

INTEGRATIVE APPLICATION OF DIGCOMPEDU, TPACK, SECTIONS, AND PICRAT MODELS IN DEVELOPING EDUCATORS' INFORMATIONAL-DIGITAL COMPETENCE

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Abstract

The rapid advancement of digital technologies has fundamentally transformed the professional roles and responsibilities of educators, making the development of informational-digital competence a strategic priority in teacher education. Contemporary teachers are expected not only to possess technological skills but also to integrate digital technologies into pedagogical practice effectively, select appropriate digital tools, and evaluate their impact on teaching and learning processes. Despite the availability of several internationally recognized frameworks for digital competence development, existing studies predominantly examine these frameworks independently, while limited attention has been paid to their systematic integration.

This study aims to develop and theoretically substantiate an integrative conceptual framework based on the sequential application of the DigCompEdu, TPACK, SECTIONS, and PICRAT models for developing educators' informational-digital competence. The research adopts a qualitative conceptual design employing systematic literature review, comparative analysis, and conceptual modelling methods. Scientific publications indexed in Scopus, Web of Science, ERIC, and Google Scholar, together with official documents published by the European Commission, UNESCO, and OECD, were analysed to identify the functional characteristics and complementary relationships among the four frameworks.

The analysis demonstrates that DigCompEdu provides a comprehensive framework for assessing teachers' digital competence, TPACK supports the pedagogical integration of technology with content knowledge, SECTIONS facilitates evidence-based technology selection, and PICRAT evaluates the educational impact of technology integration on learner engagement and transformation. Based on these complementary functions, an integrative framework structured as **DigCompEdu → TPACK → SECTIONS → PICRAT** is proposed. The practical applicability of the model is illustrated through an early childhood education scenario demonstrating how the four frameworks can operate as interconnected stages of instructional design.

The proposed model contributes to the existing literature by integrating internationally recognized frameworks into a coherent methodological sequence that supports teacher preparation and continuous professional development. The findings provide theoretical guidance for curriculum designers, teacher educators, and educational policymakers seeking to strengthen educators' informational-digital competence within contemporary digital learning environments.

Keywords: Informational-digital competence; teacher education; digital competence; DigCompEdu; TPACK; SECTIONS; PICRAT; technology integration; professional development; early childhood education.

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Introduction

The accelerated digital transformation of education has substantially redefined the professional role of teachers worldwide. Rather than serving solely as transmitters of knowledge, contemporary educators are expected to design technology-enhanced learning environments, select digital resources appropriate to pedagogical objectives, facilitate learner-centred instruction, and critically evaluate the educational impact of digital technologies (Redecker, 2017; UNESCO, 2018). Consequently, developing educators' informational-digital competence has become one of the principal priorities of international educational policy and teacher professional development.

International organizations increasingly recognize digital competence as a multidimensional construct encompassing technological knowledge, pedagogical decision-making, ethical responsibility, digital communication, assessment literacy, and continuous professional learning. The **European Framework for the Digital Competence of Educators (DigCompEdu)** conceptualizes teachers' professional digital competence through six interconnected competence areas and six proficiency levels ranging from A1 (Newcomer) to C2 (Pioneer), providing a comprehensive framework for self-assessment and professional growth (Redecker, 2017; Caena & Redecker, 2019). Similarly, the **UNESCO ICT Competency Framework for Teachers** emphasizes that digital competence should be integrated with curriculum development, pedagogy, assessment, educational leadership, and lifelong professional learning rather than being limited to technological proficiency alone (UNESCO, 2018).

Recent empirical studies indicate that teachers' successful integration of digital technologies depends not only on technological skills but also on pedagogical beliefs, professional self-efficacy, reflective practice, and institutional support (Gudmundsdottir & Hatlevik, 2018; Scherer et al., 2018; Tondeur et al., 2017). Falloon (2020) further argues that digital competence frameworks should be viewed as comprehensive models of professional practice rather than collections of isolated technical skills. Likewise, Ertmer and Ottenbreit-Leftwich (2010) emphasize that teachers' beliefs and confidence strongly influence the quality of technology integration in classroom practice.

