

THE USE OF EDUCATIONAL MODELS IN TRAINING SPECIALISTS IN ARTIFICIAL INTELLIGENCE WITHIN THE SYSTEM OF HIGHER EDUCATION

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Abstract

The article is devoted to the role of educational models as a practice-oriented tool in engineering and applied education. The formation of professional competencies of future engineers in the context of the digital transformation of the national economy is examined. It is shown that educational models enable students to deeply master academic material and safely simulate complex engineering processes, thereby contributing to the training of qualified personnel. Examples of student projects (“Smart Home,” “Smart Autonomous University,” “Smart Transport”) and their practical value for the development of engineering thinking and innovative design skills are presented.

Keywords

educational models, engineering education, professional competencies, digital transformation, safe educational environment, practice-oriented learning.

In the current conditions of technological development and the digital economy, the system of engineering education faces the task of training highly qualified specialists. As experts note, the development of carriers of unique competencies and knowledge is a key priority in development strategies. National projects on the digital transformation of the economy are aimed at forming human resources potential that meets these priorities.

One of the effective means of practice-oriented learning in engineering and applied education is educational models – physical representations of real systems. They provide students with the opportunity to study complex processes in depth and to conduct safe simulation: modern virtual and augmented reality technologies demonstrate that students can model processes that are difficult or dangerous to

reproduce in reality. Similarly, educational models allow project solutions to be tested in practice without risk to expensive equipment or human safety, thereby ensuring a safe educational environment.

This article analyzes methods of practice-oriented learning and the role of educational models in the development of professional competencies of engineering students. Examples of practical projects (“Smart Home,” “Smart Autonomous University,” “Smart Transport”) are provided, and their significance for the training of future specialists is discussed.

In the educational process, future engineers use a variety of practice-oriented methods and tools. Among them, the following areas can be distinguished:

- Project-based and independent work aimed at reinforcing theory through the implementation of real tasks;
- Case studies, tests, and non-standard problems (1–3) that develop critical thinking and the ability to solve practical engineering problems;
- Visual aids (crosswords (4), support cards and lesson outlines (5–7), infographics (8–18), computer simulations) for the visualization of complex concepts;
- Innovative technological tools (educational models, 3D models, VR/AR technologies) for interactive immersion in learning material and safe process simulation.

These approaches ensure comprehensive assimilation of theory and create a foundation for integrating models into educational practice. In particular, physical models demonstrate the interconnections between system components and stimulate systems thinking. Experience in using models shows that they provide students with opportunities for deeper immersion in studied topics, practical exercises and simulations, and the development of decision-making skills.

Educational models, as a special tool of project-based learning, serve as a key element in the training of engineering personnel. They allow students to test various engineering solutions through their own experience in a safe environment.

For example, virtual (augmented) reality technologies demonstrate that modeling complex or dangerous processes becomes possible without risk to learners. Physical models implement a similar principle in the real world: students can create system prototypes and test their operation before implementation in real production. This makes the learning process more practice-oriented and engaging.

At the same time, models help to form interdisciplinary competencies. When designing models, students integrate knowledge from electronics, programming, design, and economics, which corresponds to the goals of training engineers of the

future. Thus, in one of the student projects, a “Smart Transport” model was developed. It simulates intelligent transportation systems: using solar panels, storage devices, sensors, and simple automation, students learn to design vehicles taking environmental factors into account. Other projects – the “Smart Home” and the “Smart Autonomous University” models – include elements of automation of residential and educational spaces: control of lighting, temperature, security sensors, autonomous energy consumption and water supply, and water filtration. At the same time, emphasis is placed on energy and water conservation and ensuring a safe environment. Within the model, students can practice fire safety systems and access control without exposing real facilities to risk. These projects provide future engineers with experience in system design in accordance with modern standards.

Conducted pilot testing and students’ participation in innovation project competitions confirm the practical value of such models. The developed models correspond to the “Computer Engineering” field and clearly demonstrate the acquired skills. The achievements of participants show that models serve as an effective means of engaging students in real engineering tasks and motivate them toward further scientific and technical creativity.

Conclusion

Thus, educational models serve as an effective means of forming engineering competencies. They integrate practice-oriented learning and safe experimentation into the educational process, which corresponds to the strategic objectives of digital transformation. Models:

- develop engineering thinking and practical skills in students, allowing them to solve real problems in practice;
- form interdisciplinary competencies and 21st-century skills (critical thinking, creativity, engineering abilities);
- ensure safe modeling of complex processes, reducing risks when training on real facilities;
- contribute to the preparation of specialists who meet modern professional requirements and the objectives of the digital economy (including requirements for technical and digital competencies).

