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METHODOLOGICAL JOURNAL**<http://mentaljournal-jspu.uz/index.php/mesmj/index>**DIGITAL COMPETENCE IN PRIMARY SCHOOL TEACHING: THEORETICAL
FOUNDATIONS AND PRACTICAL APPROACHES****Mukhiddin Makhmudovich Berdiyev***Lecturer of the Department of Primary Education**Termez State Pedagogical Institute**E-mail address: muxiddinberdiyev1@gmail.com**Termez, Uzbekistan***ABOUT ARTICLE**

Key words: digital competence, primary school teacher, ICT integration, DigComp framework, TPACK model, digital literacy, educational technology, pedagogical digitalization, teacher professional development, digital pedagogy, UNESCO ICT framework, e-learning, foundational digital skills, primary education, technology-enhanced learning.

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Abstract: The accelerating integration of digital technologies into contemporary educational systems has fundamentally transformed the professional demands placed upon primary school teachers, rendering digital competence a non-negotiable component of effective pedagogical practice at the foundational stage of schooling. This article presents a comprehensive theoretical and analytical review of the concept of digital competence as it applies specifically to the professional activity of primary school teachers, examining its definitional evolution, structural dimensions, internationally recognized frameworks, and practical implementation approaches within the primary education context. Drawing on a systematic analysis of peer-reviewed literature, international policy documents, and comparative educational research, the article first traces the conceptual development of digital competence from early information and communication technology (ICT) literacy frameworks through to contemporary multidimensional models, with particular reference to the European DigComp 2.2 framework, UNESCO's ICT Competency Framework for Teachers, and the TPACK (Technological Pedagogical Content Knowledge) model. The article then examines the specific manifestations and demands of

digital competence within primary school teaching practice, addressing the integration of digital tools in literacy and numeracy instruction, the pedagogical use of interactive learning environments, the ethical dimensions of digital education with young learners, and the cultivation of foundational digital literacy among primary-age children.

Introduction. The global proliferation of digital technologies across all domains of human activity — professional, civic, communicative, and cultural — has generated unprecedented pressure on educational systems to equip learners with the knowledge, skills, and dispositions required for effective participation in digitally mediated environments. Within this context, the digitalization of teaching practice has emerged as one of the most consequential and contested dimensions of contemporary educational reform. At no level of schooling is this transformation more significant, or more delicate, than at the primary stage, where the foundational experiences of formal education shape children's long-term orientations toward learning, technology, and knowledge [1].

Primary school teachers occupy a uniquely pivotal position in the digitalization of education. As the architects of children's earliest structured encounters with educational technology, they bear responsibility not only for integrating digital tools into their instructional practice but for doing so in ways that are developmentally appropriate, pedagogically purposeful, and ethically sound. The quality of this integration depends critically on the digital competence of the teacher — understood not merely as proficiency in the operational use of digital devices and platforms but as a multidimensional professional capacity encompassing the ability to select, adapt, and critically evaluate digital resources; to design technology-enhanced learning environments that promote active inquiry and collaborative knowledge construction; to address the safety, privacy, and well-being of young learners in digital contexts; and to cultivate foundational digital literacy among primary-age children [2].

Despite the growing international consensus on the importance of teacher digital competence, and the proliferation of policy frameworks and professional development initiatives designed to promote it, primary school teachers in many educational systems — including those of Central Asia — continue to face significant challenges in developing and applying effective digital competencies in their everyday practice. These challenges reflect a complex interplay of structural factors — including inadequate infrastructure, limited access to high-quality professional development, and insufficient institutional support — and conceptual

factors, including the absence of a shared, contextually grounded understanding of what digital competence means for primary school teaching specifically [3].

The present article is motivated by the recognition that progress in addressing these challenges requires, as a prerequisite, a rigorous and contextually sensitive theoretical foundation. Without a clear, empirically grounded understanding of the structure, dimensions, and developmental pathways of digital competence in primary teaching, practical interventions — however well-intentioned — risk being misdirected, fragmented, or disconnected from the actual demands of primary classroom practice. The article therefore pursues two complementary objectives: first, to synthesize and critically analyze the principal theoretical frameworks and conceptual models of teacher digital competence that have been developed at the international level; and second, to examine the specific practical approaches through which these frameworks can be meaningfully translated into primary school teaching contexts [4].