Several internationally recognized theoretical frameworks have been developed to support different dimensions of teachers' digital competence. The **TPACK framework** explains how technological knowledge, pedagogical knowledge, and content knowledge interact to support effective technology integration (Mishra & Koehler, 2006; Koehler et al., 2013). Numerous studies have confirmed its value for teacher preparation and instructional design (Chai et al., 2013; Voogt et al., 2013; Baran et al., 2011). However, TPACK primarily focuses on the integration of knowledge domains and provides limited guidance for selecting appropriate digital technologies within specific educational contexts.

To address technology selection, Bates (2015) proposed the **SECTIONS model**, which evaluates digital technologies according to learner characteristics, ease of use, costs, teaching functions, interaction, organizational issues, networking opportunities, and security considerations. This framework supports evidence-based pedagogical decision-making by helping teachers select technologies that align with instructional objectives and contextual constraints (Bates, 2015; Laurillard, 2012).

Another important dimension concerns evaluating the educational impact of technology integration. The **PICRAT framework** assesses technology use through two complementary perspectives: the level of student engagement (Passive, Interactive, Creative) and the extent to which technology transforms learning (Replacement, Amplification, Transformation). Compared with the widely used SAMR model, PICRAT places greater emphasis on learners' cognitive engagement and creative participation, making it particularly valuable for evaluating instructional quality in digital learning environments (Kimmons et al., 2020; Kimmons & Hall, 2018; Graham et al., 2019).

Although these frameworks are widely recognized in teacher education research, they are generally examined independently. Existing studies mainly investigate DigCompEdu as a competence framework, TPACK as a pedagogical knowledge model, SECTIONS as a technology selection framework, and PICRAT as an evaluation model (Caena & Redecker, 2019; Falloon, 2020; Cabero-Almenara et al., 2022). Relatively limited attention has been devoted to exploring how these frameworks can operate sequentially as complementary components of a unified methodological system for developing educators' informational-digital competence. This conceptual gap is particularly evident in early childhood teacher education, where research integrating these frameworks remains scarce (Underwood & Farrington-Flint, 2015).

Accordingly, the present study addresses the following research question:

How can DigCompEdu, TPACK, SECTIONS, and PICRAT be integrated into a coherent conceptual framework for developing educators' informational-digital competence?

The aim of this study is to develop and theoretically substantiate an integrative conceptual model that combines these internationally recognized frameworks into a coherent sequence (**DigCompEdu** → **TPACK** → **SECTIONS** → **PICRAT**) for supporting teacher preparation and continuous professional development. By synthesizing existing theoretical perspectives through systematic literature review, comparative analysis, and conceptual modelling, the study seeks to contribute a comprehensive methodological framework that strengthens both the theoretical foundations and practical implementation of educators' informational-digital competence development.

Methods

Research Design

This study employed a **qualitative conceptual research design** based on a systematic literature review, comparative analysis, and conceptual modelling. The purpose of the study was to examine the theoretical foundations, functional characteristics, and complementary roles of four internationally recognized frameworks—DigCompEdu, TPACK, SECTIONS, and PICRAT—and to develop an integrated conceptual model for enhancing educators' informational-digital competence.

Unlike empirical studies that collect primary data from participants, conceptual research aims to synthesize existing scientific knowledge, identify theoretical relationships, and propose new methodological frameworks grounded in established evidence. Following this approach, the study systematically reviewed international scholarly publications and policy documents to identify the strengths, limitations, and interrelationships of the selected frameworks (Mishra & Koehler, 2006; Redecker, 2017; Bates, 2015; Kimmons et al., 2020; Falloon, 2020).

