MUHANDISLIK GRAFIKASI FANINI BIM TEXNOLOGIYALARIGA ASOSLANGAN DASTURLARDAN FOYDALANIB O‘QITISH METODIKASINI TAKOMILLASHTIRISH

v.b.dotsenti X.T.Rizayev (TAQU)

Annotation. *This article discusses the issues of improving the methodology of teaching engineering graphics through Building Information Modeling (BIM)-based software technologies. Today, the rapid development of digital technologies requires the integration of innovative software into the educational process. In particular, the use of Autodesk Revit and other BIM-oriented programs in engineering graphics education helps students develop spatial imagination, graphic competence, and practical design skills. The article analyzes the didactic possibilities of BIM technologies, the advantages of parametric modeling, and the effectiveness of digital teaching methods. In addition, experimental results and methodological recommendations for organizing practical lessons based on BIM technologies are presented.*

Keywords: *BIM technology, engineering graphics, Autodesk Revit, parametric modeling, digital education, CAD technologies, spatial thinking, graphic competence.*

Introduction.

In the modern educational environment, the integration of digital technologies into the teaching process is becoming one of the most important directions of pedagogical development. In higher technical education institutions, engineering graphics subjects play a crucial role in developing students’ graphic literacy, spatial imagination, and technical thinking abilities. Traditional teaching methods based mainly on two-dimensional drawings are gradually being replaced by modern digital technologies.

Today, Building Information Modeling (BIM) technologies are widely used in architecture, construction, and engineering industries. BIM technologies not only create three-dimensional models but also allow the integration of engineering, architectural, economic, and technical information into a single digital environment. Therefore, introducing BIM technologies into engineering graphics education is considered one of the urgent pedagogical issues.

The use of BIM-based software such as Autodesk Revit, AutoCAD, and ArchiCAD in teaching engineering graphics expands the possibilities of practical learning. Students gain opportunities to create virtual building models, visualize engineering objects in three-dimensional form, and develop project-oriented thinking skills.

The purpose of this research is to improve the methodology of teaching engineering graphics by using BIM-based software technologies and to determine their pedagogical effectiveness in the educational process.

MATERIALS AND METHODS

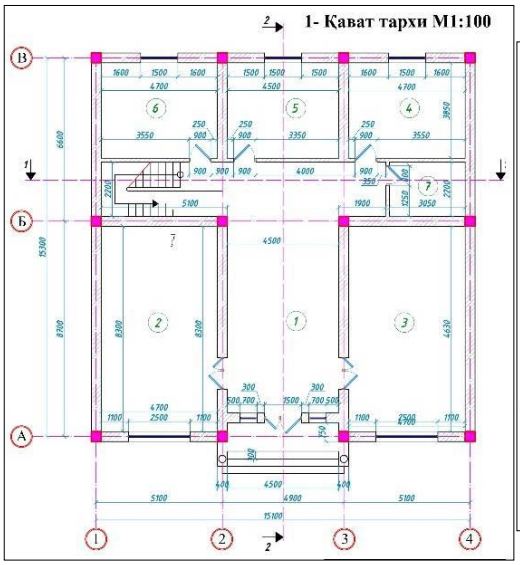
The research process employed pedagogical observation, comparative analysis, experimental teaching methods, and statistical evaluation techniques. During the study, engineering graphics lessons were organized using traditional methods and BIM-based digital technologies.

The experimental work was conducted among university students studying technical and engineering specialties. The educational process involved the application of the following software: (Figure-1).

- Autodesk Revit;
- AutoCAD;
- ArchiCAD.

Figure-1.

At the initial stage, students were taught traditional engineering graphics concepts, including orthographic projection, sections, and dimensioning rules (Figure-2). Afterwards, BIM technologies were introduced through practical assignments and project-based learning activities. (Figure-3).