The article is structured as follows. The materials and methods section describes the methodology of the literature review and analytical approach. The results and discussion section presents a systematic analysis of major international frameworks, a structural model of digital competence for primary school teachers, a comparative examination of practical implementation approaches, and a critical discussion of the theory-practice gap and its determinants. The conclusion synthesizes the principal findings and advances recommendations for professional development policy and institutional practice [5].

Materials and Methods. The present article is based on a systematic theoretical review of the scholarly literature, international policy documents, and comparative educational research pertaining to digital competence in teacher education and primary school pedagogy. The review was conducted in accordance with the principles of systematic literature analysis, prioritizing peer-reviewed publications from internationally indexed journals (Scopus, Web of Science), authoritative policy documents from international educational organizations, and foundational theoretical texts in the fields of educational technology, teacher professional development, and digital literacy education [6].

The literature search was conducted using the following principal databases and sources: Scopus, Web of Science, ERIC (Education Resources Information Center), Google Scholar, and the official document repositories of UNESCO, the European Commission, and the OECD. Search terms employed included: 'digital competence teacher', 'primary school digital literacy', 'ICT integration elementary education', 'TPACK primary school', 'DigComp teacher', 'teacher professional development technology', 'digital pedagogy primary education', and combinations thereof. The search was limited to publications from 2010 to 2024 to ensure

relevance to contemporary digital educational contexts, with the exception of seminal foundational works published prior to this period that retain direct theoretical significance [7].

The analytical approach employed in this review is that of conceptual synthesis, through which findings from multiple theoretical traditions and empirical research programmes are integrated into a coherent analytical framework. The review proceeded through three principal stages: (1) identification and descriptive mapping of major international frameworks for teacher digital competence; (2) structural analysis of the dimensions and components of digital competence as they apply to primary school teaching; and (3) critical examination of the relationship between theoretical frameworks and practical implementation, with particular attention to the specific conditions and demands of primary education. Throughout the review, attention was directed to identifying convergences and divergences between frameworks, noting areas of theoretical consensus and ongoing debate, and foregrounding the particular characteristics of primary teaching that distinguish its digital competence demands from those of other educational levels [8].

The theoretical analysis is complemented by a comparative examination of practical approaches to digital competence development in primary school teaching, drawing on documented case studies, programme evaluations, and comparative policy analyses from diverse national educational contexts, including European, East Asian, and Central Asian systems. This comparative dimension is intended to provide a contextually sensitive foundation for the practical recommendations advanced in the article's conclusion [9].

Result And Discussion. The systematic review of the literature revealed a rich and increasingly consolidated body of theoretical and empirical knowledge regarding digital competence in teaching, while also identifying significant gaps and tensions — particularly with respect to the application of general teacher digital competence frameworks to the specific context of primary school practice. The findings are organized across four principal thematic areas, each addressing a distinct dimension of the review's analytical objectives.

1. Conceptual Evolution of Digital Competence in Teaching

The concept of digital competence in education has undergone substantial evolution since the early formulations of ICT literacy in the 1990s. Initial conceptions of teacher digital competence were predominantly instrumental, equating competence with the ability to operate digital hardware and software. This narrow, tool-centric understanding was progressively displaced by broader, more pedagogically oriented frameworks that recognized the importance of integrating technological capability with pedagogical knowledge and content expertise [10].

A landmark development in this conceptual evolution was Mishra and Koehler's articulation of the Technological Pedagogical Content Knowledge (TPACK) model in 2006. Building on Shulman's foundational distinction between content knowledge and pedagogical content knowledge, TPACK introduced technological knowledge as a third primary knowledge domain and conceptualized teacher digital competence as residing in the intersection of all three domains — specifically in teachers' capacity to design and implement instructional experiences that productively integrate technological, pedagogical, and content considerations. For primary school teachers, whose instructional remit encompasses foundational literacy, numeracy, and cross-curricular learning, the TPACK framework highlights the importance of selecting and deploying digital tools that simultaneously serve content-specific learning objectives and developmentally appropriate pedagogical approaches [11].

