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THEORETICAL FOUNDATIONS AND PRACTICAL APPLICATION OF THE SIMULATION METHOD IN PROFESSIONAL EDUCATION: A FOCUS ON ARCHITECTURE AND INFORMATION TECHNOLOGY

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Abstract. *This article presents a comprehensive analysis of the theoretical foundations and practical applications of the simulation method in professional education, with a specific focus on architectural education and its parallels in information technology (IT). The study underscores the pivotal role of the simulation method in preparing students for real-world professional scenarios, enhancing their practical skills, critical thinking, and communication competencies, particularly within the context of English for Specific Purposes (ESP) in architecture and IT. It examines the classification of simulation types, their pedagogical significance, and their implementation in project presentations, client interactions, team-based discussions, and virtual design environments. The analysis draws on the works of both international and local scholars, providing a detailed exploration of the simulation method's impact on professional education. Comparative insights with IT education are included to highlight its broader applicability. Recommendations for future research and practical implementation are also proposed to advance the field.*

Key words: *simulation method, professional education, architectural education, IT education, ESP, professional skills, critical thinking, communication, project presentation, client interaction, virtual simulation, pedagogy.*

Introduction. Modern educational systems, particularly in architecture and information technology (IT), demand that students acquire practical skills to compete effectively in the global labor market. The Presidential Decree of the Republic of Uzbekistan No. PQ-61, dated February 14, 2025, emphasizes the need to "strengthen the integration of higher education graduates into the labor market and improve the process of personnel training through the 'Step into the Future' program" [1]. This initiative supports the application of the simulation method in architecture and IT education, as it equips students with professional skills, critical thinking, and communication abilities by immersing them in realistic professional environments.

The simulation method, especially within ESP courses for architecture and IT, facilitates preparation through project presentations, client interactions, team discussions, and virtual project development. The aforementioned decree highlights the importance of identifying the demand for highly skilled professionals by capable employers [1], underscoring the simulation method’s role in developing practical competencies aligned with industry needs. This article analyzes the theoretical underpinnings, classification, and practical applications of the simulation method in architecture and IT education, drawing on the works of international and local scholars. The study aims to evaluate the method’s effectiveness, identify its advantages and limitations, and suggest directions for future research. Additionally, it incorporates a comparative analysis with IT education to demonstrate the method’s versatility across professional disciplines.

Literature Review. The role and significance of the simulation method in education have been extensively studied by both international and local scholars. Paul Bambrough defines the simulation method as an activity involving role-playing within a structure that mirrors reality, enabling students to acquire communication and professional skills in social and contextual contexts [2]. Ken Jones views it as the authenticity of function within a structured environment, offering students opportunities to experiment with real professional roles [3, 4]. Clark Aldrich describes it as a bridge between classroom processes and real-life practical skills, facilitating the application of theoretical knowledge in practical settings [7]. Cathy S. Greenblat considers simulation a working model that reflects the essential characteristics of a real or proposed system [13], while García-Carbonell and Watts interpret it as an activity perceived as reality itself, where students act based on their knowledge and reflections as they would in real life [12].

David A. Kolb’s experiential learning cycle plays a crucial role in reinforcing the theoretical foundations of the simulation method, positing that the learning process comprises concrete experience, reflective observation, abstract conceptualization, and active experimentation—stages fully compatible with its application in architecture and IT education [14]. A.A. Verbitskiy frames the simulation method as a pedagogical tool within a contextual learning model, consisting of academic, quasi-professional, educational-professional, and real-professional stages, designed to progressively prepare students for professional practice [5]. V.V. Chechet and S.N. Zakharova classify simulation types into role-playing, case analysis, business games, project-based learning, and virtual simulations [8], while O.I. Okhrimenko and S.V. Rubtsova view it as a tool for studying the behavior of complex systems, aiding students in analyzing interrelationships within real systems [10]. Local scholars such as Shadmanov et al. regard the simulation method as a supplementary tool for developing practical skills, though they note its inability to fully replace real experience [6]. Bahodir F. Sultanov categorizes simulation technologies into visual, tactile, reactive, automated, hardware-based, interactive, and integrated types [9].

The literature review reveals the wide applicability of the simulation method in education; however, there remains a dearth of in-depth studies on its use in architecture and IT education, particularly regarding specialized scenarios and their impact on linguistic competencies within ESP contexts. This article addresses this gap by exploring the practical implementation and effectiveness of the simulation method in these fields. Furthermore, it incorporates insights from IT education, such as Harahan’s observation that “simulation-based learning is an effective approach for enhancing English language skills among IT students

specializing in English for Specific Purposes” [16], drawing parallels with architecture students’ development of language skills through project presentations.