The research design combined three complementary methodological approaches:

- **systematic literature review** to identify relevant international research on teachers' digital competence;
- **comparative analysis** to examine similarities and differences among the selected frameworks;
- **conceptual modelling** to develop an integrated methodological sequence that combines the complementary functions of DigCompEdu, TPACK, SECTIONS, and PICRAT.

This multi-stage design enabled the construction of a theoretically grounded framework that connects digital competence assessment, pedagogical planning, technology selection, and evaluation of educational impact within a coherent professional development model.

Participants

As a conceptual study, this research did not involve human participants, experimental groups, or survey respondents. Instead, the units of analysis consisted of peer-reviewed scientific publications, international policy documents, and theoretical frameworks addressing teachers' informational-digital competence and technology integration in education.

The reviewed literature included publications indexed in **Scopus**, **Web of Science**, **ERIC**, and **Google Scholar**, together with official reports and competency frameworks published by the **European Commission**, **UNESCO**, and **OECD**. Priority was given to highly cited and internationally recognized studies that have substantially contributed to the development of teacher digital competence frameworks and educational technology integration (Redecker, 2017; UNESCO, 2018; OECD, 2023).

The inclusion criteria comprised:

- peer-reviewed journal articles and scholarly books;
- internationally recognized digital competence frameworks;
- studies focusing on teacher education and professional digital competence;
- publications examining DigCompEdu, TPACK, SECTIONS, or PICRAT;
- English-language publications with substantial theoretical or methodological contributions.

Studies unrelated to teacher education, duplicate publications, opinion papers without theoretical justification, and sources lacking academic credibility were excluded from the analysis.

Data Collection

Data were collected through a systematic search of international academic databases and official institutional repositories. The literature search focused on publications related to teacher digital competence, technology integration, instructional design, and educational technology evaluation.

The search strategy incorporated combinations of the following keywords:

"digital competence", "teacher digital competence", "DigCompEdu", "TPACK", "SECTIONS", "PICRAT", "technology integration", "teacher education", "professional digital competence", "educational technology", "instructional design", and "early childhood education".

The literature selection process consisted of four sequential stages:

1. identification of potentially relevant publications through database searches;
2. screening of titles and abstracts according to predefined inclusion criteria;
3. full-text assessment of eligible publications;
4. final selection of studies and policy documents for comparative analysis and conceptual synthesis.

Particular attention was given to foundational studies introducing the selected frameworks, together with more recent publications examining their application in teacher education and professional development (Mishra & Koehler, 2006; Koehler et al., 2013; Redecker, 2017; Caena & Redecker, 2019; Cabero-Almenara et al., 2022; Falloon, 2020).

Data Analysis

The collected literature was analysed using **thematic analysis**, **comparative analysis**, and **conceptual synthesis**.

Initially, each framework was examined independently to identify its theoretical foundations, objectives, structural components, strengths, and limitations. Subsequently, the frameworks were compared across four analytical dimensions:

- digital competence assessment;
- pedagogical integration of technology;
- technology selection and decision-making;
- evaluation of technology-enhanced learning.

The findings of the comparative analysis were synthesised to identify complementary relationships among the four frameworks. Based on these relationships, an integrated conceptual model was developed following the sequential progression:

DigCompEdu → TPACK → SECTIONS → PICRAT

This sequence reflects the logical progression from identifying teachers' digital competence needs, through pedagogical planning and technology selection, to evaluating the educational impact of technology integration.

To enhance the practical relevance of the proposed model, its application was illustrated through an early childhood education instructional scenario presented in **Table 2**, while the functional comparison of the four frameworks is summarised in **Table 1**.

Ethical Considerations

This study was conducted in accordance with internationally accepted principles of academic integrity and research ethics. As the research employed a conceptual design based exclusively on publicly available scientific publications and official policy documents, it did not involve human participants, personal data, biological materials, or experimental interventions.

