The OSCAR PUBLISHING Services
International Journal of Pedagogics

VOLUME Vol.06 Issue04 2026
PAGE NO. 681-685
DOI 10.37547/ijp/Volume06Issue04-135

Didactic Opportunities of Digital Pedagogy in Developing Future Teachers' Competence in Modeling the Educational and Upbringing Process

Matchanova Dinora Yusupboyevna
Physics Teacher at Urgench RANCH University of Technology, Uzbekistan

Received: 18 March 2026; **Accepted:** 05 April 2026; **Published:** 30 April 2026

Abstract: This article examines the didactic opportunities of digital pedagogy in developing future teachers' competence in modeling educational and upbringing processes. The study explores the integration of digital visualization, interactive simulations, collaborative learning environments, and pedagogical design technologies into professional teacher preparation. The research methodology is based on theoretical analysis, comparative examination, and conceptual modeling of contemporary educational approaches. The findings identify the principal didactic mechanisms through which digital pedagogy can support instructional planning, pedagogical decision-making, professional reflection, and the integration of educational and developmental objectives. A conceptual model combining motivational, cognitive, technological, practical, and reflective components is proposed. Particular attention is given to the application of digital tools within the Digital Pedagogy curriculum and their potential contribution to developing pedagogical modeling competence. The study establishes theoretical and methodological foundations for organizing competency-oriented learning activities and identifies directions for further empirical investigation.

Keywords: Digital pedagogy, future teachers, pedagogical modeling, didactic opportunities, educational and upbringing process, professional competence, digital visualization, instructional design, educational technologies, reflective learning.

Introduction: The digital transformation of contemporary education has fundamentally changed the requirements for professional teacher preparation. Modern teachers are expected not only to transmit subject knowledge but also to design educational environments, organize meaningful learning experiences, facilitate learners' personal development, and evaluate the effectiveness of pedagogical decisions. These responsibilities require an integrated system of professional competencies, among which the ability to model educational and upbringing processes occupies an important position. Pedagogical modeling enables teachers to anticipate educational situations, establish relationships between instructional objectives and expected outcomes, and develop appropriate strategies for managing complex learning environments.

Within contemporary pedagogical theory, modeling is understood as the purposeful construction of simplified representations of educational processes that reflect their essential components, relationships, and developmental mechanisms. Such representations may include instructional sequences, interaction patterns, assessment procedures, and educational interventions. Shulman [1] emphasizes the importance of pedagogical reasoning in transforming professional knowledge into meaningful instructional activities. From this perspective, the development of modeling competence requires future teachers to integrate theoretical understanding with practical decision-making and reflective evaluation.

Digital pedagogy creates additional opportunities for developing these abilities through interactive

technologies, visual representations, educational simulations, and collaborative platforms. Unlike traditional approaches based predominantly on verbal descriptions and static lesson plans, digitally supported modeling allows prospective teachers to construct, modify, compare, and evaluate alternative pedagogical scenarios. The technological pedagogical content knowledge framework proposed by Mishra and Koehler [2] demonstrates that effective integration of digital technologies depends on the interaction of technological knowledge, pedagogical principles, and subject-specific content.

Despite the increasing availability of digital educational resources, their systematic application to developing pedagogical modeling competence remains a methodological challenge. In particular, digital tools are frequently associated with content presentation rather than the analysis and construction of educational processes. This distinction highlights the need to investigate their didactic functions and establish pedagogically justified mechanisms for their integration into professional teacher education. Accordingly, the purpose of this study is to identify and theoretically substantiate the didactic opportunities of digital pedagogy for developing future teachers' competence in modeling educational and upbringing processes.

The study employed theoretical analysis, comparative interpretation, scientific generalization, and conceptual pedagogical modeling. Its methodological foundation comprises research addressing professional teacher knowledge, digital competence, instructional design, multimedia learning, formative assessment, and technology integration in teacher education.

The theoretical analysis was organized around the technological pedagogical content knowledge framework [2], the European Framework for the Digital Competence of Educators [3], and Laurillard's conception of teaching as a design science [4]. These approaches were examined to determine the relationships between digital technologies, pedagogical decision-making, and the design of educational experiences. The cognitive principles of multimedia learning developed by Mayer and Moreno [5] were considered to establish conditions under which visual representations can support meaningful information processing.

Comparative examination was applied to identify the instructional functions of concept mapping, interactive visualization, digital simulations, and collaborative modeling. The conceptual synthesis involved relating these functions to professional competencies required for educational planning, developmental guidance, assessment, and reflection. The resulting framework describes the anticipated mechanisms of competence development rather than experimentally verified effects.

Particular methodological attention was devoted to the integration of educational and upbringing objectives. In this study, the educational process encompasses the acquisition of knowledge and skills, while the upbringing dimension concerns the development of values, social responsibility, constructive interpersonal relationships, and appropriate behavior. Their integration was treated as an essential requirement for comprehensive pedagogical modeling.

