COMPETENCE-BASED APPROACH AND QUALITY ASSURANCE IN THE MATHEMATICAL TRAINING OF FUTURE PRIMARY SCHOOL TEACHERS

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ABSTRACT
In the contemporary era of globalization, the integration of higher education systems into the European Higher Education Area (EHEA) and the alignment with the Bologna Process have prioritized quality assurance in pedagogical training. This research addresses the limitations of the traditional "academic knowledge transmission" model, which no longer satisfies student-centered paradigms or modern labor market requirements. Evidence suggests that while graduates may possess deep theoretical knowledge of elementary mathematics, they frequently encounter methodological challenges in implementing interactive pedagogy and managing learning environments. This study analyzes the role of the competence-based approach in harmonizing mathematical content knowledge with pedagogical-methodological proficiency. Through a comparative examination of international quality standards (ESG) and national curricula, the research evaluates the integration of mathematical methodology with core specialty subjects. Findings indicate that establishing a sustainable quality culture necessitates a transformation in instructional strategies, where "soft skills," digital literacy, and pedagogical innovation become fundamental pillars of primary teacher education.
Keywords*:* quality assurance, mathematics education, competence-based approach, teacher training, mathematical literacy, student-centered learning.

Introduction
As global integration intensifies, the primary objective of higher education is to cultivate competitive professionals equipped with robust competencies. The integration of the Republic of Azerbaijan into the European Higher Education Area (EHEA) necessitates a paradigm shift in pedagogical training quality. Within this framework, quality assurance transcends mere normative compliance; it is defined by the effective application of theoretical frameworks in practical pedagogical settings (ESG, 2015). Despite these goals, existing literature indicates that traditional transmissive models remain insufficient for addressing the learning needs of "Generation Z" (Həmzəyev, 2021).

Aim of the Study
The primary objective of this research is to analyze the function of the competency-based approach in preparing future primary school teachers. Specifically, it explores mechanisms to ensure the organic unity between mathematical content and pedagogical methodology, focusing on fostering mathematical literacy and pedagogical reasoning through subjects such as "Propaedeutics of Algebra."

Significance of the Reseach
This study contributes to bridging the theoretical-practical gap in primary mathematics education. Since the foundations of algorithmic thinking and a scientific worldview are established in the early years, the preparation of primary teachers is of strategic importance. This research provides actionable recommendations for curriculum developers and institutions to transform assessment criteria and instructional strategies.

Theoretical Framework
The study is anchored in the Competency-Based Approach and the KSA (Knowledge, Skills, Attitude) model, which defines competence as the integration of these three domains (Niss, 2003). Furthermore, the research utilizes Shulman's (1986) Pedagogical Content Knowledge (PCK) model to distinguish between general mathematical knowledge and the specialized knowledge required for teaching. Additionally, the Concrete-Pictorial-Abstract (CPA) model proposed by Bruner (1966) provides the basis for navigating cognitive transitions in elementary mathematics.

Literature Review
The evolution of teacher education reflects a global shift from teacher-centered to learner-centered paradigms. Historically, teacher preparation emphasized advanced mathematical content under the assumption that advanced knowledge naturally improves teaching efficacy. However, Shulman (1986, 1987) introduced PCK to argue that effective teaching requires a unique blend of content and pedagogy. Expanding this, Ball et al. (2008) developed the framework of Mathematical Knowledge for Teaching (MKT), distinguishing between Common Content Knowledge (CCK) and Specialized Content Knowledge (SCK).

In the context of Azerbaijan, Həmzəyev (2021) observed that while pre-service teachers often exhibit strong CCK, they frequently lack the SCK necessary to diagnose student misconceptions. International assessments further support this; for example, OECD (2019) PISA results emphasize that student performance correlates higher with cognitive activation strategies than with rote memorization. Aligning national teacher training with European Standards (ESG) thus requires a renewed focus on these specialized pedagogical competencies.

