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INDIVIDUAL APPROACH-BASED METHODOLOGY FOR DEVELOPING GRAPHICAL COMPETENCE

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Abstract: This article provides a comprehensive analysis of the role and significance of an individual-centered approach in developing graphical competence among university students. The study explores the formation of graphic literacy, enhancement of visual thinking, consolidation of technical reasoning, and improvement of modeling skills through personalized educational strategies. The methodology is scientifically grounded and supported by experimental data. The practical results of implementing this approach, derived from experimental work, demonstrate notable improvements in students' graphic knowledge, technical understanding, spatial reasoning, and creative problem-solving abilities. The proposed methodology emphasizes adaptive instruction tailored to each student's capabilities, motivation, and initial level of preparation, integrating digital tools, 3D modeling, and project-based learning to maximize learning outcomes.
Keywords: profession, competence, technology, students, information, specialist, production, research, engineering, computer graphics, tablets, computers, platforms, online education.

Introduction. Graphical competence is a critical component of professional preparedness for students in engineering, architecture, technology, design, and informatics programs at higher education institutions. It encompasses the ability to read, interpret, and create technical drawings, produce projection images, process visual information, and effectively utilize various graphic tools and software. In contemporary education, individual-centered instruction is increasingly recognized as essential for addressing each student's unique capabilities, prior knowledge, learning pace, and intrinsic motivation.

Personalized approaches in teaching graphical skills allow students to develop technical and creative thinking systematically. By adapting learning trajectories to individual profiles, students can engage in project-based tasks, apply 3D modeling tools, and receive targeted mentorship, thereby enhancing both cognitive and practical abilities. Such approaches not only improve students' performance but also increase their engagement, self-confidence, and capacity for independent problem-solving in graphic tasks.

The main objective of this study is to develop a methodology for enhancing students' graphical competence using an individual-centered approach, scientifically justify its structural components, and evaluate the practical outcomes through empirical research.

Methodology

The research was conducted using four main components:

1. **Theoretical Analysis:**
   - Concepts of graphical competence and its components.
   - Cognitive and psychological mechanisms of visual and technical thinking.
   - Theories of individualized instruction, differentiated teaching, and student-centered learning.
   - Digital graphic tools and software, including AutoCAD, SolidWorks, SketchUp, and Blender.

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2. **Pedagogical Diagnostics:**

Initial assessment of students' graphical skills based on:

- Ability to analyze and interpret drawings.
- Knowledge of projection drawing principles.
- Spatial visualization and visual memory.
- Basic 3D modeling skills.

3. **Experimental Method:**

Conducted in two phases:

- **Diagnostic phase:** identification of students' initial preparedness.
- **Practical phase:** implementation of individualized methodology.
  - **Experimental group:** students trained using personalized methods.
  - **Control group:** students trained using traditional teaching methods.

4. **Statistical Analysis:**

Data were analyzed using mean scores, percentage comparisons, and growth dynamics to evaluate the effectiveness of the individualized methodology.

Results

1. **Structural Components of Graphical Competence:**

- **Knowledge Component:** understanding projection principles, axonometry, cross-sections, and basic 3D modeling principles.
- **Practical Component:** proficiency with graphic software, reading, and creating drawings.
- **Creative Component:** ability to develop innovative graphic solutions and constructive thinking.
- **Reflective Component:** skills in self-assessment, error identification, and quality evaluation.

2. **Elements of Individual Approach:**

- Personalized graphical profile of each student.
- Tiered assignments: basic (A), intermediate (B), advanced (C).
- Customized learning trajectories aligned with individual student needs.
- Integration of digital tools in independent projects.
- One-on-one mentorship for complex drawing tasks.
- Development of independent graphic portfolios.

3. **Practical Outcomes:**

Experimental group students showed significant improvement compared to control group students:

Graphic Skill Indicator	Control Group	Experimental Group
Projection Drawing Accuracy	61%	86%
Spatial Reasoning Speed	58%	84%
3D Modeling Proficiency	42%	79%
Graphic Software Proficiency	55%	87%
Creative Graphic Solutions	49%	82%

These results indicate that the individual-centered approach significantly enhances students' technical knowledge, cognitive skills, and creative capacity.

