних графічних компетенцій та стійких практичних навичок у процесі підготовки майбутніх креативних фахівців є актуальним питанням. Для студентів першого курсу, особливо спеціальностей «Дизайн» та «Архітектура», креслення від руки залишається фундаментальною навичкою, яка вимагає систематичного розвитку за допомогою спеціальних технік та вправ. Головна мета — «тренувати руку», розвивати окомір, почуття міри та впевненість у лінії. Розвиток ручної графіки нерозривно пов'язаний з класичними графічними дисциплінами, насамперед такими: «Нарисна геометрія», «Геометрія зображень», «Шрифтова графіка» або «Мистецтво шрифту», «Акцидентний шрифт», «Каліграфія», «Типографіка» тощо. Основні результати дослідження методичних інструментів для вдосконалення графічних можливостей майбутніх дизайнерів та архітекторів розглянуто авторами з використанням багаторічних досліджень у процесі навчання студентів першого та другого курсів на кафедрі нарисної геометрії та інженерної графіки Одеської державної академії будівництва та архітектури (ОДАБА). У дослідженні використано аналітичні методи для узагальнення експертних оцінок графічних та індивідуальних, зокрема конкурсних, студентських робіт, результатів погодинних спостережень за виконанням завдань на аудиторних заняттях, передбачених Навчальними програмами, та висновків критичного порівняльного аналізу сучасних публікацій з методики викладання графічних дисциплін студентам творчого профілю тощо. Результати дослідження апробовано в навчальному процесі, що передбачає вдосконалення та розвиток цієї теми в подальшій перспективі.

Ключові слова: нарисна геометрія, графічні дисципліни, студенти першого курсу спеціальностей дизайн та архітектура, технічна грамотність

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