

Verification of the Efficiency of Future Teachers' Meta-Competencies Using an Integrative Approach

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Abstract

This article examines the issues of methodological verification of the effectiveness of developing the metacompetence of future primary school teachers based on an integrative approach. Within the framework of the study, the patterns of transition from the traditional reproductive education paradigm to the cognitive-reflexive model were analyzed based on empirical indicators. In the process of pedagogical monitoring, the levels of metacognitive monitoring, optimization of problem situations, and professional autonomy of respondents were differentiated. The statistical stability and reliability of the final results obtained were verified using mathematical and statistical criteria, and the pedagogical invariance of the proposed methodology was proven.

Keywords: Integrative approach, meta-competence, future primary school teacher, pedagogical monitoring, methodological verification, cognitive transfer.

Introduction

The architectonics of modern primary education prioritizes the formation of high-order cognitive systems by moving away from unified requirements for the professional training of future educators. In the global pedagogical space, the conceptual basis of the system is the ability of a future teacher to manage their personal intellectual resources, perform reflexive self-assessment, and make flexible decisions in a non-standard educational environment—that is, meta-competence. However, in the practice of training pedagogical personnel, the teaching of interdisciplinary components in a mutually isolated manner slows down the rate of transfer of fundamental knowledge to practical reflection by future teachers.

Overcoming this methodological conflict requires the implementation of an integrative approach to the educational process at a conceptual level, as well as strict monitoring and verification of the effectiveness of the developed pedagogical mechanisms. In modern pedagogical research, the concepts of meta-competence and meta-learning are studied in a synergistic relationship. In particular, the subject's deep understanding of their cognitive processes and the ability to independently control these intellectual resources are interpreted as the fundamental basis of metacompetence [1, p. 285].

2. METHODS (METHODOLOGY AND TOOLS FOR APPROBATION)

To evaluate the effectiveness of developing the meta-competence of future primary school teachers based on an integrative approach, a multi-stage pedagogical monitoring and methodological verification algorithm was developed. The approbation process was organized in a higher pedagogical educational environment, where the initial and final cognitive state indicators of the respondents were studied in comparison. To ensure the objectivity of the process, the subjects were differentiated into control and experimental groups based on the principle of neutral grouping.

In a modern transformative educational environment, diagnosing students' metaprofessional and metacognitive skills, as well as differentiating their level of development based on reproductive, heuristic, and creative criteria, requires systematic pedagogical monitoring [2, p. 19]. To measure the dynamics of metacompetence development, the following set of functional criteria and diagnostic tools was used:

Cognitive-strategic criterion: The ability to model pedagogical problems based on interdisciplinary integration and design solution algorithms (case studies and heuristic tests).

Reflexive-monitoring criterion: Assessment of the personal educational trajectory, analysis of intellectual errors made, and the level of correction of reflexive actions (metacognitive reports and reflexive questionnaires).

Activity-adaptive criterion: Readiness for the operational application of integrated knowledge in unexpected and non-standard pedagogical crises (simulation of pedagogical scenarios).

The process of developing the meta-competence of future primary school teachers involves not the artificial integration of educational content, but the fundamental laws of interdisciplinary synergy. To this end, the methodologies of specialized disciplines in the curriculum for experimental groups were integrated and modified in the form of special invariant pedagogical modules. In modern pedagogical approaches, activating students' metacognitive strategies and coordinating cognitive processes based on integrated models is a fundamental catalyst that ensures subjects' reflexive independence and a culture of professional thinking [3, p. 1].

This modular educational architecture was implemented in three strict stages:

Propedeutic-cognitive stage: Students have formed fundamental concepts regarding complex scenarios of future professional activity. At the same time, the subjects not only mastered ready-made knowledge but also learned strategies for the independent analysis of information flows.

Heuristic modeling stage: A system of interdisciplinary problem situations and integrated tasks has been implemented. Respondents developed algorithms for synergistically linking mathematical patterns with linguistic or natural science elements when designing lesson scenarios.

Reflexive-correctional stage: After each completed integrated task, monitoring of students' self-assessment and work on intellectual errors was organized. This stage served to stabilize reflexive autonomy, which is the most important component of metacompetence.

3. RESULTS (EMPIRICAL RESULTS AND ANALYSIS)

At the end of the pedagogical testing process, a significant quantitative and qualitative differentiation was observed in the metacompetence levels of the respondents in the control and experimental groups. While the growth rate of cognitive and reflexive indicators in the control groups trained using the traditional methodology was static in nature, a dynamic growth trend was

observed in the experimental group of students trained using integrative modules [4, p. 2].

The increase in high and medium-level metacompetence indicators in the experimental group indicates the stabilization of the respondents' cognitive autonomy. Consequently, the principles of global pedagogical research show that the systematic organization of reflexive practice in the education of future specialists is a fundamental pedagogical tool that ensures the integration of theory and practice and forms a culture of professional analysis [5, p. f693].