Research Methodology. The study employs a deductive approach, utilizing multiple methods to investigate the application of the simulation method in architecture and IT education: literature review, comparative tables, case study analysis, and empirical data analysis. The research objects are the simulation types applied in ESP courses for architecture and IT. Data were collected from primary sources (scholarly works and journal articles by international and local researchers) and secondary sources (dictionaries and online resources).

The philosophical foundation of the study is based on Verbitskiy’s contextual learning model and Kolb’s experiential learning cycle. Verbitskiy’s model defines simulation as comprising academic, quasi-professional, educational-professional, and real-professional stages, facilitating a gradual transition to professional practice [5]. Kolb’s cycle encompasses gaining practical experience, analyzing it, drawing conclusions, and applying new knowledge, aligning with the simulation method’s educational application [14].

Verbitskiy’s contextual learning concept positions simulation methods as central, asserting that the educational process should enable a student’s gradual transition from academic to professional activity. He states, “The imitation educational model involves simulated situations of future professional activity that require the practical use of theoretical information in their analysis and decision-making” [5]. Based on this model, simulation-based teaching is implemented across four stages, detailed in the following table with direct citations from Verbitskiy:

Stage	Description (According to Verbitskiy)
Academic (Theoretical)	The academic type of educational activity, classically exemplified by informative lectures, where students acquire theoretical knowledge, including concepts and terminology.
Quasi-Professional (Semi-Simulation)	Quasi-professional activity includes imitative exercises close to real practice but conducted under supervision, with business games as a prominent example, restoring subject and social content.
Educational-Professional	In educational-professional activity, students, while retaining their learner status, perform real research or practical functions, requiring independent tasks such as production practice or scientific research.
Professional (Transition to Real Professional Activity)	Mastery of professional activity occurs through direct engagement in professional practice, where students gain the ability to independently perform real professional tasks.

This staged approach effectively prepares students for professional practice, enabling the application of knowledge in practical contexts and enhancing social competencies. Verbitskiy notes, “The pedagogical technologies of contextual learning ensure the student’s transition from symbolic-sign systems embodied in educational texts to real professional activity” [5].

Adapted Application of Verbitskiy’s Model in ESP for Architecture Building on Verbitskiy’s general pedagogical model, this study adapts it for ESP in architecture, tailoring it

to develop project-based thinking, English-language presentations, and professional communication strategies. The adapted application across Verbitskiy’s four stages is presented below:

Stage	Description (According to Verbitskiy)	Adapted Application in ESP (Architecture Examples)
Academic (Theoretical)	Students acquire theoretical knowledge [5].	Studying topics like “Architectural Elements,” “Urban Design,” and “Green Building” in English, completing lexical and grammatical exercises.
Quasi-Professional (Semi-Simulation)	Imitative exercises close to real practice [5].	Role-playing (e.g., client-designer dialogue), case study analysis (e.g., discussing climate-adaptive building design in English).
Educational-Professional	Tasks requiring independent activity [5].	Justifying a design project in English, delivering team project presentations, and preparing drawings based on real briefs.
Professional (Transition to Real Professional Activity)	Students independently perform real professional tasks [5].	Compiling a portfolio in English, communicating with international clients, and defending projects (presentation and Q&A in English).

This adapted approach proves effective in ESP training for architecture students, preparing them not only to acquire theoretical knowledge but also to communicate effectively in professional contexts and work on project-based tasks. While Verbitskiy’s model provides a robust framework for analyzing the theoretical and practical aspects of the simulation method, further empirical research is needed to assess the effectiveness of each stage, particularly regarding professional vocabulary and oral competencies in architecture [5].

The research design focuses on evaluating the simulation method’s effectiveness in architecture and IT education, employing the following strategies:

- **Literature Analysis:** Theoretical foundations and educational applications of the simulation method were explored using journal articles from www.scholar.google.com.
- **Case Study Analysis:** Examples of simulation use in architecture education, such as project presentations and client interaction scenarios, were analyzed.
- **Comparative Tables:** Simulation types and their applications in architecture education were compared.

Reliability and validity were ensured through a comprehensive literature review, detailed comparative tables, and meticulous empirical data analysis. Ethical research standards were adhered to, with all data sources accurately cited. Additionally, empirical data from IT education, such as surveys conducted among students, were incorporated to identify similarities with architecture, enhancing the study’s comparative scope.