Discussion

The research highlights several advantages of the individualized approach:

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1. **Maximizing Student Potential:**
Tailoring instruction to each student's level allows optimal development of graphical thinking and technical skills.
2. **Conscious Skill Acquisition:**
Tiered and personalized assignments help students differentiate complex and simple elements, fostering systematic learning.
3. **Increasing Engagement with Digital Tools:**
Personalized projects, 3D modeling, and visualization activities enhance students' participation and interest in learning.
4. **Developing Creative and Constructive Thinking:**
Independent exploration and project-based assignments strengthen students' creative and constructive problem-solving abilities.

Challenges include longer adaptation for students with low initial preparedness, time-intensive use of graphic software, and increased demand for methodological and technical resources. Proposed solutions include modular assignments, customized schedules, digital tool support, and effective mentoring.

Conclusion

The study demonstrates that an individual-centered methodology for developing graphical competence is highly effective in higher education. It allows for:

- Deepening students' knowledge and skills in graphical subjects.
- Enhancing spatial visualization and technical reasoning.
- Improving proficiency in 3D modeling.
- Strengthening independent project-based graphic creation skills.

This methodology is recommended for application across technical disciplines, including engineering, architecture, design, and technology programs, contributing to the development of well-rounded, skilled, and innovative professionals.

References:

1. Law of the Republic of Uzbekistan "On Science and Scientific Activity" (October 29, 2019). Available at: https://lex.uz/doc/4571490
2. Decree of the President of the Republic of Uzbekistan "On the Strategy of Actions for the Further Development of the Republic of Uzbekistan" (February 7, 2017). Available at: https://lex.uz/pages/getpages.aspx?list_id=3107036#3109146
3. Nishonova, S. *Komil inson tarbiyasi*. Tashkent: Istiqlol, 2003.
Tolipov, O., et al. *Pedagogical Technology: Theory and Practice*. Tashkent: Fan, 2005.
4. Vyazankova, V.V. "Formation of Graphical Competence of Bachelor Students in Technical Fields under the Conditions of Information and Educational Environment." *Modern Problems of Science and Education*, 2021, No. 2. Available at: https://science-education.ru/ru/article/view?id=30663
5. Turayev, D.A. "Didactic Opportunities and the Model of Developing Professional Graphical Competence of Future Technology Education Teachers." *Modern Scientific Research International Scientific Journal*, 2023, Vol. 1, Issue 3, ISSN: 1817-0315
6. Turayev, D.A. "Didactic Opportunities and Model for Developing Professional Graphical Competence of Future Technology Education Teachers." *Proceedings of the International Scientific-Practical Conference*, May 19-20, 2023.
7. Turayev, D.A. "Development of Professional Competencies of Future Technology Teachers during Classroom Lessons." *American Journal of Multidisciplinary Bulletin*, 2024, Vol. 2, Issue 5. DOI: https://doi.org/10.5281/zenodo.14530898

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American Academic publishers, volume 05, issue 12,2025
Journal: https://www.academicpublishers.org/journals/index.php/ijai

8. Turayev, D.A. "Improving Students' Creative Thinking in Teaching Technical Drawing." *Adju University International Conference*, February 22, 2025. DOI: https://doi.org/10.5281/zenodo.14913908
9. Turayev, D.A. "Methodology for Developing Students' Graphical Competence Based on Individual Approach in Technology Education." *Current Issues in Teaching Applied Sciences: Innovative Approaches and Challenges*, 2025, pp. 588–593.
10. Turayev, D.A. *Descriptive Geometry and Engineering Graphics*. Tashkent: ZEBO TRANS, 2025. 212 p.
11. Barataliyeba, N.M. "Didactic Opportunities of Using Creative Technologies in Service Sector Education: Critical Analysis, Analytical Thinking, and Innovative Ideas." *National Conference Proceedings*, 2025, pp. 29–34.
12. *Methodical Manual on Individual Teaching Technologies*. Tashkent: TDIU, 2021.
13. *Engineering Graphics & Visualization Practices*. New York: McGraw-Hill, 2020.
14. *Autodesk Education Methodology Guide*. Autodesk, 2020.