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IMPROVING ELECTRONIC METHODOLOGICAL SUPPORT TO DEVELOP LOGICAL COMPETENCIES IN FUTURE PRIMARY SCHOOL TEACHERS

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Annotation

This article examines the improvement of electronic methodological support aimed at developing logical competencies in future primary school teachers. The study is grounded in internationally recognized frameworks of teacher professional competence, digital competence, and logical reasoning development, including UNESCO ICT Competency Framework for Teachers (2018), the European Digital Competence Framework for Educators (DigCompEdu), and research on logical thinking in teacher education. The article analyzes the structure of logical competence, the didactic potential of electronic educational resources, and the pedagogical conditions necessary for their effective integration into teacher training programs. Based on a systematic review of scientific literature and normative documents, the study identifies methodological principles for designing electronic resources that foster logical reasoning, analytical thinking, and problem-solving skills among pre-service teachers.

Keywords

Logical competence, primary education, pre-service teacher training, electronic methodological support, digital pedagogy, ICT integration, professional competence.

Introduction

The modernization of teacher education systems worldwide emphasizes the formation of professional competencies aligned with the demands of the digital society. Logical competence, understood as the ability to analyze, compare, generalize, classify, reason deductively and inductively, and solve pedagogical problems systematically, is considered a core component of professional competence in primary education [1, p. 45; 2, p. 18].

The UNESCO ICT Competency Framework for Teachers (2018) highlights that teachers must integrate ICT tools not only for content delivery but also for developing higher-order thinking skills, including critical and logical reasoning [3, p. 11]. Similarly, the European Framework for the Digital Competence of Educators (DigCompEdu) emphasizes the pedagogical use of digital technologies to enhance learners' cognitive engagement and analytical abilities [4, p. 22].

In primary education, logical thinking forms the basis for mathematical literacy, reading comprehension, and scientific inquiry. Research by Bruner (1960) demonstrated that the structure of knowledge influences the development of logical reasoning, particularly when instruction emphasizes conceptual understanding and discovery learning [5, p. 33]. Piaget's theory of cognitive development identifies the concrete operational stage (7–11 years) as critical for the formation of logical operations such as classification and seriation [6, p. 91]. Therefore, future primary school teachers must themselves possess well-developed logical competencies to effectively facilitate such development in pupils.

The integration of electronic methodological support into teacher education creates opportunities to enhance logical competence through interactive simulations, digital problem-solving tasks, and adaptive assessment systems [7, p. 59]. However, empirical studies indicate that the mere presence of digital tools does not guarantee cognitive development; their pedagogical design and methodological grounding are decisive factors [8, p. 74].

This article aims to identify evidence-based approaches to improving electronic methodological support for developing logical competencies in future primary school teachers.

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Methodology

The study is based on a systematic analysis of international scientific literature, normative documents, and empirical research related to teacher competence development and digital pedagogy. The methodological foundation includes:

- Analysis of UNESCO ICT Competency Framework for Teachers (2018) [3];
- Analysis of DigCompEdu (2017) [4];
- Review of research on logical thinking and cognitive development (Piaget, 1970; Bruner, 1960) [5; 6];
- Review of studies on digital learning environments and higher-order thinking (Redecker, 2017; Mishra & Koehler, 2006) [4; 9].

The method of comparative analysis was applied to identify common elements in competence frameworks related to logical reasoning. Structural-functional analysis was used to define components of logical competence and their correspondence to digital methodological tools.

The study does not rely on speculative claims but synthesizes established scientific findings and internationally recognized standards.

Results

The analysis of competence frameworks indicates that logical competence in teacher education encompasses three interconnected components:

Cognitive component – knowledge of logical operations (analysis, synthesis, induction, deduction), understanding of cognitive development theories [6, p. 94].

Operational component – ability to apply logical reasoning in pedagogical decision-making, lesson planning, and assessment design [1, p. 48].

Reflective component – capacity for self-assessment, error analysis, and evidence-based reasoning [2, p. 25].

Electronic methodological support contributes to these components through several mechanisms:

Interactive digital tasks. Research shows that computer-based problem-solving environments enhance analytical reasoning when tasks require hypothesis testing and structured feedback [7, p. 63].

Adaptive assessment systems. According to OECD (2019), digital assessment tools can diagnose reasoning processes and provide formative feedback that supports logical development [10, p. 102].

Multimedia conceptual modeling. Studies confirm that visual and interactive representations improve conceptual understanding when aligned with pedagogical objectives [8, p. 76].

Collaborative digital platforms. The TPACK framework (Mishra & Koehler, 2006) emphasizes the intersection of technological, pedagogical, and content knowledge in designing digital tasks that stimulate logical reasoning [9, p. 1029].

Effective electronic methodological support must therefore integrate:

- Structured logical exercises (classification, comparison, pattern recognition);
- Problem-based learning modules;
- Reflective digital portfolios;
- Automated feedback mechanisms.

These findings correspond with UNESCO's recommendation that ICT integration should support knowledge deepening and knowledge creation approaches in teacher education [3, p. 14].

Conclusion

Logical competence is a fundamental element of professional readiness for future primary school teachers. International competence frameworks and cognitive development theories

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confirm that the effective integration of ICT into teacher education can significantly enhance logical reasoning when supported by sound pedagogical design.

Improving electronic methodological support requires:

- Structuring digital resources around logical operations;
- Embedding adaptive and formative assessment tools;
- Integrating reflective digital environments;
- Ensuring constructive alignment within curricula;
- Providing methodological training for faculty members.

Evidence-based integration of digital tools, grounded in recognized educational frameworks and cognitive theory, ensures sustainable development of logical competencies in pre-service primary teachers and contributes to the quality of primary education.

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