

Architecture and Construction Students' Perception of "Technical Drawing" and "Descriptive Geometry" Discipline Content

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Abstract. The present paper highlights the results of pedagogical research conducted at the Architectural Department in the Kamianets-Podilskyi Professional College of Construction, Architecture and Design. The study considers the vocational pre-higher education students' perceptions of various graphic works in drawing and descriptive geometry in the context of graphic work features, and understanding the significance of drawing works for the formation of a future specialist in the construction industry. Students were suggested to fill in the forms with a list of the curriculum topics and give grades according to three criteria: usefulness for the future profession, the complexity of the graphic work and the engagement in performing the task. Research results provide problem-solving solutions related to teaching methodology of such disciplines as "Technical Drawings", "Drawings and Basics of Descriptive Geometry" and "Descriptive geometry". Based on research findings, the recommendations concerning teaching and increasing interest in educational material can be made. It has been found that certain topics do not arouse much interest in students, so we recommend improving students' motivation in the classroom by employing engaging tasks, taking into account the peculiarities of perception and attention when studying these topics. The topics that are difficult to master according to students' responses require

more hours for studying, and the topics that students consider least useful should be reviewed, reformatted, or even excluded from the program.

Keywords: technical drawing, descriptive geometry, graphic work, perception of the material, interest in work, complexity of performing, usefulness for the profession.

I. INTRODUCTION

Improving the content of education is a priority task for the state. In this regard, it is necessary to improve curricula and training plans; provide innovative teaching methods and materials; substantiate modern criteria for evaluating the effectiveness of the educational process.

An important component in future construction specialties' training is the development of students' graphic skills and abilities. That is why their professional training should include activities for acquiring well-formed graphic knowledge and skills to develop a high level of graphic culture.

The standard of higher education indicates such special (professional) competencies as SC06 and SC09. The first competence, for example, includes the ability to perform technical and artistic images for use in architectural, urban

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planning, design and landscape design. The second competence (SC09) suggests developing architectural, artistic, functional, volumetric-planning and design solutions, as well as carrying out technical drawings, and preparing documentation for architectural projects [1]. These competencies are implemented during the study of disciplines related to graphic literacy and the creation of images carried out in the form of drawings or blueprints. Therefore, the subjects of the research are the disciplines related to teaching technical drawing to students. Such disciplines as "Technical Drawing", "Drawing and Descriptive Geometry", "Drawing and Perspective", "Engineering Graphics", and "Architectural Graphics" are taught to students of different specialities.

Studies have shown that disciplines related to drawing are the only disciplines that develop the spatial vision. They are the basics of jobs such as architect, builder, designer, engineer and many others. In addition, teachers of Natural and Mathematical Sciences note that when students are familiar with drawing, they have no difficulties in mastering science-related disciplines [2].

It should be mentioned that teaching "Technical Drawing", "Drawing and Descriptive Geometry", "Drawing and Perspective", "Engineering Graphics", and "Architectural Graphics" has peculiarities for each speciality, so the content of various alternative programs will differ significantly. The units and topics related to the basics of Drawing and Descriptive Geometry can be considered the least variable component. It is here that the common features of mastering drawing graphics are concentrated, so the topics from this cycle slightly differ for both construction and non-construction specialities. However, this does not mean that all topics have the same content importance and significance for students of different majors.

V.M. Burynskyi, O.M. Dzhedzhula, M.M. Kozziar, V.V. Moshuk, V.Y. Naumenko, H.O. Raikovska, V.K. Sydorenko, D.O. Thorzhevskyi, V.I. Chepok, A.P. Verkhola, Z.M. Shapoval, N.P. Shchetina, M.F. Yusupova and several other researchers actively worked on various issues of teaching drawing in Ukraine [3-11]. However, there is no previous research on scientifically based and student-centred approaches to the structure of the training course in Drawing [12-18].

The purpose of the present study is to explore the perception of topics from the Drawing and Descriptive Geometry course by students majoring in "Architectural Design and Interior" (architecture), and "Decoration of Buildings and Structures and Building Design" (design). To achieve this goal it is necessary to solve the following tasks:

- highlight the most specific and commonly used topics in the Drawing and Descriptive Geometry course and identify appropriate graphic works;
- design a questionnaire survey to obtain students' opinions;
- conduct a survey;
- analyze the results and make conclusions.

II. MATERIALS AND METHODS

The research was conducted at the Architectural Department of Kamianets-Podilskyi Professional College of Construction, Architecture and Design in the 2018/19, 2019/20 and 2020/21 academic years. Two groups of second-year students (D-21 (Designers) and A-21 (Architects)) participated in the experiment. The discipline "Drawing and Perspective" was taught to the students of the first group, and the discipline "Drawings and Descriptive Geometry" was taught to the students of the second group. The survey included topics that were commonly used for all specialities. The topics relating to the construction drawings of houses and their elements, the setting of shadows, as well as the construction of perspectives, were not taken into account. After studying the relevant topics and performing graphic works, the respondents were suggested to assess the significance of a particular work in terms of:

- a) The complexity of the construction,
- b) The engagement in performing the task,
- c) Usefulness of the skills acquired during the performance for the future profession.

