



THE IMPORTANCE OF METHODOLOGICAL COMPETENCE FOR TECHNICAL STUDENTS

Sakbayeva Vitaliya Vladimirovna

Head of the Department of "Uzbek Language and Literature"
Termez State University of Engineering and Agrotechnologies

sakbaevavitavladimirovna@gmail.com

+998-88-225-77-85

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Abstract

In the era of rapid technological advancement and global educational transformation, the development of methodological competence has emerged as a vital component of technical education. This article explores the concept of methodological competence, its role in technical disciplines, and its impact on students' academic success, professional readiness, and adaptability in a dynamic labor market. The study emphasizes the integration of methodological training in technical curricula, supporting lifelong learning and interdisciplinary problem-solving. Recommendations are proposed for embedding methodological competence in engineering and technology-oriented educational programs.

Keywords: methodological competence, technical education, engineering students, educational methodology, higher education, problem-solving, curriculum design.

1. Introduction

In the 21st-century knowledge-based economy, technical education has become more than the transmission of disciplinary knowledge. It requires the development of essential competences that enable learners to apply knowledge effectively, solve complex problems, and adapt to rapidly changing technological environments. Among these, **methodological competence** plays a central role. It empowers students to select, apply, and critically evaluate methods and tools in both academic and professional settings. This paper examines the significance of methodological competence for students in technical universities, its theoretical underpinnings, and its practical implications for curriculum development and instructional practice.

The growing demand for highly qualified engineering and technology professionals necessitates not only deep subject knowledge but also the ability to think critically, solve complex problems, and conduct independent research. In this context, **methodological competence**—the ability to choose and apply suitable methods to acquire and process information—has become a cornerstone of technical education.

However, most engineering curricula prioritize theoretical knowledge and technological skills while often underestimating the role of methodological training. This paper seeks to demonstrate that systematic development of methodological competence enhances students' academic success, adaptability, and professional readiness.

2. Conceptual Framework

Methodological competence refers to a student's ability to understand and apply various methods of learning, research, analysis, and professional practice in a structured and goal-oriented manner. According to Weinert (2001), competence encompasses not only

knowledge and skills but also cognitive and metacognitive strategies for self-directed learning and decision-making.

Within the context of technical education, methodological competence includes:

- Problem-solving strategies.
- Research and inquiry-based learning.
- Project planning and management.
- Analytical and critical thinking.
- Mastery of scientific and engineering methods.
- Technological tool usage and data interpretation.

Methodological competence refers to the ability to apply appropriate methods, tools, and strategies to effectively acquire, organize, and use knowledge in a structured and purposeful way. For technical students, this competence is especially crucial. Here's why:

1. Foundation for Problem-Solving

Technical fields (engineering, IT, architecture, etc.) require systematic problem-solving.

Methodological competence enables students to:

- Analyze problems clearly.
- Select suitable methods or technologies.
- Follow structured procedures.
- Evaluate results critically.

2. Effective Learning and Research Skills

With strong methodological skills, students can:

- Independently conduct research or experiments.
- Plan and manage projects systematically.
- Understand and apply scientific and engineering methods.

This leads to greater autonomy and success in academic and professional work.

3. Adaptability to Technological Changes

Technology evolves rapidly. Methodologically competent students are:

- Better equipped to learn new tools and techniques.
- More adaptable in applying different approaches to new challenges.

This flexibility is essential for lifelong learning and staying current in the field.

4. Professional Efficiency and Quality

In technical professions, errors can be costly. Methodological competence ensures:

- Higher accuracy and precision in tasks.
- Time management and workflow optimization.
- Better documentation and reproducibility of processes.

5. Interdisciplinary Collaboration

Technical specialists often work in interdisciplinary teams. Methodological competence allows them to:

- Communicate and coordinate effectively.
- Integrate methods from different fields.
- Contribute to joint problem-solving in a structured way.

6. Support for Innovation and Creativity

While creativity is key to innovation, it must be grounded in a methodological approach to be feasible. Students with such competence can:

- Test and refine innovative ideas methodically.

- Apply design thinking or engineering design processes.
- Combine logic with creativity to develop real-world solutions.

3. Relevance in Technical Education

Technical students—engineers, IT specialists, architects—are expected to manage complex systems, conduct applied research, and implement innovative solutions. The mastery of disciplinary knowledge alone is insufficient. Methodological competence is essential for the following reasons:

3.1. Enhanced Learning Autonomy

Students with strong methodological skills are capable of setting learning objectives, organizing tasks, and evaluating outcomes independently. This promotes lifelong learning, a key expectation in technical professions.

3.2. Research and Innovation

Research competence depends on understanding methodologies. Students must know how to design experiments, collect and analyze data, and validate findings. Methodological training facilitates innovation and evidence-based decision-making.

3.3. Professional Adaptability

The dynamic nature of the tech industry requires graduates who can rapidly acquire and apply new methods. Methodological competence underpins adaptability and resilience in professional environments.

3.4. Interdisciplinary Collaboration

Engineering projects often require cross-disciplinary collaboration. Methodologically competent students can communicate effectively, select appropriate tools, and align procedures across disciplines.

4. Methodological Competence in Curricula: Challenges and Approaches

Despite its importance, methodological competence is often underemphasized in technical curricula, which are traditionally content-heavy and exam-driven. Innovative approaches are required, including:

- **Inquiry-based and project-based learning** to promote active methodological engagement.
- **Integrated research modules** at early stages of education.
- **Workshops on scientific methods and academic writing.**
- **Use of digital tools** for simulations, modeling, and data analysis.
- **Formative assessment** focused on process, not just outcomes.

5. Case Studies and Empirical Evidence

Studies conducted in engineering faculties across Europe and Asia show a positive correlation between methodological training and:

- Academic performance (GPA and graduation rates).
- Self-efficacy and motivation in research projects.
- Employability and job readiness after graduation.

For instance, a comparative study by Müller & Lee (2020) found that students with higher exposure to methodological instruction scored 25% higher in capstone projects than those without.

6. Implications for Policy and Practice

To support methodological competence development, institutions should:

- Incorporate methodological objectives in course syllabi.

- Train faculty in contemporary pedagogical methods.
- Establish interdisciplinary labs for experiential learning.
- Evaluate and accredit programs based on competence outcomes, not just credit hours.

7. Conclusion

Methodological competence is not merely a supplemental skill—it is fundamental to the formation of competent, innovative, and adaptable technical professionals. Educational institutions must prioritize its development through strategic curriculum design and student-centered teaching. Only then can graduates meet the complex demands of modern industry and contribute meaningfully to technological progress. For technical students, methodological competence is not just a useful skill—it's a core component of their education. It supports academic success, prepares them for professional roles, and empowers them to be adaptive, effective, and innovative in an ever-changing technological world.

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