To verify the non-random nature of the obtained empirical data and the level of reliability of the proposed pedagogical innovation, Student's t-test and Fisher's criterion of mathematical statistics were applied. [6, 102021, p. 1].

The obtained empirical and statistical results show that the concept of developing the metacompetence of future primary school teachers based on an integrative approach is of strategic importance in modernizing the higher pedagogical education system. This theoretically grounded and practically verified model ensures that students not only master specialized subjects but also develop a high level of reflexive flexibility.

The essence of the research results is that metacompetence is not merely a set of individual skills, but a synergistic product of interdisciplinary integration. In the paradigm of the digitalization of modern education, the interactive development of metacognitive monitoring and planning strategies by integrating digital and analog approaches in the pedagogical activities of primary school teachers is a methodological necessity for the 21st-century audience [7, 100007, p. 1].

The proposed monitoring and verification algorithms serve to free the education quality assessment system in higher education institutions from subjective approaches and to create an objective diagnostic environment. In future research areas, it is advisable to study the transformation of this integrative model within the context of digital educational platforms.

The logical chain of the obtained empirical indicators confirms that the process of developing the meta-competence of future primary school teachers requires the abandonment of monotonous methods in the traditional textbook style within the education system. The integrative approach, as a pedagogical object, forms a synergistic environment that activates the student's personal intellectual autonomy. The results of this study indicate that the increase in the level of metacompetence is not merely a change in quantitative indicators, but a qualitative restructuring of the future teacher's cognitive architecture.

However, when designing models for the development of metacognitive strategies, it is necessary to consider the age characteristics of the audience and the boundaries of educational responsibility, as the direct mechanical transfer of the stability of metacognitive skills of higher education students to the primary school environment can lead to cognitive imbalance. According to N. Berdikulova, "creating conditions for the development of human activity, material, and social reality for students should be one of the primary tasks of an educational organization." [8. P. 13.]

This model, based on mathematical and statistical verification, has an invariant nature in the educational process. That is, the proposed system of integrated modules is methodologically guaranteed to be successfully adapted in other related pedagogical areas and to yield a stable empirical effect.

4. DISCUSSION

The obtained empirical and statistical results show that the concept of developing the meta-competence of future primary school teachers based on an integrative approach is of strategic importance in modernizing the higher pedagogical education system. This theoretically grounded and practically verified model ensures that students not only master specialized subjects but also develop a high level of reflective flexibility.

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CONCLUSION

In assessing the readiness of future primary school teachers, abandoning mechanical concepts such as "experimentation" and introducing principles of systematic monitoring and methodological verification instead ensures the objectivity of the education quality analysis.

Pedagogical modules formed on the basis of an integrative approach served to increase the reflexive and cognitive indicators of the respondents at a statistically significant level.

The verification of the final indicators obtained using mathematical and statistical criteria fully confirms the stability of the developed methodology and the possibility of its application in educational practice.

REFERENCES

1. Zhanadilova, K., et al. (2022). Developing metacompetence in future primary school teachers. *Cypriot Journal of Educational Sciences*, 17(1), 284–295. doi.org
2. Ergasheva, F. T. (2025). Ta'limni raqamlashtirish sharoitida talabalarning metaprofessional kompetentligini rivojlantirish metodikasini takomillashtirish. *Pedagogika fanlari bo'yicha falsafa doktori (PhD) dissertatsiyasi avtoreferati*. Buxoro: Buxoro davlat universiteti. – 46 b.
3. Ossa, C. J., Rivas, S. F., & Saiz, C. (2023). Relation between metacognitive strategies, motivation to think, and critical thinking skills. *Frontiers in Psychology*, 14, Article 1272958, 1–11. doi.org.

4. Robles Moral, F. J., & Fernández Díaz, M. (2021). Future Primary School Teachers' Digital Competence in Teaching Science through the Use of Social Media. *Sustainability*, 13(5), Article 2816. doi.org
5. Guite, T., Savi, V., & Seyie, V. (2025). Reflective practice as a pedagogical tool in teacher education: a systematic conceptual review. *Journal of Emerging Technologies and Innovative Research (JETIR)*, 12(12), f693–f697.
6. Anthonysamy, L., Wut, T. E., & Lim, O. W. (2025). Metacognitive strategy interventions to improve analytical thinking skills: A quasi-experimental study. *Social Sciences & Humanities Open*, 12, Article 102021. <https://doi.org>
7. Fahrni, D. D. D., Hascher, T., & Prasse, D. (2025). Promoting metacognitive strategies with educational technology: Primary teachers' beliefs and practices. *Learning in Context*, 2, Article 100007. <https://doi.org>
8. Berdikulova N.E. Bo'lajak boshlang'ich sinf o'qituvchilarini tayyorlashda innovatsion va integratsion texnologiyalarni takomillashtirish: Pedagogika fanlari bo'yicha falsafa doktori (PhD) diss. avtoref. – Samarqand: SamDU, 2023. – 46 b.