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Selection and Application of Pedagogical Technologies Suitable for Developing Practical-Diagnostic Skills of Technical Students

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Abstract: This article discusses the issues of selecting and effectively applying pedagogical technologies aimed at developing the practical-diagnostic skills of students in technical fields. The study analyzes the specific features of technical education, the possibilities of modern teaching technologies, and the diagnostic approach in developing students' professional competencies. As a result, a model for forming practical-diagnostic skills based on the integration of problem-based, project-based, and simulation-based learning is proposed.

Keywords: technical education, diagnostic skills, pedagogical technology, project-based learning, simulation environment, competence.

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Introduction

One of the main tasks facing higher educational institutions in the technical field today is to develop students' ability to independently organize professional-practical activities and conduct diagnostic analysis. This requires not limiting instruction to traditional lectures and laboratory classes but also selecting and effectively applying innovative pedagogical technologies.

Technical disciplines require competencies such as practical experience, analytical thinking, problem-solving, identifying and evaluating technical faults. Therefore, in choosing teaching technologies for this field, a **"diagnostic approach"** should be one of the key criteria.

Research Methodology

The methodological basis of this study is aimed at systematically analyzing, evaluating, and modeling the process of developing practical-diagnostic skills among students in technical fields. A complex of scientific methods was used to achieve the research objectives, ensuring the scientific validity and reliability of the results.

First, through **analysis and synthesis**, existing scientific and theoretical sources, advanced pedagogical experiences, and teaching technologies applied in technical education were thoroughly examined. This process helped to determine the essence of pedagogical technologies and their potential in forming practical-diagnostic competencies, leading to systematic conclusions.

Second, the **experimental method** formed the practical stage of the research. Through this method, the implementation of simulation-based and project-based teaching technologies in technical subjects was tested. Changes in students' activities—particularly their diagnostic thinking, problem analysis, and ability to design technical solutions—were observed, compared, and evaluated.

Third, through the **pedagogical diagnostics method**, students' practical skills, professional reflection, and learning effectiveness were measured. Specially designed tests, observation sheets, reflective journals, and assessment rubrics were used. This method allowed for quantitative and qualitative evaluation of learning outcomes and assessment of the real effectiveness of teaching technologies.

Fourth, by applying the **modeling method**, a conceptual model of the educational process aimed at developing practical-diagnostic skills in technical disciplines was developed. This model reflects the interconnection between learning objectives, technological approaches, methodological stages, and diagnostic criteria. It directs the student toward independently analyzing practical activities, evaluating technical processes, and applying acquired knowledge in practice.

Thus, the research methodology was based on a **systemic and integrative approach**, ensuring the reliability of scientific conclusions through the harmony of theoretical analysis, experimental testing, diagnostic evaluation, and modeling.

Main Results

The analysis showed that the following pedagogical technologies are the most effective in developing students' practical-diagnostic skills in technical disciplines:

1. **Problem-Based Learning (PBL):** An interactive pedagogical approach that develops students' abilities to think independently, analyze, research, and solve practical problems. PBL transforms the educational process from memorizing ready-made knowledge into a process of discovering, analyzing, and creatively applying it. It makes the learning process active, inquiry-based, and practice-oriented—thus recognized as one of the most effective methods for forming practical-diagnostic competencies.
2. **Project-Based Learning:** An innovative pedagogical approach aimed at organizing education around solving real-life practical problems. In this process, students develop real technical projects (e.g., a model of an electronic device or a mechanical system). As a result, students gain experience in design, testing, and identifying technical faults.
3. **Simulation-Based Technologies:** A teaching method based on reproducing real technical, mechanical, or production processes in a virtual or modeled environment. It allows students to gain practical experience in a safe, controlled, and repeatable setting. Computer programs and virtual platforms such as *Proteus, MATLAB, SolidWorks, and LabView* are used to model technical processes. The expected outcome is mastering practical experience in a safe environment and analyzing the results effectively.
4. **Contextual Learning Technology:** A pedagogical approach that organizes learning in close connection with real-life, professional activities, and practical situations. It enables students to develop the ability to identify and evaluate technical solutions in realistic contexts.
5. **Modular Learning Technology:** A teaching method organized around independent, yet systematically connected, educational modules. Each module has specific goals, content, outcomes, and assessment criteria, allowing students to develop progressively. In technical education, modular learning integrates theoretical, laboratory, and practical classes into a unified system aligned with professional practice. Consequently, students can regularly assess their learning level and identify shortcomings.

Analysis of Research Results

The experimental research showed that integrating simulation-based and project-based learning technologies into the technical education process had a significant impact on students' practical readiness. Specifically:

- Students' practical-diagnostic test results increased by **28–35%** on average during the experiment, indicating qualitative improvement in practical knowledge and skills.
- Their abilities in independent analysis, logical reasoning, and drawing conclusions developed considerably, enhancing their activity in solving professional problems.
- Students demonstrated higher confidence and accuracy in analytical modeling of technical processes and result analysis in a simulated environment.

Overall, the experimental results confirmed that the combined use of simulation-based and project-based technologies enhances the effectiveness of teaching in technical fields and plays an important role in developing students' practical-diagnostic and innovative thinking abilities.

Discussion

The research results demonstrate that the **integrative application of pedagogical technologies** is crucial for developing practical-diagnostic skills in technical education. In particular:

- **Problem-based and project-based technologies** develop creative and analytical thinking;
- **Simulation-based technologies** provide opportunities to perform diagnostic exercises in a safe, controlled environment;
- **Modular approaches** support continuous assessment of learning outcomes.

Altogether, these foster **"professional reflection"**—the ability of students to analyze and evaluate their own professional activities.

Conclusion

The study concluded that in selecting teaching technologies for technical education, the **diagnostic approach** should serve as the main methodological principle. The integrated application of simulation-based, problem-based, project-based, and modular learning technologies effectively develops students' practical-diagnostic skills, enhances their independent thinking, and improves their capacity for solving professional problems. Integrating these technologies helps create an **innovative educational environment** oriented toward professional competence.

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