The theoretical analysis indicates that digital pedagogy possesses considerable didactic potential for developing future teachers' pedagogical modeling competence. This potential is associated with the possibility of transforming educational information into interactive representations, supporting the systematic analysis of pedagogical situations, and creating conditions for independent instructional design.

The first significant finding concerns the cognitive and analytical functions of digital modeling. The construction of pedagogical models requires prospective teachers to distinguish essential educational components from secondary information, identify logical relationships, and explain the influence of instructional decisions on anticipated outcomes. Digital concept maps and interactive diagrams facilitate the external representation of these relationships. Novak and Cañas [6] demonstrate the importance of concept mapping in supporting meaningful learning and knowledge organization. Applied to teacher education, this approach enables students to develop structured representations of learning objectives, instructional activities, learner characteristics, educational interactions, and assessment criteria.

Another important didactic opportunity is associated with developing instructional design competence. Digital pedagogical environments enable students to

construct detailed learning scenarios in which educational objectives are connected with teaching strategies, differentiation procedures, and formative assessment. Such modeling activities encourage future teachers to move beyond reproducing ready-made lesson plans toward independently designing pedagogical processes. Laurillard [4] considers teaching a design-oriented professional activity in which instructional solutions are developed, evaluated, and improved through systematic reasoning. This perspective provides a theoretical basis for incorporating iterative modeling tasks into professional preparation.

The integration of educational and upbringing objectives represents a distinctive dimension of pedagogical modeling competence. Digital simulations can support the examination of situations involving classroom cooperation, interpersonal conflict, academic responsibility, and ethical decision-making. By developing alternative scenarios, future teachers can analyze how particular instructional methods may influence not only academic achievement but also communication, empathy, and social participation. For example, modeling collaborative group work requires the consideration of subject-specific objectives alongside mutual respect, individual responsibility, and constructive communication. These dimensions must be represented within a coherent pedagogical structure rather than treated as unrelated instructional outcomes.

The research synthesis also identifies digital visualization as an important mechanism for connecting theoretical knowledge with practical pedagogical activities. Interactive diagrams and process maps allow prospective teachers to represent the sequence of instructional actions and clarify the relationships between educational conditions and expected results. Nevertheless, visualization effectiveness depends on appropriate cognitive design. Mayer and Moreno [5] emphasize that multimedia environments should account for limitations in human information-processing capacity. Consequently, visual pedagogical models should prioritize meaningful relationships, consistent organization, and the avoidance of unnecessary information.

A further opportunity involves strengthening prospective teachers' digital and methodological competencies. The DigCompEdu framework [3] identifies professional engagement, digital resources, teaching and learning, assessment, learner empowerment, and the facilitation of learners' digital competence as interconnected areas of educators' professional development. Pedagogical modeling activities can integrate several of these areas by requiring students to select technological resources, design learning experiences, establish assessment mechanisms, and consider accessibility. In this context, digital competence becomes closely connected with instructional reasoning rather than remaining limited to operational knowledge of software.

Collaborative digital modeling constitutes another didactic mechanism. Shared online environments provide opportunities for prospective teachers to develop pedagogical models collectively, discuss alternative instructional decisions, and revise proposed solutions through peer feedback. The synthesis conducted by Tondeur and colleagues [7] emphasizes the importance of learning technology through design, authentic experiences, and appropriate institutional support in preparing future teachers for technological integration. These findings support the theoretical relevance of collaborative modeling tasks that resemble real professional responsibilities.

The analysis further demonstrates the importance of formative assessment and reflection in modeling competence development. Digital platforms can preserve successive versions of pedagogical designs, making it possible to compare initial assumptions with revised instructional solutions. Black and Wiliam [8] emphasize the educational significance of feedback and formative assessment in supporting learning improvement. When applied to pedagogical modeling, feedback may focus on the consistency of educational objectives, the suitability of methods, the inclusion of developmental priorities, and the quality of proposed assessment procedures.

On the basis of these theoretical relationships, a conceptual model of competence development is proposed. The model integrates motivational and value-oriented readiness, cognitive understanding of pedagogical processes, technological and methodological proficiency, practical modeling skills, and reflective evaluation. These components are considered mutually dependent. Cognitive knowledge

enables future teachers to interpret educational situations, technological proficiency facilitates the construction of digital representations, practical experience supports decision-making, and reflection enables the continuous correction of pedagogical models. The proposed model provides a basis for designing competency-oriented activities within the Digital Pedagogy curriculum.

The identified didactic opportunities indicate that the contribution of digital pedagogy to professional teacher preparation depends primarily on the instructional purposes for which technological resources are employed. Digital visualization and modeling technologies cannot independently ensure competence development. Their educational value emerges through systematically organized activities requiring theoretical interpretation, practical problem-solving, and reflective decision-making.

Within the Digital Pedagogy curriculum, these principles may be implemented through authentic pedagogical design assignments. Future teachers can be asked to construct a digital model of a classroom learning process that incorporates educational objectives, learner needs, teaching methods, interpersonal interactions, and assessment mechanisms. The proposed model may subsequently be examined through simulated classroom situations involving differences in academic readiness, learner motivation, or group participation. Students would then revise their models and provide theoretical justification for the modifications.

