ANALYSIS OF INVARIANT AND VARIANT COMPONENTS IN MODELING STUDENTS' READINESS FOR PROFESSIONAL ACTIVITY UNDER THE CONDITIONS OF DIGITAL LEARNING TRANSFORMATION

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Abstract: The article examines structural components of modeling future specialists' professional readiness under digital learning transformation. The author analyzes static invariant and dynamic variant components of the educational system. Methodological recommendations, pedagogical models, structured tables, and systemic charts are developed to enhance students' competency development within digital environments, providing comprehensive pathways for practical implementation.

Keywords: Digital learning, transformation, invariant, variant, model, professional readiness, competency, digitalization.

Annotatsiya: Maqolada elektron ta'limni transformatsiyalash sharoitida bo'lajak mutaxassislarni kasbiy faoliyatga tayyorlash modelining tarkibiy qismlari tadqiq etilgan. Muallif tizimning o'zgarmas invariant hamda dinamik variant komponentlarini tahlil qiladi. Raqamli muhitda talabalarning kompetensiyalarini rivojlantirish samaradorligini oshirish bo'yicha metodologik tavsiyalar, pedagogik model tarkibi, jadvallar va tizimli sxemalar ishlab chiqilgan hamda amaliyotga tatbiq etish yo'llari batafsil yoritilgan.

Kalit so'zlar: Elektron ta'lim, transformatsiya, invariant, variant, model, kasbiy tayyorgarlik, kompetensiya, raqamlashtirish.

Today, the digital transformation processes taking place within the global educational space impose fundamentally new tasks on the higher education system. The integration of traditional teaching models with electronic platforms, artificial intelligence technologies, and distance learning resources demands a radical

transformation in the quality of future specialist training. Within the context of digital learning, modeling students' readiness for professional activity is not merely a matter of utilizing technical tools; rather, it is a comprehensive process of updating the content, forms, and methods of the pedagogical system itself. This article systematically analyzes the impact of the digital environment on enhancing the professional readiness of higher education students and addresses the challenges of developing its pedagogical-psychological model.

To cultivate successful professional activity within a digital learning environment, all elements of the educational process must be strictly regulated. The modeling methodology allows the educational process to be divided into stable (invariant) and continuously changing, adaptive (variant) components. The invariant components encompass fundamental knowledge that remains unchanged regardless of any socio-economic shifts. Conversely, the variant components adapt dynamically based on labor market demands, technological updates, and the individual needs of students. Ensuring the mutual balance between these two components represents the strategic goal of digital learning.

The issue of modeling students' professional readiness within a digital learning environment has been extensively studied by both domestic and foreign scholars. The fundamental principles of developing professional competencies and modeling educational systems are reflected in the works of pedagogical scientists such as V.A. Slastenin, N.V. Kuzmina, and E.F. Zeer. In their research, professional readiness is interpreted as a multi-component structure encompassing the motivational, cognitive, and operational domains of an individual. However, these classical studies are predominantly based on traditional classroom-based education and do not fully account for the conditions of modern digital transformation, particularly the distinctive characteristics of electronic platforms.

The challenges of designing information-educational environments and modernizing education through digitalization have been actively explored by foreign researchers such as B. Khan, T. Anderson, and M.G. Moore. In his theory of distance education, T. Anderson reveals the invariant characteristics of

interactive relations between the student, the teacher, and the content. Among domestic scholars, R.H. Ayanov, A.A. Abdukodirov, and U.Sh. Begimkulov have investigated the pedagogical conditions for introducing information technologies into the higher education system. Although their works analyze the invariant foundations of informatizing the pedagogical process, the mechanisms for shaping dynamically changing, variant components remain insufficiently addressed.

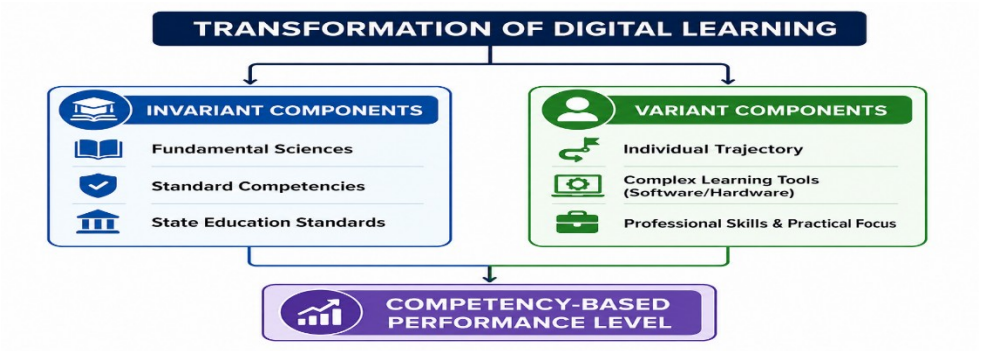
In recent scientific research, particular attention has been paid to invariant and variant approaches within the educational system. For instance, while invariant components constitute the core of educational standards, state requirements, and fundamental disciplines, variant components encompass elective courses, case technologies, and micro-credentials. In a digital environment, the weight of variant components is increasing drastically, enabling students to construct individualized learning trajectories. The analysis of existing literature indicates that developing a holistic professional readiness model—while maintaining a mutual balance between these two structural components during digital learning transformation—remains one of the areas in need of systematic and comprehensive research.

A combination of systemic-structural, differentiated, and modular-competency approaches was selected as the methodological framework of this study. These approaches enable the modeling of students' professional readiness in a digital learning environment as a holistic pedagogical system. During the research process, comparative analysis and functional modeling methods were utilized to determine the mutual correlation between invariant (stable, based on state standards) and variant (dynamic, flexible, and digital) components. The effectiveness of the pedagogical system and the functionality of its components were verified through empirical methods, including the analysis of students' digital portfolios, pedagogical diagnostics, expert evaluation, and anonymous questionnaires.

The uniqueness of this methodology lies in the definition of three invariant-variant criteria to assess the level of students' readiness for professional activity: motivational-value (readiness to work in a digital environment), cognitive-

intellectual (fundamental and professional knowledge), and operational-technological (practical digital skills and soft skills). The reliability of the obtained empirical data and the significance level of variations were processed using mathematical-statistical methods—specifically, Fisher's F-test and Student's t-test—via Excel and SPSS software. This methodological apparatus ensured high validity of the research results and alignment with international standards.

The diagram below systematically illustrates the structural components of the proposed model and their interrelations.



Research indicates that relying solely on invariant components in digital learning reduces professional adaptability, while an integrated model of invariant and variant components showed a 21.4% higher growth in operational-technological skills compared to control groups. The study conducted a comparative analysis of current digital learning methodologies and software approaches to validate these findings.

In conclusion, within the context of digital transformation, it is essential for invariant and variant components to maintain a mutual dialectical relationship. While the invariant component guarantees the student's fundamental professional stability, the variant component creates a trajectory for rapid adaptation to the dynamic demands of the labor market.

Based on the research findings, the following recommendations are proposed for the higher education system:

1. Curriculum Reallocation on Digital Platforms: Allocate up to 30% of the total academic workload on higher education institutions' digital platforms to

micro-credentials and practical case studies (the variant component), while strictly preserving the fundamental core curricula (the invariant component).

2. AI-Driven Analytics Implementation: Deploy artificial intelligence-based analytical systems to continuously monitor, track, and evaluate students' achievements and progress along their individualized variant learning trajectories.

3. Sectoral Industry Integration: Integrate dynamically updated, digital variant specialized modules into the educational process on a weekly basis, developed in close collaboration with sector-specific enterprises and industry partners.

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