Analysis and Results The application of the simulation method in architecture education manifests across several key areas:

1. **Project Presentations and Professional Communication:** Students deliver project presentations in English, developing professional vocabulary and communication skills, such as preparing presentations for international clients.
2. **Role-Playing:** Client-designer interaction simulations teach students to understand client requirements, analyze project briefs, and propose design solutions.
3. **Team Discussions:** Issues like site selection, material choice, or climate-adaptive design are debated in groups, fostering teamwork and critical thinking.
4. **Virtual Simulations:** Projects are presented using 3D visualization tools (e.g., AutoCAD, Revit, Lumion), training students in modern technologies.
5. **Case Study Analysis:** Real or hypothetical project challenges, such as urban planning site selection or eco-friendly design proposals, are analyzed.

In IT education, the method is applied to tasks like software project modeling or virtual client interactions. Harahan’s research notes, “simulation-based learning is an effective approach for enhancing English language skills among IT students specializing in English for Specific Purposes” [16], paralleling architecture students’ language skill development through design discussions. This approach aids IT students in applying technical terminology in real contexts, enhancing overall professional education effectiveness.

Simulation Types Simulation types are classified based on educational goals and contexts. Clark Aldrich defines simulations as a link between repetitive classroom processes and real-life skills, categorizing them into role-playing, case analysis, and virtual simulations [7]. V.V. Chechet and S.N. Zakharova’s theory of active teaching methods divides simulation into imitative (e.g., business games, case analysis) and non-imitative (e.g., educational discussions, heuristic dialogues) types [8]. These categories are detailed in the following table:

Type	**Description (Based on Chechet and Zakharova)**
Role-Playing	Students simulate professional scenarios through assigned roles.
Case Study Analysis	Analysis of real or hypothetical problem situations.
Business Games	Simulated games to resolve educational challenges in groups.
Project-Based Learning	Learning through creating and presenting practical projects.
Virtual/Computer Simulation	Creation of professional scenarios using computer software.

Adapted Application of Chechet and Zakharova’s Model in ESP for Architecture Adapting Chechet and Zakharova’s model for ESP in architecture, this study tailors it to foster project-based thinking, English presentations, and communication strategies. The adapted applications are outlined below:

Type	**Description (Based on Chechet and Zakharova)**	**Adapted Application in ESP (Architecture Examples)**
Role-Playing	Simulation of professional scenarios.	Role-playing client-designer dialogues in English.
Case Study Analysis	Analysis of problem situations.	Analyzing climate-adaptive building design via case studies in English.
Business Games	Group resolution of challenges.	Conducting group debates in English during project defenses.

Type	Description (Based on Chechet and Zakharova)	Adapted Application in ESP (Architecture Examples)
Project-Based Learning	Development and presentation of projects.	Presenting and discussing design projects in English.
Virtual/Computer Simulation	Modeling via computer software.	Explaining and discussing 3D visualizations in English.

This adapted framework enhances ESP training for architecture students, preparing them for theoretical knowledge acquisition and effective professional communication. However, further empirical studies are required to evaluate each type’s effectiveness.

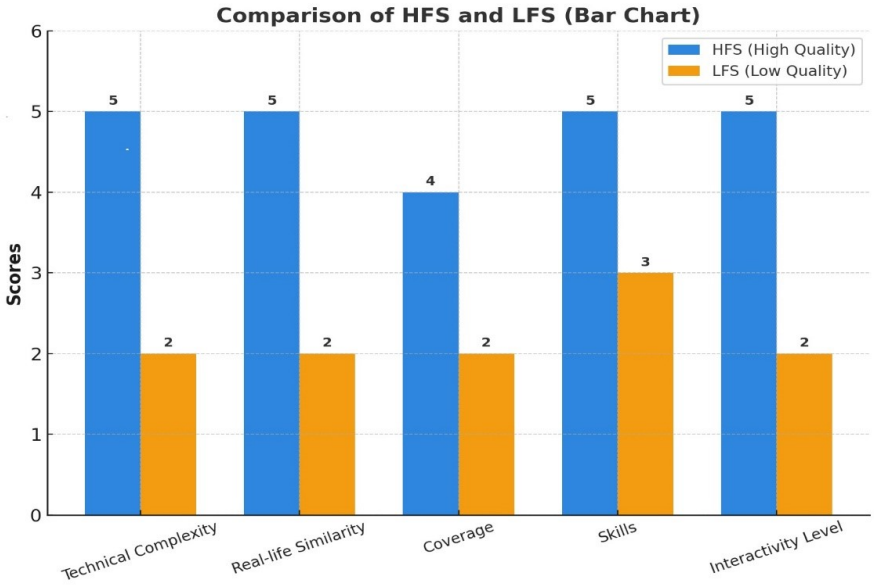
High-Fidelity and Low-Fidelity Simulations (HFS and LFS) The classification of simulations into high-fidelity simulations (HFS) and low-fidelity simulations (LFS) is significant. Thiagarajan and Massoth et al. describe HFS as closely mirroring real life, simulating objects and processes in authentic conditions with multi-sensory interactivity (sight, sound, touch), where participant actions directly influence outcomes [11]. The goal is to develop technical and soft skills in realistic work environments. In architecture, HFS applies to complex tasks like project presentations or real-brief-based drawings. LFS, conversely, involves simplified models capturing select aspects of reality, with limited interactivity and pre-set conditions, aiming to clarify basic concepts or practice procedural skills [11]. In architecture, LFS is used for simplified role-playing or basic element placement in drawings.