Parallel to the development of TPACK, the European Commission's DigComp framework — first published in 2013 and subsequently revised through versions 2.0, 2.1, and most recently 2.2 — has provided the most widely adopted comprehensive model of digital competence for citizens, with significant implications for teacher education. DigComp 2.2 organizes digital competence across five principal areas: information and data literacy; communication and collaboration; digital content creation; safety; and problem-solving. The framework's explicit attention to safety and well-being — encompassing the protection of personal data, the management of digital health risks, and the cultivation of responsible digital citizenship — is particularly relevant to primary school teaching, where teachers bear heightened responsibility for the safety of young, developmentally vulnerable learners in digital environments [12].

**Table 1. Principal International Frameworks for Teacher Digital Competence:
Comparative Overview**

Framework	Originating Body	Year	Key Dimensions	Primary School Relevance
TPACK	Mishra & Koehler	2006	Technology, Pedagogy, Content Knowledge	High — integrates subject and age-appropriate tech use
DigComp 2.2	European Commission	2022	Information literacy, Communication, Content creation, Safety, Problem-solving	High — safety dimension essential for young learners

Framework	Originating Body	Year	Key Dimensions	Primary School Relevance
UNESCO ICT-CFT	UNESCO	2018	Technology literacy, Knowledge deepening, Knowledge creation	Medium-High — adaptable to primary level
DigCompEdu	European Commission	2017	Professional engagement, Digital resources, Teaching, Assessment, Learner empowerment	Very High — teacher-specific framework
P21 Framework	Partnership for 21st C.	2019	Learning & Innovation, Digital literacy, Life & Career skills	High — foundational skills for primary age

As shown in Table 1, while each framework approaches teacher digital competence from a distinct theoretical perspective and with particular emphases, several convergent themes emerge across the corpus: the importance of integrating technological capability with pedagogical expertise; the centrality of information and data literacy as a foundational dimension of digital competence; the growing recognition of safety, ethics, and responsible digital citizenship as core professional responsibilities; and the aspiration toward higher-order applications of technology that support creative knowledge construction rather than passive content consumption.

2. Structural Dimensions of Digital Competence for Primary School Teachers

Synthesizing insights from the frameworks reviewed above and from empirical research on primary school teachers' digital practices, it is possible to identify six structural dimensions of digital competence that are specifically relevant to primary school teaching. Table 2 presents these dimensions along with their principal behavioral indicators and associated practical demands in the primary classroom context.

Table 2. Structural Dimensions of Digital Competence for Primary School Teachers

Dimension	Core Definition	Primary Classroom Manifestation
Operational digital proficiency	Basic command of digital devices, platforms, and educational software	Using interactive whiteboards, tablets, and educational apps fluently in lessons
Pedagogical technology integration	Ability to select and deploy digital tools aligned with learning objectives and child development	Designing literacy activities using digital storytelling tools appropriate for ages 6–10
Digital content creation & curation	Creating, adapting, and evaluating digital learning resources	Producing and selecting age-appropriate video, audio, and interactive content
Digital safety & ethical practice	Protecting learner privacy, promoting responsible digital behaviour, managing screen time	Teaching safe internet use; enforcing age-appropriate content guidelines
Data-informed teaching	Using digital assessment data to monitor progress and adapt instruction	Analysing learning platform analytics to identify pupils needing additional support
Digital citizenship education	Cultivating pupils' foundational digital literacy and responsible technology use	Integrating structured digital citizenship lessons into the primary curriculum

The six-dimensional model presented in Table 2 reflects both the breadth of digital competence demands placed on contemporary primary school teachers and the specific developmental, ethical, and pedagogical considerations that distinguish primary digital teaching from its counterparts at secondary and tertiary levels. Of particular significance is the dimension of digital safety and ethical practice, which assumes a qualitatively different

character in the primary context given the age and developmental vulnerability of the learners concerned. Primary school teachers are not only required to maintain safe digital environments but to actively teach the dispositions and skills of responsible digital citizenship to children who may be encountering formal digital learning environments for the first time [13].