Accordingly, ethical approval from an Institutional Review Board was not required. Likewise, informed consent was not applicable because no primary data were collected.

Throughout the study, all original sources were appropriately acknowledged through accurate citation and referencing in accordance with APA (7th edition) standards. The research adhered to internationally recognized

principles of transparency, intellectual honesty, respect for authorship, and responsible scholarly communication, consistent with the recommendations of the **Committee on Publication Ethics (COPE)** and UNESCO's principles for responsible educational research (UNESCO, 2018; COPE, 2023).

Results

The findings indicate that the integration of internationally recognized frameworks provides a comprehensive methodological foundation for developing educators' informational-digital competence. The systematic analysis of the reviewed literature demonstrates that **DigCompEdu**, **TPACK**, **SECTIONS**, and **PICRAT** represent complementary rather than competing frameworks. Each framework addresses a distinct dimension of teachers' professional digital competence, while their integration creates a coherent model for technology-enhanced teaching and continuous professional development (Redecker, 2017; Mishra & Koehler, 2006; Bates, 2015; Kimmons et al., 2020).

The comparative analysis revealed that the four frameworks differ in their primary objectives but complement one another throughout the instructional process. As presented in **Table 1**, DigCompEdu focuses on assessing educators' digital competence, TPACK supports pedagogical integration of technology, SECTIONS guides evidence-based technology selection, and PICRAT evaluates the educational impact of digital technologies. These findings demonstrate that no individual framework independently addresses all dimensions of teachers' informational-digital competence.

Table 1. Comparative Functional Roles of International Frameworks for Developing Educators' Informational-Digital Competence

Framework	Role in Technology Classification	Pedagogical and Content Delivery	Teacher Self-Assessment	Student-Oriented Assessment
DigCompEdu	Identifies and protects digital assets.	Connects digital literacy with learning objectives.	Primary function: Diagnoses the teacher's individual growth dynamics (A1-C2).	Evaluates students' digital safety and ethical habits.
TPACK	Synthesizes appropriate software with subject matter and methodology.	Primary function: Answers "What", "How", and "With what tool" questions for the teacher.	Evaluates the artificial vs. organic application of technology within the lesson.	Measures how the student master both the subject and the media in the textbook.
SECTIONS	Primary function: Serves as a filter to choose the safest,	Validates the suitability of the selected tool for students' age and	Evaluates the teacher's time, financial, and administrative	Measures the response of the tool's built-in interactive

	cheapest, and most interactive tool.	inclusivity parameters.	resource decisions.	feedback to diverse needs.
PICRAT	Checks for maximum utilization of the technical capabilities of the tool.	Confirms whether pedagogy has moved beyond the lecture model.	Measures whether the teacher designed the lesson as a simple paper replacement or as transformation.	Primary function: Maps the student's transition from passive listening to active creativity.

The comparative evidence further indicates that the strengths of one framework compensate for the limitations of another. DigCompEdu provides a comprehensive competence assessment system but offers limited guidance regarding technology selection. TPACK explains how technology, pedagogy, and content knowledge interact during instructional design; however, it does not provide explicit criteria for evaluating digital tools. SECTIONS addresses this limitation by supporting informed technology selection, while PICRAT complements the previous frameworks by evaluating the extent to which digital technologies transform learning processes and promote active learner engagement (Bates, 2015; Kimmons et al., 2020).

Based on these complementary characteristics, the reviewed literature supports the development of an integrated methodological sequence consisting of **DigCompEdu → TPACK → SECTIONS → PICRAT**. This sequence establishes a logical progression beginning with competence assessment, followed by pedagogically informed instructional planning, technology selection, and evaluation of educational impact.

The practical applicability of the proposed framework is demonstrated through the instructional scenario presented in **Table 2**. The example illustrates how the integrated framework can be operationalized in early childhood education by systematically connecting competence assessment, pedagogical planning, technology selection, and learning evaluation within a single instructional process.