Such activities create opportunities to integrate pedagogical theory with professional practice. Instead of learning digital tools as isolated technical applications, prospective teachers employ them to solve educational problems. This orientation corresponds with the principle of meaningful technology integration described by Mishra and Koehler [2] and the emphasis on authentic design experiences presented by Tondeur and colleagues [7].

The development of modeling competence also requires systematic attention to professional reflection. Zimmerman's theory of self-regulated learning [9] highlights the importance of planning, monitoring, and self-evaluation in purposeful learning activities. In pedagogical modeling, these processes may be represented through the formulation of instructional hypotheses, examination of anticipated difficulties, and evaluation of alternative pedagogical decisions. Digital technologies can support such processes by recording design revisions and enabling comparisons between initial and improved models.

From a methodological perspective, assessment should consider both the structure and professional justification of digital pedagogical models. Technical appearance alone cannot serve as an adequate indicator of competence. Greater importance should be attached to the logical connection between objectives and activities, sensitivity to learners' developmental characteristics, appropriateness of instructional strategies, and the ability to revise decisions based on feedback.

Several limitations must also be acknowledged. Access to digital infrastructure, differences in technological readiness, and the possibility of cognitive overload may restrict effective implementation. Moreover, digitally represented classroom situations cannot fully reproduce the unpredictability and emotional complexity of authentic educational interactions. Therefore, modeling activities should complement, rather than replace, classroom observation, teaching practice, and direct communication with learners.

The present study is limited by its theoretical and conceptual design. Although the proposed relationships are supported by established educational literature, their effectiveness in developing pedagogical modeling competence has not been empirically measured. Future investigations should examine the proposed framework through experimental and comparison groups, diagnostic assessment rubrics, and systematic analysis of changes in prospective teachers' modeling performance.

Digital pedagogy provides significant didactic opportunities for developing future teachers' competence in modeling educational and upbringing processes. These opportunities are associated with visual representation of pedagogical relationships, the construction of instructional scenarios, collaborative problem-solving, integration of educational and developmental objectives, and reflective evaluation.

The proposed conceptual model connects cognitive, technological, practical, motivational, and reflective

components within a unified competency-oriented approach. Its implementation in Digital Pedagogy courses can provide a methodological foundation for linking theoretical preparation with authentic instructional design tasks.

The effectiveness of this approach depends on purposeful technology selection, appropriate pedagogical guidance, accessibility, and systematic feedback. Further empirical research is necessary to determine the extent to which digitally supported modeling improves future teachers' professional decision-making and their readiness to organize comprehensive educational and upbringing processes.

REFERENCES

1. Shulman L. S. Knowledge and Teaching: Foundations of the New Reform // Harvard Educational Review. – 1987. – Vol. 57, No. 1. – P. 1–23. – DOI: 10.17763/haer.57.1.j463w79r56455411.
2. Mishra P., Koehler M. J. Technological Pedagogical Content Knowledge: A Framework for Teacher Knowledge // Teachers College Record. – 2006. – Vol. 108, No. 6. – P. 1017–1054. – DOI: 10.1111/j.1467-9620.2006.00684.x.
3. Redecker C. European Framework for the Digital Competence of Educators: DigCompEdu / ed. Y. Punie. – Luxembourg: Publications Office of the European Union, 2017. – DOI: 10.2760/159770.
4. Laurillard D. Teaching as a Design Science: Building Pedagogical Patterns for Learning and Technology. – New York: Routledge, 2012. – 272 p.
5. Mayer R. E., Moreno R. Nine Ways to Reduce Cognitive Load in Multimedia Learning // Educational Psychologist. – 2003. – Vol. 38, No. 1. – P. 43–52. – DOI: 10.1207/S15326985EP3801_6.
6. Novak J. D., Cañas A. J. The Theory Underlying Concept Maps and How to Construct and Use Them // Práxis Educativa. – 2010. – Vol. 5, No. 1. – P. 9–29. – DOI: 10.5212/PraxEduc.v.5i1.009029.
7. Tondeur J., van Braak J., Sang G., Voogt J., Fisser P., Ottenbreit-Leftwich A. Preparing Pre-Service Teachers to Integrate Technology in Education: A Synthesis of Qualitative Evidence // Computers & Education. – 2012. – Vol. 59, No. 1. – P. 134–144. – DOI: 10.1016/j.compedu.2011.10.009.
8. Black P., Wiliam D. Assessment and Classroom Learning // Assessment in Education: Principles, Policy & Practice. – 1998. – Vol. 5, No. 1. – P. 7–74. – DOI: 10.1080/0969595980050102.
9. Zimmerman B. J. Becoming a Self-Regulated Learner: An Overview // Theory Into Practice. – 2002. – Vol. 41, No. 2. – P. 64–70. – DOI: 10.1207/s15430421tip4102_2.