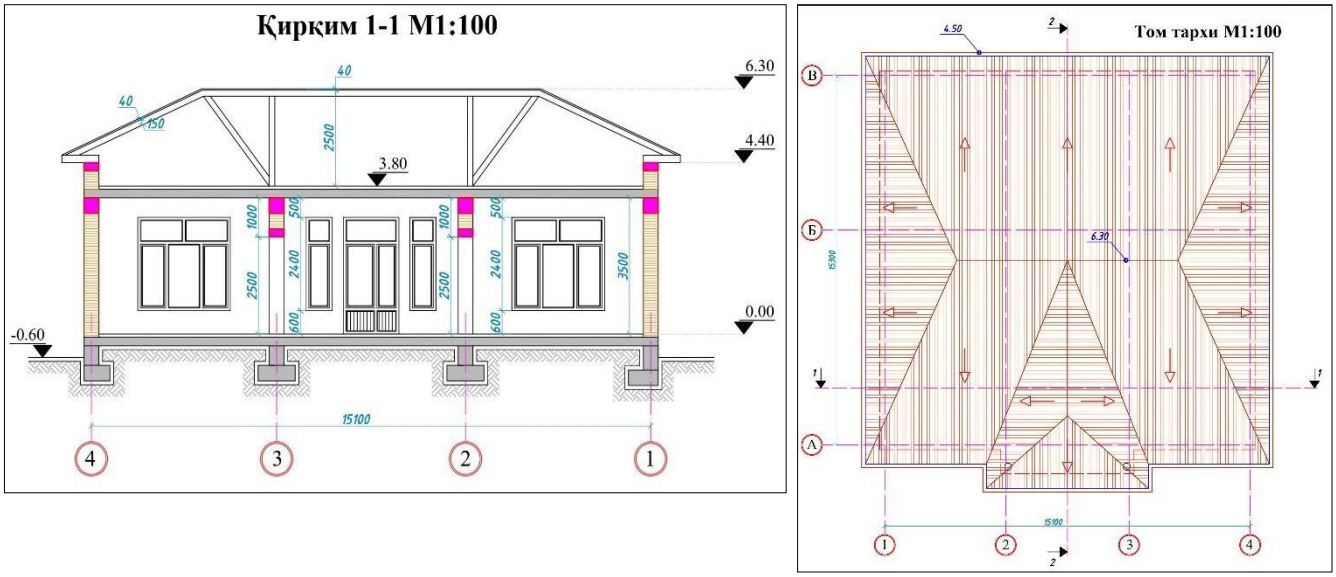

Кирқим 1-1 М1:100
6.30
4.40
3.80
0.00
-0.60
15100
4
3
2
1
Том тархи М1:100
4.50
6.30
15100
В
Б
А

Figure-2.