Table 2. Practical Application of the Integrated DigCompEdu–TPACK–SECTIONS–PICRAT Framework in an Early Childhood Education Lesson

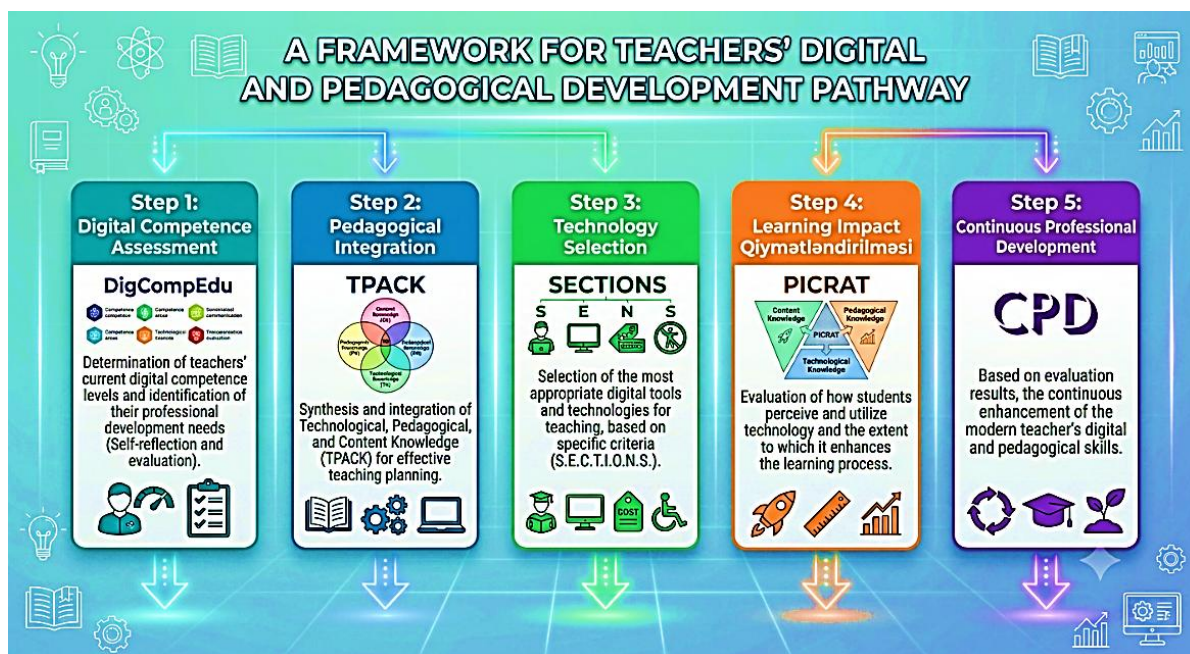
Stages	Applied Tools and Strategy	Pedagogical Scenario and Form of Activity	Level according to PICRAT
Step 1: DigCompEdu	Google Forms Self-Diagnosis	The teacher researcher identifies the need for skills in designing digital inclusive resources.	Introduction / Planning
Step 2: TPACK	Wordwall, LearningApps	Science-based subject (change of seasons) is integrated with game-	Curriculum Synthesis

	interactive whiteboard apps	based methodology in a digital environment.	
Step 3: SECTIONS	Safety and Age-group Audit (No student registration required)	The Wordwall platform is filtered for age appropriateness (drag-and-drop), zero cost, and safety.	Contextual Filter
Step 4: PICRAT	Interactive assessment module created by the author	Scenario 1: The student simply looks at the pictures on the screen. Scenario 2: The student drags winter clothes onto the character with a touch. Scenario 3: Children draw seasonal pictures themselves; the teacher immediately uploads them to the template, and children become the creators of their own games.	1. Passive-Replacement (PR) 2. Interactive-Amplification (IA) 3. Creative-Transformation (CT)[cite: 3]

The instructional scenario confirms that the integrated framework is applicable to authentic educational practice and supports teachers' professional decision-making throughout lesson preparation, implementation, and evaluation. Rather than applying digital technologies independently, educators are guided through a structured sequence that promotes pedagogically meaningful and evidence-informed technology integration.