Equally distinctive is the dimension of digital citizenship education, which assigns primary school teachers the role of foundational digital literacy educators — a responsibility with far-reaching implications for children's capacity to navigate digital environments safely and critically throughout their lives. Research consistently demonstrates that the quality of foundational digital literacy education received in the primary years is one of the most powerful predictors of digital competence development across the subsequent schooling trajectory, underscoring the particular strategic importance of primary teachers' competence in this domain [14].

3. Practical Approaches to Digital Competence Development in Primary Teaching

The translation of digital competence frameworks into effective primary school teaching practice requires purposeful, sustained, and contextually sensitive professional development support. The comparative analysis of international practice identified several evidence-based practical approaches that have demonstrated effectiveness in developing digital competence among primary school teachers:

1. Job-embedded professional development — research consistently identifies professional development approaches that are situated within teachers' own classrooms and integrated into their regular instructional practice as more effective than off-site, decontextualized training programmes. For primary school teachers, this implies digital competence development activities that directly address the specific digital tools, platforms, and pedagogical challenges encountered in primary classrooms, rather than generic ICT training that teachers must independently translate to their teaching context.

2. Collaborative professional learning communities — the formation of school-based professional learning communities in which primary teachers collaboratively explore, trial, and reflect on digital instructional approaches has been identified across multiple national contexts as a particularly effective vehicle for sustained digital competence development. Such communities provide primary teachers with peer support, shared problem-solving resources, and collective accountability for professional growth.

3. Mentoring and coaching by digital pedagogy specialists — the provision of sustained, individualized coaching from digital pedagogy specialists who possess both technological expertise and primary pedagogical knowledge has demonstrated significant

effectiveness in supporting the development of TPACK-level integration competencies. Coaching models that involve direct classroom observation, collaborative lesson planning, and reflective debriefing are especially promising.

4. Micro-credentialing and competency-based certification — the introduction of granular, competency-based digital certification pathways that allow primary teachers to demonstrate and receive formal recognition for specific dimensions of digital competence has been shown to enhance motivation for professional development and to provide clearer developmental roadmaps than traditional, undifferentiated ICT training programmes.

5. Design-based professional learning — approaches in which primary teachers engage as active designers of digital learning experiences — rather than as passive consumers of pre-packaged digital resources — have been associated with deeper and more transferable digital competence development, as they require the simultaneous application of technological, pedagogical, and content knowledge in authentic instructional design tasks.

4. The Theory-Practice Gap: Barriers and Bridging Strategies

Despite the sophistication of international digital competence frameworks and the growing body of evidence regarding effective professional development approaches, a persistent and well-documented gap between theoretical aspirations and actual classroom practice characterizes the digitalization of primary education in many contexts. The comparative analysis identified several categories of barrier that contribute to this gap:

- Infrastructural barriers — inadequate access to reliable digital devices, high-quality internet connectivity, and appropriate educational software platforms in primary schools, particularly in rural and resource-constrained contexts, constrains teachers' ability to implement digital instructional approaches regardless of their competence level.

- Conceptual barriers — a widespread tendency among primary school teachers to conceptualize digital competence primarily in operational rather than pedagogical terms, leading to technology use patterns that prioritize tool operation over instructional purpose and that fail to leverage the transformative pedagogical potential of digital environments.

- Time and workload barriers — the chronic time pressures experienced by primary school teachers — whose professional responsibilities encompass a broad and demanding curriculum alongside significant pastoral and administrative duties — limit the time available for professional development engagement and for the careful instructional planning required for effective technology integration.

- Confidence and anxiety barriers — digital anxiety and low self-efficacy beliefs regarding technology use remain significant impediments to digital competence development

among a substantial proportion of primary school teachers, particularly those who completed their initial teacher education before the digital transformation of schooling became a prominent professional concern.

