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THEORETICAL AND METHODOLOGICAL FOUNDATIONS FOR DEVELOPING THE PROFESSIONAL COMPETENCE OF FUTURE TEACHERS THROUGH INNOVATIVE TECHNOLOGIES

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Abstract. The digital transformation of higher education requires teacher training institutions to rethink how the professional competence of future teachers is formed. This article analyses the concept of professional competence in pedagogical education and examines how innovative technologies can serve as a means of developing it. Using theoretical analysis, comparison of international frameworks (TPACK, DigCompEdu, the UNESCO ICT Competency Framework for Teachers) and generalisation of the regulatory documents of the Republic of Uzbekistan, the study proposes a five-component structure of a future teacher's professional competence: motivational-value, cognitive, technological-methodical, communicative and reflective. For each component, criteria, indicators and corresponding classes of innovative technologies are identified. The article argues that innovative technologies develop professional competence only when they are embedded in a purposeful methodical system that combines content knowledge, pedagogical design and reflective practice, rather than being used as isolated tools. The results can be used to improve curricula, course syllabi and teaching practice in pedagogical higher education institutions.

Keywords: future teachers, professional competence, innovative technologies, digital competence, TPACK, DigCompEdu, teacher education, methodical system, generative artificial intelligence.

1. Introduction

The quality of any education system is limited by the quality of its teachers. This idea has become especially pressing as schools and universities move into digital learning environments, where a teacher is expected not only to master subject content and pedagogy but also to design, manage and evaluate learning with the help of digital and innovative technologies.

In the Republic of Uzbekistan, the modernisation of teacher education is a declared state priority. The Concept for the Development of the Higher Education System until 2030, approved by Presidential Decree No. PF-5847 of 8 October 2019, sets the goals of introducing digital technologies and modern teaching methods into the educational process. The Law "On Education" (No. ZRU-637, 23 September 2020) and the Development Strategy of New Uzbekistan for 2022–2026 (Decree No. PF-60, 28 January 2022) further emphasise competence-based education and the training of teachers who can work in a digital environment.

At the same time, practice in pedagogical higher education shows a persistent gap. Future teachers often learn about innovative technologies as separate tools in separate courses, but they are rarely trained to integrate them into the design of a lesson, the assessment of learners and the

reflection on their own teaching. As a result, technological skills do not automatically turn into professional competence.

The **purpose** of this article is to clarify the theoretical and methodological foundations for developing the professional competence of future teachers through innovative technologies. The **objectives** are: (1) to analyse the concept of professional competence in pedagogical literature; (2) to compare international frameworks of teachers' digital and technological competence; (3) to define the structure of a future teacher's professional competence and its criteria; and (4) to match each structural component with classes of innovative technologies that can develop it.

2. Literature Review

The concept of competence. Weinert (2001) defines competence as a combination of cognitive abilities and skills together with the motivational, volitional and social readiness to use them in variable situations. Blömeke, Gustafsson and Shavelson (2015) describe competence as a continuum that runs from dispositions (knowledge, beliefs, motivation) through situation-specific skills (perception, interpretation, decision-making) to observable performance. This view is important for teacher education: knowing about a technology is only the starting point, and competence is visible only when the teacher acts effectively in a real classroom situation.

Professional competence of teachers. Shulman (1986) introduced pedagogical content knowledge, the knowledge that allows a teacher to transform subject content into forms accessible to learners. The COACTIV model (Baumert & Kunter, 2013) extends this by treating professional competence as the interaction of professional knowledge, beliefs and values, motivational orientations and self-regulation. Darling-Hammond (2006) stresses that strong teacher education programmes connect coursework closely with supervised practice, so that knowledge is tested and refined in action.

Technology in teacher competence frameworks. Mishra and Koehler (2006) proposed the TPACK framework, which adds technological knowledge to Shulman's model and argues that effective technology integration arises from the interaction of technology, pedagogy and content rather than from any of them alone (Koehler & Mishra, 2009). The European Framework for the Digital Competence of Educators, DigCompEdu (Redecker, 2017), describes 22 competences in six areas, from professional engagement to facilitating learners' digital competence, and six proficiency levels from A1 to C2. The UNESCO ICT Competency Framework for Teachers (UNESCO, 2018) organises competences into three stages of knowledge acquisition, knowledge deepening and knowledge creation. Falloon (2020) argues that the focus should shift from digital literacy towards broader teacher digital competence, which includes ethical, personal and professional dimensions.

Barriers to integration. Ertmer and Ottenbreit-Leftwich (2010) show that teachers' knowledge, self-efficacy, pedagogical beliefs and school culture all shape whether technology is used meaningfully. Tondeur et al. (2012), in a synthesis of qualitative studies, identify key strategies for preparing pre-service teachers: role models, reflection on attitudes, learning by design, collaboration with peers, authentic experiences and continuous feedback.

Emerging technologies. Zawacki-Richter et al. (2019) note that research on artificial intelligence in higher education rarely includes the perspective of educators. Kasneci et al. (2023) argue that large language models create new opportunities for lesson planning, feedback and personalised learning, but require teachers to develop new competences in critical evaluation, ethics and prompt design.

