



METHODOLOGY FOR DEVELOPING STUDENTS' COMPETENCE IN DESIGNING THREE-DIMENSIONAL LEARNING TOOLS FOR INDEPENDENT STUDY ACTIVITIES

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Abstract. *This article presents theoretical information on the methodology for developing the competence of designing three-dimensional learning tools in students' independent learning activities. The main content of the article is the formation of practical skills in 3D design in students, increasing their potential for creative thinking and independent work. This article analyzes the theoretical foundations, foreign experience, methodological approaches, and pedagogical conditions.*

Keywords: *3D graphics, competence, methodology, method, design, 3D modeling, 3D Max, Blender, Tinkercad, independent project, STEM, 3D technology.*

Currently, the use of information technologies and digital technologies in the educational process is expanding. In particular, the creation of three-dimensional teaching aids and their integration into the educational process is an important factor in strengthening students' knowledge and skills. Independent learning activity contributes to the independent enrichment of students' knowledge, the development of a creative approach and critical thinking skills.

The development and scientific substantiation of the methodological foundations for the development of competence in

designing 3D educational tools in students' independent educational activities is of great importance.

In recent years, a number of scientific studies have been conducted on the use of 3D technologies in the educational process at the international level. In his research, D.W.Johnson emphasizes the role of 3D modeling in the development of design competence in students. The combination of digital pedagogy and 3D technologies significantly increases the effectiveness of education. A.Kurbanov developed the theoretical foundations for creating pedagogical tools using 3D technologies. Kh.Abduazizova studied the methods of developing creative thinking in students through three-dimensional means. These studies show that the use of 3D technologies in independent educational activities is important not only for the formation of theoretical knowledge, but also for the formation of practical skills.

Methodological approaches aimed at the effective organization of students' independent educational activities and the development of 3D design competence include the following stages:

1. Theoretical training - familiarization with the basic concepts and software tools of 3D modeling.
2. Practical exercises - performing practical tasks in programs such as 3D Max, Blender, Tinkercad.
3. Independent projects - development of small 3D learning tools and projects by students.
4. Analysis and evaluation - verification of created projects and determination of their effectiveness.

This methodology helps to harmonize students' theoretical knowledge and practical skills.

Studies have shown that the design of 3D learning tools in independent learning activities increases students' creativity, develops technological skills, and significantly strengthens the level of competence. Students will have the opportunity to connect their theoretical knowledge with practice by applying their 3D models in the educational process. This significantly improves their motivation and level of assimilation.

In addition, the process of developing independent projects based on the design of three-dimensional learning tools directs students to scientific research, problem analysis, and finding solutions. During the work on each project, the student makes creative decisions, creates new ideas and products by applying existing theoretical knowledge. This process, based on the theory of constructivist education, allows for the assimilation of knowledge not only in a ready-made form, but also in the process of activity.

Also, the creation of 3D models forms in students the skills of critical thinking, logical analysis, and problem-solving based on a comprehensive approach. For example, when modeling a complex mechanical device or biological structure, the student takes into account not only technical aspects, but also aesthetic, functional, and practical effectiveness. As a result, the development of their competence in applying knowledge in several areas at the same time and combining them in practical activities is achieved.

Practical experience shows that students involved in working on 3D projects are usually highly motivated and strive for independent learning, assimilation of new information, and effective use of modern technologies. Their learning process occurs not as a passive student, but

as an active researcher and creator. This prepares them even more thoroughly for their future professional activities.

In particular, tasks implemented through three-dimensional technologies also develop students' skills in working in a team. In the process of group project development, students learn to respect each other's opinions, share responsibility, and achieve a collective result. This serves to strengthen their communicative competence.

Consequently, the design of 3D learning tools in independent learning activities not only expands students' knowledge and skills, but also plays an important role as a powerful pedagogical tool that comprehensively develops their creative, critical, communicative, and technological competence.

In conclusion, the methodology for developing the competence of designing three-dimensional learning tools in students' independent learning activities gives an effective result. This methodology serves to reveal the creative potential of students, develop innovative thinking, and strengthen practical skills.

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