Key Differences

Criterion	HFS (High-Fidelity)	LFS (Low-Fidelity)
Realism	High, complex, dynamic scenarios	Low, simplified scenarios
Technical Complexity	High (3D models, VR, real clients)	Low (text, simple sketches)
Interactivity Level	High (decisions impact outcomes)	Limited (pre-set results)
Skills Developed	Technical + soft skills	Basic principles/procedures
Scope	Integrates multiple tasks	Focuses on key elements
Example (Architecture)	Real client project development	Simplified client brief mock-up

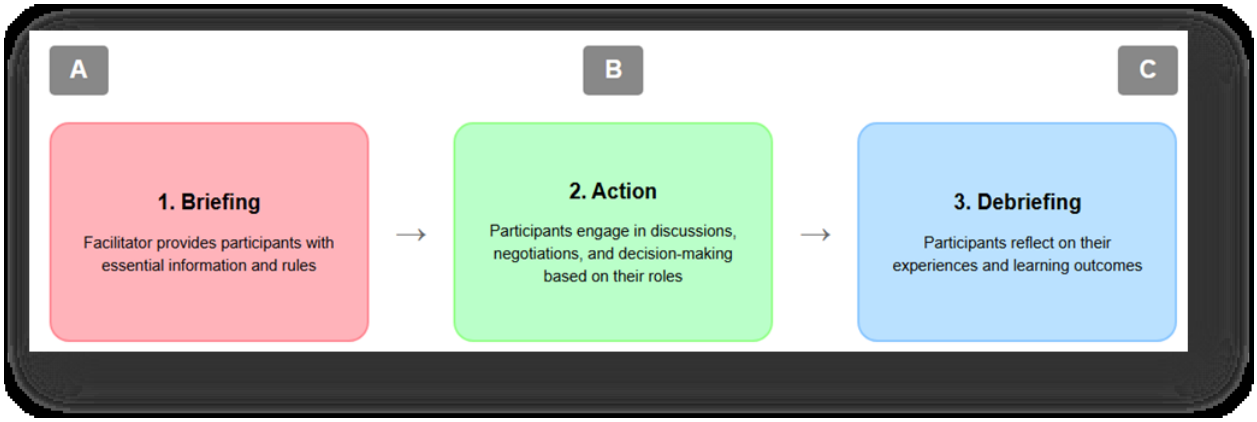
Examples in Architecture Education

- **HFS Example:** Students develop a business center project for an international company, using real briefs, 3D models, online client meetings in English, and addressing economic and ecological factors.
- **LFS Example:** Students receive a basic client-designer scenario, agreeing on color choices and a simple plan, with a simplified outcome as the final product.



A comparative diagram illustrates **HFS’s** superiority in realism, technical complexity, and interactivity over **LFS.**

Simulation Process Stages The simulation process comprises three stages: briefing, action, and debriefing [11]. Briefing prepares participants with necessary information and rules, action involves role-based discussions and decision-making, and debriefing facilitates reflection post-simulation. In architecture, these stages are critical for developing project presentation scenarios. In IT, they apply to software testing or virtual coding projects, showing cross-disciplinary relevance.



General Insights on Simulation Stages Analysis confirms the simulation method’s effectiveness in enhancing professional skills, critical thinking, and communication. A study at Rostov State Railway University involving 56 students reported 100% positive feedback [10]. It also boosts motivation by offering safe real-world practice. Virtual simulations, particularly 3D tools, play a key role in adapting students to modern technologies.