The respondents were suggested to evaluate graphic works common to all specialities:

1. Drawing fonts.
2. Drawing lines.
3. Conjugation.
4. Projections of a point and a straight line.
5. Plane. Plane conversion.
6. Axonometric images.
7. Group of geometric bodies.
8. Cut geometric figure (pyramid, cone).
9. The intersection of geometric bodies.
10. Complex drawing of a volumetric model.
11. Simple cuts.

The students were given forms with a list of these topics, miniature images of graphic works and three columns for grading according to the three above criteria (Fig. 1). The assessment was conducted according to a 10-point system, where 0 is the minimum impact and 10 is the maximum impact on the criterion.

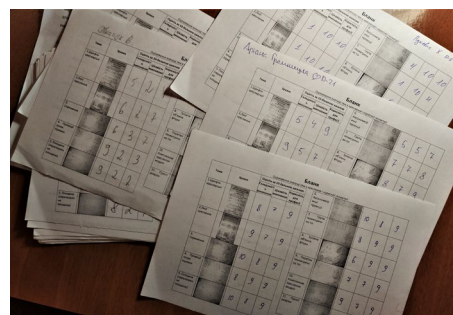


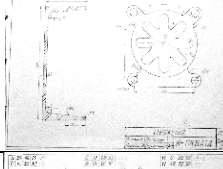
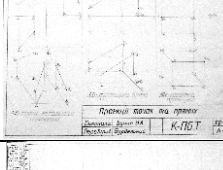
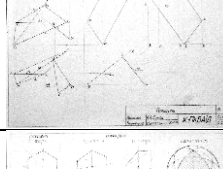
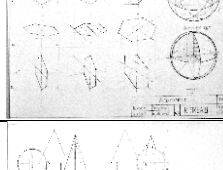
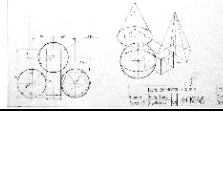


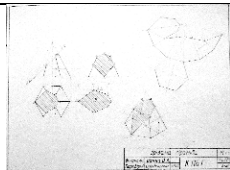
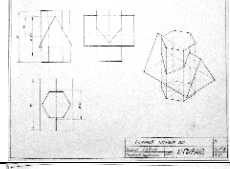
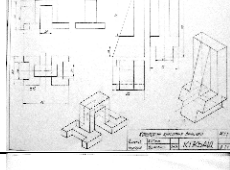
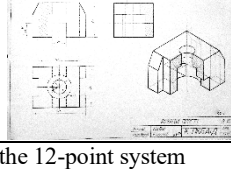
Fig. 1. Student survey forms.

III. RESULTS AND DISCUSSION

The curriculums of the disciplines "Drawing and Perspective" (D-21) and "Drawings and Descriptive Geometry" (A-21) basically have many common topics and differ little in terms of content and number of hours to study such topics. Both courses provide for similar graphic works. Joint graphic works are presented in Table 1. The table also shows the characteristics of the works, the percentage of students who passed the works without delays in the specified period, as well as the average score for the work of all studied students.

TABLE 1 INDICATORS OF JOINT GRAPHIC WORKS AND THEIR CHARACTERISTICS

No	The name of the graphic work	Format	Miniature	Execution time, hours	Submitted on time, %	Average score*
1	Drawing fonts	A4		4	80	7.8
2	Drawing lines	A4		4	91	8.2
3	Conjugation	A3		4	93	9.1
4	Projections of a point and a straight line	A3		4	92	9.6
5	Plane. Plane conversion	A3		6	82	7.5
6	Axonometric images	A3		4	95	9.4
7	Group of geometric bodies	A3		4	91	8.8

8	Cut geometric figure	A3		4	93	8.2
9	The intersection of geometric bodies	A3		6	88	8.0
10	Complex drawing of a volumetric model	A3		6	92	9.1
11	Simple cuts	A3		4	92	9.0

* according to the 12-point system

After studying all topics, students were surveyed to determine their perception of these works according to the three criteria indicated above.

The results obtained will be presented in the form of a column chart shown in Fig. 2.