Overall, the results demonstrate that the proposed integrated framework extends existing approaches by combining competence assessment, pedagogical knowledge integration, technology selection, and instructional evaluation into a unified methodological model. Consequently, the framework provides both theoretical and practical guidance for teacher education institutions, professional development programmes, and educational policymakers seeking to strengthen educators' informational-digital competence.

Figure 1. Proposed Integrated Framework for Developing Educators' Informational-Digital Competence



Literature Review

The development of educators' informational-digital competence has become one of the central priorities of contemporary educational research and policy. The rapid digital transformation of education has significantly expanded teachers' professional responsibilities, requiring them not only to operate digital technologies but also to integrate them effectively into teaching, assessment, communication, collaboration, and professional development (UNESCO, 2018; OECD, 2023). Consequently, numerous international organizations and researchers have proposed conceptual frameworks to guide teachers' digital competence development.

Among these frameworks, the **European Framework for the Digital Competence of Educators (DigCompEdu)** has become one of the most influential international reference models. Redecker (2017) conceptualizes teachers' digital competence as a multidimensional construct comprising six competence areas: professional engagement, digital resources, teaching and learning, assessment, empowering learners, and facilitating learners' digital competence. Unlike earlier technology-oriented approaches, DigCompEdu emphasizes that teachers' digital competence extends beyond technical proficiency and includes pedagogical, ethical, collaborative, and reflective dimensions. Subsequent studies have confirmed its effectiveness as a framework for self-assessment, professional development planning, and institutional evaluation (Caena & Redecker, 2019; Cabero-Almenara et al., 2022).

While DigCompEdu defines **what competencies teachers should possess**, it provides limited methodological guidance regarding **how these competencies should be translated into instructional practice**. This limitation has directed considerable attention toward the **Technological Pedagogical Content Knowledge (TPACK)** framework developed by Mishra and Koehler (2006). TPACK explains that effective technology integration emerges through the interaction of technological knowledge, pedagogical knowledge, and content knowledge rather than through technological skills alone. Later studies demonstrated that teachers possessing balanced TPACK competencies are more likely to design learner-centred digital learning environments and achieve meaningful technology integration (Koehler et al., 2013; Chai et al., 2013; Voogt et al., 2013).

Despite its widespread application, TPACK primarily focuses on instructional design and professional knowledge integration without providing explicit criteria for selecting appropriate digital technologies in different educational contexts. Bates (2015) addressed this limitation through the **SECTIONS model**, which proposes a systematic framework for evaluating educational technologies according to learner characteristics, ease of use, costs, teaching functions, interaction, organizational issues, networking opportunities, and security considerations. Unlike TPACK, which emphasizes teachers' knowledge structures, SECTIONS supports practical pedagogical decision-

making by helping educators select technologies that best correspond to instructional objectives and contextual conditions. Laurillard (2012) similarly argues that technology selection should always be aligned with pedagogical purposes rather than driven by technological novelty.

Although DigCompEdu, TPACK, and SECTIONS collectively support competence development, instructional planning, and technology selection, they provide relatively limited guidance regarding the **educational impact** of technology integration. This aspect is addressed by the **PICRAT framework**, developed by Kimmons and colleagues (Kimmons & Hall, 2018; Kimmons et al., 2020). PICRAT evaluates digital learning from two complementary perspectives: the degree of student engagement (Passive, Interactive, Creative) and the extent to which technology transforms instruction (Replacement, Amplification, Transformation). Compared with the widely adopted SAMR model, PICRAT places stronger emphasis on learner participation and cognitive engagement, thereby providing a more comprehensive perspective on instructional quality (Graham et al., 2019).