Research gap. The literature provides strong frameworks for describing competence, but fewer studies explain how a pedagogical university should organise the step-by-step development of these competences through innovative technologies, particularly in the context of Uzbekistan's teacher education system.

3. Methods

The study is theoretical and methodological in nature. The following methods were used:

- **theoretical analysis** of pedagogical, psychological and methodological literature on competence and teacher education;
- **comparative analysis** of international frameworks of teachers' technological and digital competence (TPACK, DigCompEdu, UNESCO ICT CFT);
- **analysis of regulatory documents** of the Republic of Uzbekistan on higher and pedagogical education;
- **modelling**, used to construct the structure of the professional competence of future teachers;
- **generalisation** of the author's experience of teaching and of organising an ICT training laboratory at Bukhara International University.

4. Results

4.1. Definition. On the basis of the analysis, the professional competence of a future teacher is defined as *an integrative personal quality that unites motivational-value orientations, subject and psychological-pedagogical knowledge, technological-methodical skills, communicative abilities and reflective self-regulation, and that ensures the effective design, implementation and evaluation of the educational process in a digital learning environment.*

4.2. Structure. Five interrelated components were identified. Table 1 shows each component with its content, criteria and the classes of innovative technologies that most directly develop it.

Table 1. Structure of the professional competence of future teachers and corresponding innovative technologies

Component	Content	Criteria and indicators	Innovative technologies that develop it
Motivational-value	Professional orientation, interest in innovation, readiness to change one's practice	Positive attitude to innovation; self-efficacy in using technology; ethical stance on digital tools	Case studies of successful practice, gamification, digital portfolios, project-based learning
Cognitive	Subject knowledge, pedagogical and psychological knowledge, knowledge of digital tools and their didactic potential	Completeness and depth of TPACK knowledge; ability to explain a tool's didactic function	Learning management systems (Moodle), micro-learning, video lectures, flipped classroom

Component	Content	Criteria and indicators	Innovative technologies that develop it
Technological-methodical	Ability to design lessons, select and adapt tools, create digital learning materials and assessments	Quality of lesson plans; correct alignment of goals, methods and tools; quality of created resources	Learning by design, interactive content tools, online assessment platforms, generative AI for lesson planning
Communicative	Pedagogical communication in face-to-face and online settings, collaboration, feedback	Clarity of online communication; ability to organise group work and give feedback	Blended learning, collaborative platforms, online discussion forums, peer review
Reflective	Self-analysis, self-evaluation and self-development of teaching practice	Depth of reflection; ability to identify and correct one's mistakes; professional development plan	Microteaching with video recording, e-portfolios, reflective journals, learning analytics

4.3. Levels. Following the logic of DigCompEdu and the UNESCO framework, four levels of development are distinguished: *initial* (knows about tools, uses them on instruction), *basic* (uses tools independently in standard situations), *productive* (integrates tools purposefully into lesson design) and *creative* (creates new digital resources and methods and shares them with colleagues).

4.4. Pedagogical conditions. The analysis shows that innovative technologies develop professional competence when four conditions are met:

1. technologies are introduced across the curriculum, not only in a separate ICT course;
2. future teachers learn *by design*: they create real lesson materials rather than only studying tools;
3. learning in the university is connected with teaching practice in schools;
4. each cycle of technology use ends with structured reflection and feedback.

5. Discussion

The proposed structure is consistent with the competence-as-continuum view of Blömeke et al. (2015): the motivational-value and cognitive components correspond to dispositions, the technological-methodical and communicative components to situation-specific skills, and the reflective component links performance back to dispositions. It also operationalises TPACK for teacher education, because the technological-methodical component requires future teachers to align content, pedagogy and technology in concrete lesson designs.

The key finding is that technology itself does not develop competence. This agrees with Ertmer and Ottenbreit-Leftwich (2010), who show that beliefs and self-efficacy are as important as technical knowledge, and with Tondeur et al. (2012), whose strategies such as learning by design and reflection correspond closely to the pedagogical conditions identified here.

Generative artificial intelligence deserves special attention. Tools based on large language models

can draft lesson plans, tasks and assessment rubrics in minutes. For a future teacher, however, the professional value lies not in generating a plan but in critically evaluating, correcting and adapting it to specific learners. Therefore, AI-supported lesson design should be treated as a tool for developing the technological-methodical and reflective components, with explicit attention to accuracy, academic integrity and data privacy (Kasneci et al., 2023).

The study has limitations. It is theoretical, and the proposed structure and conditions need empirical verification through a pedagogical experiment with valid diagnostic instruments for each component.

6. Conclusion

1. The professional competence of a future teacher is an integrative quality that is revealed in action, in the design, implementation and evaluation of learning in a digital environment.
2. Its structure includes five interrelated components: motivational-value, cognitive, technological-methodical, communicative and reflective; each has its own criteria and indicators and can be assessed at four levels.
3. Innovative technologies are an effective means of developing this competence only within a purposeful methodical system based on cross-curricular integration, learning by design, links with teaching practice and systematic reflection.
4. Further research will focus on building a methodical model on this basis and testing its effectiveness experimentally at Bukhara International University.

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