

Improving Software for Developing the Graphic Representations of Future Teachers in An Electronic Educational Environment

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Abstract: The article examines the issues of improving software for developing the graphic representations of future teachers in an electronic educational environment. The significance of graphic representations as an important component of the professional training of teachers in the context of the digitalization of education is substantiated. The possibilities of modern electronic educational resources, interactive platforms and software tools aimed at forming spatial thinking, visualizing educational information and developing students' graphic competencies are analyzed. Ways of improving software based on the integration of digital technologies, interactive graphic tools and adaptive educational resources are proposed. The results of the study show that the use of improved software tools contributes to increasing the level of graphic training of future teachers, developing their creative and logical thinking, as well as the effectiveness of professional activity in a digital educational environment.

Keywords: Electronic educational environment, software, future teachers, graphic representations, graphic competencies, digital technologies, information visualization, interactive educational resources, spatial thinking, professional training of teachers.

Introduction: In the context of the rapid digitalization of education, the use of modern information technologies in the process of professional training of future teachers is becoming especially important. The electronic educational environment is becoming an important component of the educational process, providing access to various digital resources, interactive tools and innovative teaching methods. In this regard, there is a growing need to improve software that contributes to the formation and development of professionally significant competencies of future teachers.

One of the important areas of training future teachers is the development of graphic representations, which ensure the ability to perceive, analyze, interpret and create graphic information. Graphic representations play a significant role in the development of spatial

thinking, logical analysis, visualization of educational material and effective solution of professional tasks. This issue becomes especially relevant in the context of the introduction of digital educational technologies, which require the teacher to be able to work with graphic models, schemes, diagrams, electronic drawings and other means of information visualization. Modern software tools provide broad opportunities for forming students' graphic competencies. However, analysis of practice shows that existing software does not always fully meet the requirements of training future teachers, since it does not sufficiently take into account the individual characteristics of students, the level of their graphic training and the specifics of the professional activity of a teacher. This determines the need to search for new approaches to improving software aimed at developing graphic representations in an electronic educational environment.

In this regard, the relevance of this study is determined by the need to develop and improve software tools that ensure the effective development of graphic representations of future teachers on the basis of modern digital technologies. The purpose of the study is to examine the possibilities of the electronic educational environment and to determine ways of improving software in order to improve the quality of forming the graphic competencies of future teachers.

LITERATURE REVIEW

The problem of developing students' graphic representations is one of the relevant areas of modern pedagogical research. In the scientific literature, graphic representations are considered as an important component of a person's cognitive activity, ensuring the formation of spatial thinking, the development of analytical abilities and the effective perception of visual information [1].

The theoretical foundations for the development of graphic thinking and graphic representations were laid in the works of domestic and foreign scholars. Studies have shown that graphic activity contributes to the development of logical thinking, spatial imagination and creative abilities of students. Special attention to the issues of forming graphic competencies is paid in works devoted to the professional training of future teachers and the use of modern educational technologies [2].

In recent years, a significant number of studies have been related to the introduction of digital technologies into the educational process. The authors note that the electronic educational environment provides broad opportunities for visualizing educational information, organizing interactive learning and developing students' graphic skills. The use of computer graphics, multimedia tools, virtual laboratories and specialized software contributes to increasing the effectiveness of mastering educational material and forming the professional competencies of future teachers [3].

Ряд исследований посвящен вопросам совершенствования программного обеспечения в системе педагогического образования. Ученые подчеркивают, что современные цифровые платформы должны обеспечивать интерактивность, адаптивность, наглядность и возможность индивидуализации обучения. Особое значение

приобретают программные средства, позволяющие создавать графические модели, схемы, диаграммы и визуальные объекты, способствующие развитию графических представлений обучающихся[4].

Несмотря на значительное количество научных работ по вопросам цифровизации образования и формирования графических компетенций, проблема совершенствования программного обеспечения для развития графических представлений будущих учителей в электронной образовательной среде остается недостаточно изученной. Анализ литературы показывает необходимость разработки новых методических подходов и программных решений, направленных на повышение эффективности формирования графических представлений в условиях цифровой образовательной трансформации[5].

Таким образом, результаты проведенного анализа научной литературы свидетельствуют о важности дальнейших исследований в области совершенствования программного обеспечения для развития графических представлений будущих педагогов и подтверждают актуальность выбранной темы исследования[6].