Recent research increasingly suggests that no single framework can independently address all dimensions of educators' informational-digital competence. Falloon (2020) argues that digital competence should be understood as an integrated professional capability encompassing technological knowledge, pedagogical reasoning, ethical responsibility, reflective practice, and continuous professional learning. Similarly, Cabero-Almenara et al. (2022) emphasize that digital competence frameworks should be implemented through complementary rather than isolated approaches, allowing teachers to connect competence development with instructional practice and educational evaluation.

International policy documents also support integrated approaches to teachers' professional digital development. The UNESCO ICT Competency Framework for Teachers (UNESCO, 2018) highlights that digital competence should be embedded within curriculum design, pedagogy, assessment, organizational development, and lifelong learning. Likewise, the OECD (2023) emphasizes that effective digital transformation requires coherent systems that combine teacher competence, pedagogical innovation, and evidence-based educational decision-making.

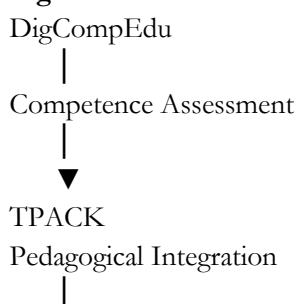
The comparative analysis of the reviewed literature demonstrates that each framework contributes a distinct but complementary component to teachers' informational-digital competence development. DigCompEdu provides the competence assessment foundation; TPACK supports pedagogical integration; SECTIONS guides informed technology selection; and PICRAT evaluates instructional effectiveness and learner engagement. These complementary characteristics are summarized in **Table 1**, which illustrates the functional distribution of the four frameworks.

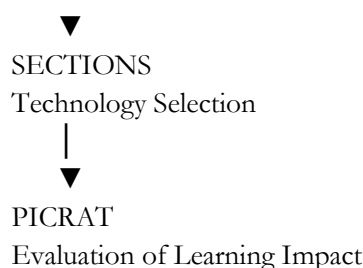
However, despite the substantial body of international research on each framework individually, relatively limited attention has been devoted to developing an integrated methodological model that combines their complementary functions into a coherent professional development sequence. Existing studies generally analyse these frameworks separately or compare only two of them, leaving an important conceptual gap concerning their systematic integration. Addressing this gap constitutes the principal theoretical contribution of the present study. By proposing the sequential model **DigCompEdu → TPACK → SECTIONS → PICRAT**, the study extends existing literature and provides a unified methodological framework for developing educators' informational-digital competence across assessment, instructional planning, technology selection, and evaluation.

Table 1

Comparative Characteristics of the Four International Frameworks

Figure 2. Evolution of International Digital Competence Frameworks



**Table 3. Comparative Analysis of International Frameworks**

Framework	Primary Focus	Main Strength	Limitation
DigCompEdu	Competence assessment	Comprehensive competence framework	Limited instructional guidance
TPACK	Pedagogical integration	Knowledge integration	No technology selection criteria
SECTIONS	Technology selection	Context-based decision making	Does not evaluate learning impact
PICRAT	Learning evaluation	Measures instructional transformation	Does not assess teacher competence

Discussion

The present study sought to develop an integrated conceptual framework for educators' informational-digital competence by combining the complementary functions of the DigCompEdu, TPACK, SECTIONS, and PICRAT frameworks. The results demonstrate that these internationally recognized models should not be regarded as alternative approaches but rather as interconnected components of a comprehensive professional development system. This finding supports previous research emphasizing that teachers' digital competence is multidimensional and requires the integration of technological, pedagogical, evaluative, and reflective competencies (Redecker, 2017; Falloon, 2020).

The findings are consistent with Redecker (2017), who argues that digital competence extends beyond technological skills and encompasses pedagogical innovation, assessment, professional engagement, and learner empowerment. Likewise, UNESCO (2018) emphasizes that effective digital transformation requires teachers to integrate technology with curriculum, pedagogy, assessment, and continuous professional learning. The integrated framework proposed in this study operationalizes these recommendations by connecting competence assessment with instructional planning, technology selection, and evaluation of learning outcomes.