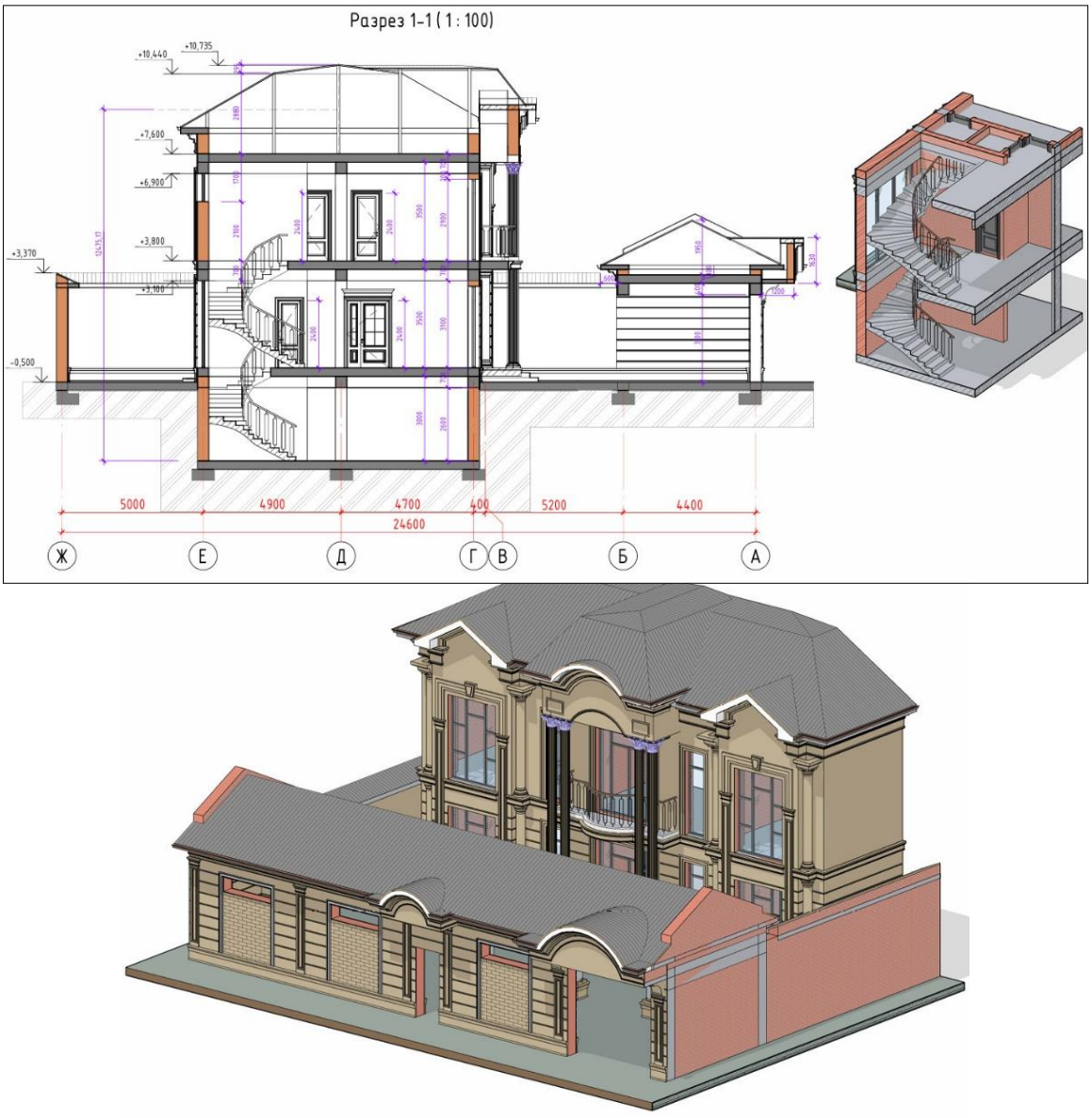

Разрез 1-1 (1 : 100)
+10,440
+10,735
+7,600
+6,900
+3,800
+3,370
+3,100
-0,500
5000
4900
4700
400
5200
4400
24600
Ж
Е
Д
Г
В
Б
А

Figure-3.

The proposed methodology included:

1. Teaching the fundamentals of three-dimensional modeling;
2. Creating parametric objects in BIM software;
3. Developing virtual architectural and engineering projects;
4. Organizing collaborative digital design activities;
5. Assessing students' graphic competencies through practical tasks.

Special attention was paid to the development of students' spatial thinking and independent problem-solving skills.

RESULTS AND DISCUSSION

The research results demonstrated that the integration of BIM technologies into engineering graphics education significantly increased students' learning motivation and practical competencies. Compared with traditional teaching methods, BIM-based lessons improved visualization opportunities and enhanced students' understanding of complex engineering objects.

Students who used Autodesk Revit showed higher performance in:

- understanding projection relationships;
- creating technical drawings;
- modeling engineering structures;
- analyzing spatial forms;
- completing project assignments independently.

Moreover, BIM technologies helped students understand the relationship between architectural, structural, and engineering components within a single digital model. This interdisciplinary integration increased the effectiveness of engineering graphics education.

The study also revealed several didactic advantages of BIM technologies:

- visualization of complex objects in 3D environments;
- increased student engagement during practical lessons;
- development of collaborative project skills;
- improvement of digital competencies;
- enhancement of creative and analytical thinking abilities.

However, several challenges were identified during implementation. Some students initially experienced difficulties adapting to new software environments. In addition, the effective application of BIM technologies requires sufficient computer resources and methodological support.

Despite these challenges, the pedagogical experiment confirmed that BIM-based teaching methods positively influence the quality of engineering graphics education and improve students' professional readiness.

Conclusion

The research results showed that BIM-based software plays an important role in improving the effectiveness of teaching engineering graphics. The integration of digital modeling tools into the educational process contributes to the development of students' spatial thinking, graphic competence, and practical design skills.

The use of Autodesk Revit and other BIM software helps students develop skills for working in a modern digital environment and enhances their professional training in engineering and architectural fields.

Based on the research findings, the following recommendations were developed:

increasing the share of BIM-based practical assignments;

widely applying project-based teaching methods;

improving teachers' digital competencies;

developing BIM-based methodological manuals;

strengthening interdisciplinary integration in technical education.

Thus, BIM-based teaching methodology is considered one of the important factors in improving the quality of modern engineering education.

Used Literature

1. Eastman C., Teicholz P., Sacks R., Liston K. BIM Handbook: A Guide to Building Information Modeling. Wiley, 2020.
2. Smith D. "An Introduction to Building Information Modeling." Journal of Building Technology, 2019, Vol. 12(3), pp. 45–53.
3. Autodesk Revit Official Website
4. Azimov Q., Raximov B. "Innovative Approaches in Engineering Graphics Education." International Journal of Engineering Pedagogy, 2022, Vol. 8(2), pp. 112–118.
5. Ismoilov S. Digital Technologies in Technical Education. Tashkent, 2021.
6. Graphisoft Archicad Official Website
7. Kholmatov A. "Development of Spatial Thinking in Engineering Education." Pedagogical Sciences Review, 2023, No. 4, pp. 67–74.