The application of models in the educational process makes it possible to improve the quality of engineering education and to bring educational practices as close as possible to real production conditions. This corresponds both to national priorities and to global trends in the formation of a new educational model focused on project-based activity and occupational safety.

REFERENCES:

1. Talipov F. M., Abdukhalilova O. Sh., Sobitova M. F. Solving Non-Standard Problems on Mechanics. *Science and Innovation: International Scientific Journal*, 2023, Vol. 2, № 4, pp. 158–161.
2. Talipov F. M., Abdukhalilova O. Sh. Solving Selected Tasks Problems in Electrostatics. *Science and Innovation: International Scientific Journal*, 2024, Vol. 3, № 3, pp. 24–26.
3. Talipov F. M., Djuraev M.Kh., Abdukhalilova O. Sh. Solving non-standard problems in physics and independent work of students. *American Journal of Education and Learning*, 2025, Vol. 3, Issue 10, pp. 303–307.
4. Talipov F.M., Juraev M.B., Perik D.A. Mastering physics concepts and developing cognitive interest among 7th grade students though greating their own crosswords. *American Journal of Education and Learning*, 2025, Vol. 3, Issue 7, pp. 311–317.
5. Талипов Ф. М. О внеаудиторной работе студентов. *Fizika, matematika va informatika. Ilmiy-uslubiy jurnal*, Тошкент, 2023, № 3, с. 133–137.
6. Талипов Ф. М. Самостоятельная работа студентов по физике и формирование человеческого капитала. *Mehnat iqtisodiyoti va inson kapitali*, 2025, № 2, с. 214–219.
7. Талипов Ф.М. О роли самостоятельной работы студентов – будущих учителей физики – в наращивании человеческого капитала . *Inson kapitali va mehnatni muhofaza qilish*, 2025, № 3 , с.484-489.
8. Jaleniauskiene, E. & Kasperiuonienė, J. Infographics in higher education: A scoping review. *E-Learning and Digital Media*,(2023), 20(2), 191-206. DOI: 10.1177/20427530221107774.
9. Талипов Ф. М., Серебрякова М. Х. Внедрение инфографики в процесс обучения физики и подготовка педагогов к её использованию на уроках. *Fizika, matematika va informatika: Ilmiy-uslubiy jurnal*, Тошкент, 2024, № 3, с. 53–59.
10. Serebryakova M. Kh., Talipov F. M. Using infografic resources in physics lessons. *Science and Innovation*, 2024, Vol. 3, Issue 2, pp. 178–180.
11. Талипов Ф. М., Кабилжанова И. К. Инфографика при изучении физики в школе. *American Journal of Education and Learning*, 2025, Vol. 3, Issue 3, pp. 181–183.

12. Talipov F. M., Djuraev M., Slamov A. Infographics and Improving the Efficiency of Students' Independence. *Science and Innovation: International Scientific Journal*, 2025, Vol. 4, № 2, pp. 100–103.
13. Talipov F. M., Djuraev M., Slamov A. Infographics in teaching the topic Newton's laws at school. *American Journal of Education and Learning*, 2025, Vol. 3, Issue 7, pp. 311–317.
14. Talipov F.M. . On the cooperation between teacher and student with artificial intelligence in creating infographics in the topic vector and scalar quantities, *American Journal of Education and Learning*. 2025, Vol. 3, Issue-7, pp.499-503.
15. Талипов Ф. М. Инфографика на тему «Линзы» к школьному учебнику физики. *Fizika, matematika va informatika. Ilmiy-uslubiy jurnal*, Тошкент, 2025, № 5, с. 112–117.
16. Талипов Ф.М. Самостоятельная работа студентов с использованием искусственного интеллекта и инфографики в контексте формирования человеческого капитала . *Inson kapitali va mehnatni muhofaza qilish*, 2025, № 4 , с.501-507.
17. Talipov F. M., Mansurova M.Z., Ismailov F.N., Nurmatov R.R., Using infographics in studying Coulomb's law by students of the "Software engineering" Program: pedagogical experience. *American Journal of Education and Learning*, 2026, Vol.4, Issue-1, pp. 7-13.
18. Talipov F.M., Nurmatova S.B., Azatbaeva A.K., Makhmudov A.O. Use of infographics in studying the force friction. *American Journal of Education and Learning*, 2026, Vol.4, Issue-2, pp. 373-379.