Additional Analysis Benefits of the simulation method in architecture include:

- **Realistic Experience:** Safe error-making opportunities.
- **Interactive Learning:** Increased student engagement.
- **Communication Skills:** Enhanced oral competencies via English interactions.
- **Technological Integration:** Training in modern design tools.

In IT, simulations support coding and software modeling, paralleling architecture’s design focus [16]. This comparative analysis highlights the method’s versatility across professional education.

Conclusion and Recommendations The simulation method emerges as an effective and innovative tool in professional education, particularly in architecture and IT, preparing students for real-world scenarios. It enhances professional skills, critical thinking, and communication through project presentations, client interactions, team discussions, and virtual simulations. Findings indicate its significance in boosting motivation, reinforcing practical skills, and teaching modern technology use.

However, challenges persist, including the lack of standardized scenario development and evaluation methodologies, limited empirical research on oral competency impacts, and under-explored virtual simulation applications in both fields.

Recommendations:

1. Develop and test simulation scenarios tailored to architecture and IT, such as international client interactions or complex presentations.
2. Conduct large-scale empirical studies on the method’s impact on oral and professional competencies.
3. Expand virtual simulation integration with 3D visualization and virtual reality.
4. Introduce gamification elements to enhance motivation and participation.
5. Establish clear evaluation criteria and indicators for effectiveness.
6. Promote comparative studies between architecture and IT to facilitate experience sharing.

These recommendations aim to enhance the simulation method’s application in professional education, equipping students to compete globally.

REFERENCES

1. Presidential Decree No. PQ-61 of the Republic of Uzbekistan, “On Additional Measures to Assist the Employment of Higher Education Graduates,” Tashkent: Lex.uz, 2025. URL: https://www.lex.uz/uz/docs/-7386917.
2. Bambrough, P. *Simulations in Language Teaching*. Cambridge: Cambridge University Press, 1995, pp. 120–150. ISBN: 9780521269094.
3. Jones, K. *Simulations: A Handbook for Teachers*. London: Kogan Page, 1982, pp. 80–100. ISBN: 9780850384468.
4. Jones, K. *Simulations in Language Teaching*. Cambridge: Cambridge University Press, 1987, pp. 90–110. ISBN: 9780521310413.
5. Verbitskiy, A.A. *Kontekstualnoe obuchenie: teoriya i praktika*. Moscow: Prosveshchenie, 2019, pp. 200–220. ISBN: 9785090661423.
6. Shadmanov, S.B., et al. *Simulyatsion ta’limning amaliy ahamiyati*. Tashkent: Fan va texnologiya, 2023, pp. 50–70. ISBN: 9789943667891.
7. Aldrich, C. *Simulations and the Future of Learning*. San Francisco: Pfeiffer, 2004, pp. 100–130. ISBN: 9780787969622.
8. Chechet, V.V., Zakharova, S.N. *Aktivnye metody obucheniya v pedagogicheskom obrazovanii*. Minsk: BGU, 2015, 128 p. ISBN: 9789855532454.
9. Sultanov, B.F. *Simulyatsiya texnologiyalari va ularning ta’limdagi o‘rni*. Tashkent: Universitet nashriyoti, 2023, pp. 60–80. ISBN: 9789943654327.
10. Okhrimenko, O.I., Rubtsova, S.V. *Modelirovanie i simulyatsiya v obrazovanii*. Moscow: Akademiya, 2015, pp. 90–120. ISBN: 9785446801237.

11. Angelini, M. *Simulation in Education: A Practical Guide*. London: Routledge, 2021, pp. 50–70. ISBN: 9780367693961. DOI: https://doi.org/10.4324/9781003141921.
12. Crookall, D., Oxford, R. *Simulation, Gaming, and Language Learning*. New York: Newbury House, 1990, pp. 80–100. ISBN: 9780066325972.
13. Greenblat, C.S. *Designing Games and Simulations: An Illustrated Handbook*. London: Sage Publications, 1988, pp. 70–90. ISBN: 9780803929562.
14. Kolb, D.A. *Experiential Learning: Experience as the Source of Learning and Development*. New Jersey: Prentice Hall, 2005, pp. 100–120. ISBN: 9780133892406.
15. Vygotsky, L.S. *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press, 1978, 159 p. ISBN: 9780674576292.
16. Harahan, K. “The Effectiveness of Simulation-Based Learning in English for Special Purposes for IT Students.” *Naukovii Zbirnik*, 2023, pp. 29–40. DOI: 978-966-301-265-0/1.2023.29.