RESEARCH METHODOLOGY AND EMPIRICAL ANALYSIS

The development of graphic representations of future teachers is one of the important tasks of modern pedagogical education. In the conditions of an electronic educational environment, the use of specialized software that contributes to the formation of spatial thinking, visual perception of information and graphic competencies of students becomes especially relevant. In the course of the study, the pedagogical possibilities of software tools aimed at developing the graphic representations of future teachers were studied, and ways of improving them were determined.

The methodological basis of the study consisted of systemic, competency-based, activity-based and personality-oriented approaches. To achieve the stated goal, methods of analyzing scientific and methodological literature, pedagogical observation, questionnaires, testing, pedagogical experiment and statistical processing of the obtained data were used.

Improving software for developing the graphic representations of future teachers is based on the following principles:

Principle of interactivity. The software must ensure active interaction of students with educational material, providing the opportunity to independently perform graphic tasks, model objects and receive prompt feedback.

Principle of visibility. Educational material must be accompanied by graphic models, schemes, diagrams, animations and three-dimensional objects that contribute to a deeper understanding of the studied processes and phenomena.

Principle of modularity. The content of the software must be organized in the form of interconnected modules that ensure the gradual formation of graphic knowledge, skills and abilities.

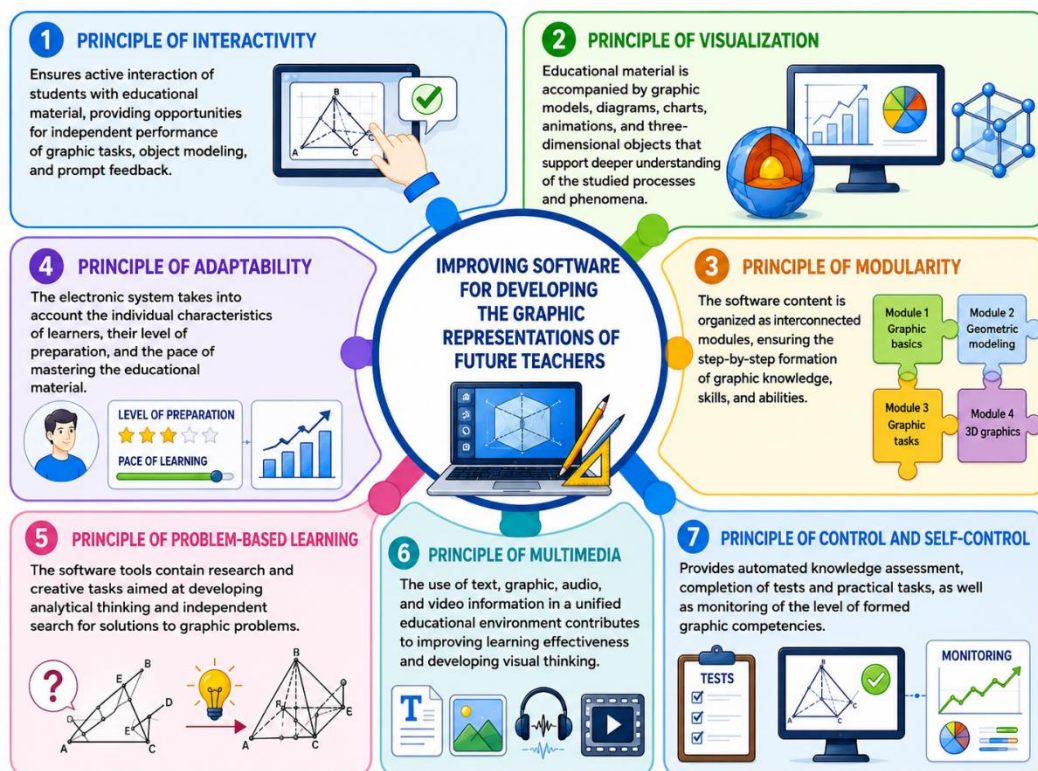
Principle of adaptability. The electronic system must take into account the individual characteristics of

students, their level of preparation and the pace of mastering educational material.

Principle of problem-based learning. Software tools must contain research and creative tasks aimed at developing analytical thinking and independent search for solutions to graphic problems.

Principle of multimedia. The use of textual, graphic, audio and video information in a single educational environment contributes to increasing the effectiveness of learning and developing visual thinking.

Principle of control and self-control. The software must ensure automated assessment of knowledge, completion of test and practical tasks, as well as monitoring the level of formation of graphic competencies.