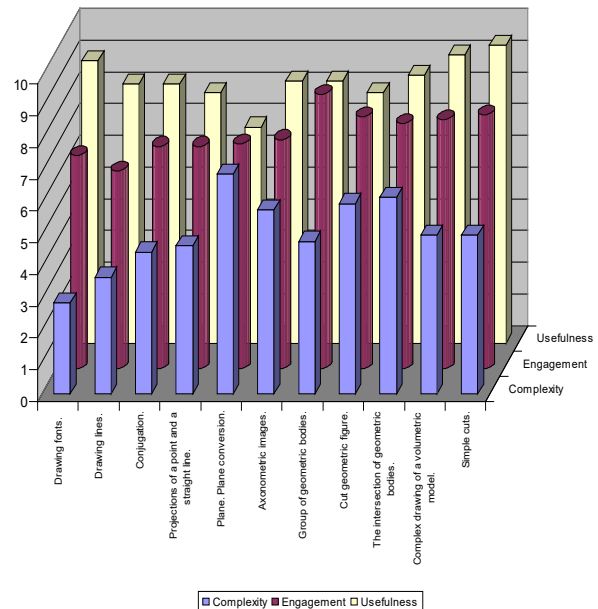


Fig. 2. Average score based on the survey results.

Figure 2 shows that according to students' responses, there is no specific dependence between the criteria of complexity, curiosity and usefulness for the future profession.

A topic that students find simple (for example, "Drawing fonts") may seem useful to them, or a topic they

consider to be least interesting (for example, "Drawing lines") can be also attributed to potentially useful ones. In contrast, a topic the students consider to be the most interesting to perform ("Group of geometric bodies") may have an average utility value.

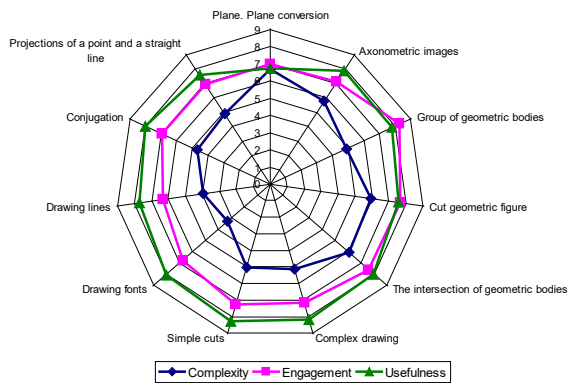


Fig. 3. Radar diagram of average scores by criteria.

The diagram in Fig. 2 demonstrates similar shifts in the average grades of students between individual graphic works, and also allows us to trace differences in the perception of the selected research criteria. We should admit a significant variation in average scores for each of the criteria, which indicates a certain imbalance, especially concerning the complexity of execution. This criterion for almost all graphic works scored the lowest marks (from 2.5 to 8), which indicates the actual assessment tested by practice (the survey was carried out after all these works were performed). Instead, the students reacted more loyally to the criterion "Usefulness for the future profession" and in fact, all the works were recognized as necessary and important for the future profession.

Having data on the success of the students' work performance (Table 1), in order to compare them with the questionnaire scores, we will convert the average score of the students into a 10-point system. By comparing them with the studied indicators (first of all with their assessment of the complexity of implementation), we will get the following diagram in Fig. 4.

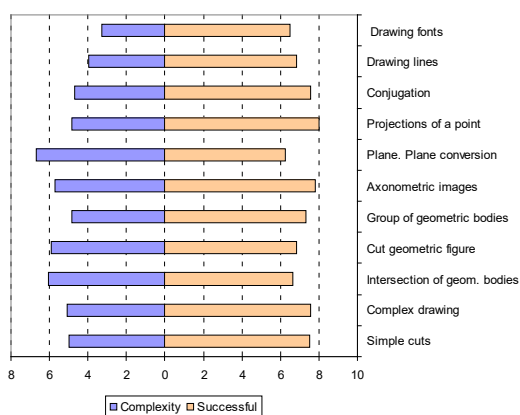


Fig. 4. Comparison of the complexity of the works execution and the successful of their implementation by students.

It can be seen from the diagram that the difficulty of execution is not always directly proportionally correlated with the success of each job. Thus, we can see that the topic "Drawing fonts" did not seem difficult to the students, but the success rate was not at the highest level. While such topics as "Projections of a point and a straight line", "Complex drawing of a volumetric model" seemed quite difficult to the students, however, they generally coped with them successfully. This is due to the fact that it was not in these works that students began to get acquainted with new types of works, which at the beginning had to be well understood.

IV. CONCLUSIONS

Analysing the data obtained, we can solve several issues related to the methodology of teaching disciplines. In particular, it can be seen from the diagram that such topics as "Drawing fonts", "Drawing lines", "Point and Straight Line", and "Plane Transformation" don't arouse much interest in students. Therefore, studying these topics may be necessary to improve this component in the classroom by employing creative and interesting tasks, taking into account the peculiarities of perception and attention, etc.

The topics "Plane Transformation", "Cut Geometric Body", and "Intersection of Geometric Bodies", which turned out to be the most difficult according to students' assessments, may require more hours to study, and the topics that students consider the least useful should be reformatted or excluded from the course. To obtain more accurate results, the experts in the field of drawing should be engaged in the experiment. Further research will deal with the comparative analysis of students' and experts' perceptions of topics and various graphic works in drawing and descriptive geometry in the context of the complexity, interest in performing graphic works and usefulness of the skills acquired for the future profession.

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