Methodology

Research Design

This study adopts a qualitative research design based on a descriptive survey model and systematic document analysis. Qualitative methodology was selected to facilitate a comprehensive understanding of the structural and pedagogical challenges in teacher preparation, prioritizing the "how" and "why" of instructional efficacy over purely statistical frequencies.

Data Sources

The primary data corpus for this research consists of the *Standards and Guidelines for Quality Assurance in the European Higher Education Area* (ESG, 2015), the national curriculum standards for primary teacher education in Azerbaijan, and a curated selection of peer-reviewed academic literature focusing on mathematics education and competency-based paradigms.

Data Analysis and Procedural Stages

The collected qualitative data were processed using the Content Analysis method. To ensure a systematic investigation of the research problem, the analysis was conducted in three distinct, progressive stages:

- **Stage 1: Coding International Standards.** The initial phase involved identifying and coding the core requirements of the ESG and other international benchmarks. Specific focus was placed on identifying indicators of "student-centered learning," "outcomes-oriented instruction," and "competence-based assessment."
- **Stage 2: Gap Analysis and Comparative Identification.** The second stage involved mapping these international codes against current local practices and curricula in Azerbaijani teacher preparation. This comparative analysis allowed for the identification of specific methodological gaps between global quality expectations and domestic instructional realities.
- **Stage 3: Development of Pedagogical Scenarios.** In the final stage, the research synthesized the findings from previous phases to develop specific pedagogical scenarios and case studies. These scenarios demonstrate practical mechanisms for bridging identified gaps, utilizing theoretical models such as Shulman's PCK and Bruner's CPA to transform mathematical instruction from theory to practice.

Findings and Discussion

The Necessity of Mathematical Reasoning and Modeling:

Findings indicate that a competent teacher must move beyond the rote application of formulas. For example, when teaching area calculation, instead of merely stating $S = a \times b$, the teacher should guide students to model the surface as a grid of unit squares. This fosters modeling and justification competencies (Van de Walle et al., 2013). Inquiry-based questions – such as "How can we visually represent a space of 24 sq.m?" – allow students to perceive mathematics as a geometric model rather than a mere number.

The Role of Pedagogical Content Knowledge (PCK)

The PCK model remains the backbone of modern teacher preparation. As Shulman (1986) suggests, academic proficiency does not guarantee effective teaching if cognitive barriers are not identified. For instance, in fraction comparison, a student may assume $\frac{1}{3} > 1\frac{1}{2}$ based on their natural number knowledge. A teacher with robust PCK identifies this "natural number bias" and uses visual "cake" or "pizza" models to prove that more partitions result in smaller individual units.

Modeling in Equations: The Balance Scale Method

A major cognitive hurdle in primary algebra is the misconception of the equals sign (=) as an operational command rather than a sign of equivalence. Utilizing the "Balance Scale Model" during the concrete stage allows students to intuitively grasp the unknown variable (x). By transitioning through the three stages of the CPA model – from a physical scale (Concrete) to board diagrams (Visual) to algebraic symbols (Abstract) – future teachers can effectively teach the principle of maintaining equality (Bruner, 1966).

General Discussion and Conclusion

The results of this study provide strong empirical support for a paradigm shift toward a competency-based model in teacher education. Consistent with Shulman's (1986) framework, the analysis confirms that Common Content

Knowledge is insufficient for effective pedagogical delivery. The success of the modeling strategies identified – specifically the transition through the CPA stages – validates the necessity of visualization tools in overcoming cognitive barriers (Bruner, 1966).

Adhering to the ESG (2015) standards requires a structural transformation in Azerbaijan's teacher training programs. Curricula must prioritize diagnostic modeling and inquiry-based strategies over theoretical instruction. Such a transition is vital for cultivating a new generation of educators capable of fostering deep conceptual understanding and mathematical literacy as defined by the OECD (2019).

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