The empirical part of the study was conducted among students of pedagogical fields of training. In the experimental group, electronic educational resources, graphic editors, computer modeling systems and interactive learning platforms were used. In the control group, instruction was carried out mainly by traditional methods.

The results of the pedagogical experiment showed that the use of improved software in an electronic educational environment contributes to a significant increase in the level of students' graphic

representations. Students in the experimental group showed improvement in spatial thinking skills, graphic analysis, modeling and visualization of information. In addition, their motivation for learning and the level of independent cognitive activity increased.

The conducted empirical analysis confirmed that interactivity, adaptability and visual saturation of software are the most important factors in the effective development of graphic representations of future teachers. The obtained results indicate the expediency of further improving digital educational

resources and their wide implementation in the system of professional training of pedagogical personnel.

RESULTS

In the modern conditions of the digital transformation of education, providing higher educational institutions with high-quality electronic educational resources and software tools that meet the requirements of state educational standards and international trends in the development of education is of particular importance. One of the most important directions of this activity is the improvement of software aimed at developing the graphic representations of future teachers.

The analysis of existing digital educational resources showed that many software products are limited to the function of displaying educational material in electronic format. Such an approach does not ensure the full formation of students' graphic competencies and does not allow the potential of the electronic educational environment to be realized. Modern software must not only contain educational information, but also provide opportunities for interactive interaction, visualization, modeling and independent activity of students.

Graphic representations are an important component of the professional training of a future teacher, since they make it possible to effectively perceive, analyze and interpret visual information. In the course of the study, it was established that the use of interactive graphic tools, computer modeling tools and digital visualization contributes to the development of spatial thinking, analytical abilities and a creative approach to solving professional tasks.

The results of the pedagogical experiment showed that the use of improved software in an electronic educational environment has a positive effect on the level of formation of students' graphic representations. Students in the experimental group demonstrated higher indicators according to such criteria as graphic analysis of objects, construction of schemes and models, visualization of information, ability for spatial transformation of images and use of digital graphic tools in professional activity.

In the course of the study, the main requirements for software ensuring the development of graphic representations of future teachers were determined:

1. The presence of interactive tools for

constructing and editing graphic objects.

2. The possibility of visualizing complex processes and phenomena using animation and multimedia tools.
3. Support for three-dimensional modeling and virtual construction of objects.
4. Organization of a system of self-control and automated assessment of learning outcomes.
5. Adaptation of the content and complexity of tasks to the individual characteristics of students.
6. Integration with electronic educational platforms and cloud services.
7. Ensuring conditions for independent research and project activities of students.

The conducted study confirmed that the use of modern software tools significantly increases the effectiveness of forming the graphic representations of future teachers. The electronic educational environment contributes to the activation of students' cognitive activity, the development of their graphic culture, spatial thinking and professional competencies.

Thus, the results of the study indicate that improving software is an important condition for increasing the quality of training future teachers and for the effective development of their graphic representations in the conditions of digital education.

CONCLUSION

In the conditions of the digitalization of the education system, the development of graphic representations of future teachers is becoming one of the important areas of professional training of pedagogical personnel. The electronic educational environment provides broad opportunities for the formation of graphic competencies, the development of spatial thinking, visual literacy and creative abilities of students.

In the course of the study, the theoretical foundations for developing the graphic representations of future teachers were studied, the possibilities of modern digital educational technologies were analyzed, and the main directions for improving software in an electronic educational environment were determined. It was established that the effective development of graphic representations is ensured through the use of interactive, multimedia and adaptive software tools focused on the active cognitive activity of students.

The results of the conducted pedagogical experiment confirmed the positive influence of improved software on the level of formation of the graphic representations of future teachers. The use of digital graphic tools, visualization tools and computer modeling contributes to the development of skills in analysis, design, interpretation and presentation of graphic information.

The study showed that the most significant factors in the effective development of graphic representations are the interactivity of the educational environment, the visibility of the presentation of educational material, the possibility of individualizing learning and the integration of modern information and communication technologies into the educational process.

Thus, improving software for developing the graphic representations of future teachers in an electronic educational environment contributes to increasing the quality of professional training of teachers, forming their digital and graphic competencies, and also ensuring more effective adaptation to the requirements of the modern information society. Prospects for further research are related to the development of intelligent educational systems based on artificial intelligence, virtual and augmented reality technologies for further improving the process of forming the graphic representations of future teachers.

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