- Assessment alignment barriers — the persistence of assessment regimes that do not reward or evaluate digitally enhanced learning outcomes reduces teachers' perceived incentive for investing in digital competence development, as they perceive no direct connection between digital instructional innovation and the performance indicators by which they and their students are evaluated.

Bridging the theory-practice gap requires coordinated action at institutional, systemic, and policy levels. At the institutional level, school leaders play a critical role in creating the enabling conditions for digital competence development — including providing adequate planning time, facilitating peer learning structures, modeling digital leadership, and ensuring equitable access to digital resources. At the systemic level, initial teacher education programmes bear responsibility for ensuring that all graduating primary teachers possess foundational digital competence and, critically, the pedagogical knowledge and confidence required to continue developing this competence throughout their careers. At the policy level, the alignment of assessment frameworks, curriculum standards, and professional development accountability mechanisms with digital competence goals is essential for creating systemic incentives for primary teachers' sustained digital professional growth [15].

Conclusion. This article has presented a comprehensive theoretical and analytical review of digital competence as it applies to the professional practice of primary school teachers, synthesizing insights from major international frameworks, structural competence models, comparative practice analysis, and critical examination of the theory-practice gap. Several principal conclusions emerge from this review.

First, digital competence in primary school teaching is a genuinely multidimensional professional construct that extends far beyond operational technology proficiency to encompass pedagogical technology integration, digital content creation and curation, digital safety and ethical practice, data-informed teaching, and digital citizenship education. Each of these dimensions makes distinctive demands on primary school teachers that reflect the specific developmental characteristics, curricular responsibilities, and ethical obligations associated with teaching children in the foundational years of schooling. Generic, undifferentiated approaches to teacher digital competence development that fail to address these primary-specific dimensions are likely to produce limited practical impact.

Second, the TPACK model and the DigCompEdu framework emerge from this review as the most directly applicable theoretical foundations for conceptualizing and developing digital competence in primary school teaching. Their respective emphases on the integration of technological, pedagogical, and content knowledge, and on the full range of professional competencies required for effective digital teaching practice, align most closely with the complex, integrative demands of primary school pedagogy.

Third, the most effective practical approaches to primary teacher digital competence development are those that are job-embedded, collaborative, sustained, and directly connected to the specific instructional challenges and opportunities of the primary classroom. One-off, decontextualized training events — however well-designed in the abstract — consistently demonstrate limited impact on teachers' actual classroom practice, while sustained coaching, peer learning communities, and design-based professional learning yield more durable and transferable competence gains.

Fourth, bridging the persistent theory-practice gap in primary school digitalization requires coordinated action across institutional, systemic, and policy levels, addressing infrastructural, conceptual, temporal, affective, and assessment-alignment barriers through a coherent and sustained strategic approach. Individual teacher motivation and effort, while essential, are insufficient in the absence of enabling institutional conditions and supportive policy frameworks.

The recommendations advanced by this review for educational policy-makers, primary school administrators, teacher education institutions, and professional development programme designers are as follows: adopt the six-dimensional structural model of primary teacher digital competence as a foundation for professional development planning and evaluation; prioritize job-embedded, collaborative, and coaching-based professional development modalities over decontextualized training events; align initial teacher education curricula for primary pedagogy students with current digital competence frameworks, with explicit attention to the primary-specific dimensions identified in this review; invest in the development of digital pedagogy specialist roles within primary schools to provide sustained coaching and mentoring support; and ensure that curriculum standards, assessment frameworks, and teacher evaluation mechanisms are aligned with digital competence expectations to create coherent systemic incentives for primary teachers' continued digital professional growth.

In conclusion, the digital competence of primary school teachers represents one of the most strategically consequential dimensions of contemporary educational investment. The

quality of the digital learning experiences that primary teachers are equipped to design and facilitate will shape the digital literacy trajectories of entire cohorts of learners — with implications that extend from individual academic outcomes to the collective capacity of societies to navigate an increasingly digitalized world. Realizing this potential requires not merely the provision of technology resources but the sustained, theoretically grounded, and contextually sensitive development of the professional competencies through which those resources can be transformed into meaningful educational experiences.

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