The study further supports the theoretical assumptions of the TPACK framework. Mishra and Koehler (2006) argue that meaningful technology integration emerges from the interaction of technological, pedagogical, and content knowledge rather than from technological proficiency alone. Subsequent empirical studies confirmed that teachers with well-developed TPACK competencies are more capable of designing learner-centred digital learning environments (Koehler et al., 2013; Chai et al., 2013; Voogt et al., 2013). However, the present analysis indicates that TPACK alone does not provide sufficient guidance for selecting appropriate digital technologies within diverse educational contexts. Consequently, integrating the SECTIONS model addresses an important methodological limitation by introducing evidence-based criteria for technology selection (Bates, 2015).

Another significant finding concerns the evaluation of technology-enhanced learning. Previous studies have shown that technology integration cannot be considered effective merely because digital tools are present in instruction. Instead, educational technologies should enhance learner engagement, creativity, collaboration, and higher-order thinking (Kimmons & Hall, 2018; Kimmons et al., 2020). The PICRAT framework complements DigCompEdu, TPACK, and SECTIONS by providing explicit criteria for evaluating whether digital technologies merely replace traditional practices or fundamentally transform teaching and learning processes. This interpretation is also consistent with Graham et al. (2019), who emphasize that learner engagement should be considered a central indicator of successful technology integration.

The comparative analysis also confirms the observations of Cabero-Almenara et al. (2022) and Falloon (2020), who argue that existing digital competence frameworks should not be implemented in isolation. Rather, effective teacher education requires coherent methodological systems that connect competence development with instructional design and classroom practice. Nevertheless, relatively few studies have proposed a structured sequence illustrating how different frameworks can operate together throughout the teaching process. The integrated model proposed in the present study addresses this conceptual gap by organizing the four frameworks into a logical developmental pathway that begins with competence assessment and concludes with evaluating instructional effectiveness.

An important contribution of the proposed framework lies in its applicability to teacher education and continuous professional development. Unlike previous conceptualizations that primarily describe individual dimensions of digital competence, the integrated model provides a practical methodological sequence that can guide curriculum development, instructional planning, teacher training programmes, and institutional digital transformation strategies. The illustrative early childhood education scenario presented in **Table 2** demonstrates the practical feasibility of the proposed framework and confirms that competence assessment, pedagogical planning, technology selection, and learning evaluation can be systematically integrated within authentic educational practice.

Despite these contributions, several limitations should be acknowledged. The present study is conceptual in nature and is based on systematic literature review and comparative theoretical analysis rather than empirical validation. Consequently, the proposed framework requires future empirical investigation across different educational levels, disciplines, and cultural contexts. Quantitative and mixed-methods studies could further examine the effectiveness of the integrated model in improving teachers' informational-digital competence, instructional quality, and learner outcomes.

Overall, the discussion indicates that integrating DigCompEdu, TPACK, SECTIONS, and PICRAT provides a more comprehensive methodological foundation than employing each framework independently. By combining competence assessment, pedagogical integration, technology selection, and evaluation of learning impact within a coherent developmental sequence, the proposed framework contributes to both the theoretical advancement of teacher digital competence research and the practical improvement of teacher education in contemporary digital learning environments.

Findings

The findings indicate that the proposed integrated framework offers a comprehensive methodological approach to developing educators' informational-digital competence by combining four internationally recognized frameworks into a coherent professional development sequence. The systematic literature review and comparative analysis consistently demonstrate that each framework contributes a distinct but complementary function throughout the technology integration process.

The analysis confirms that **DigCompEdu** serves as a comprehensive framework for assessing educators' existing digital competence and identifying professional development needs. **TPACK** provides the pedagogical foundation for integrating technology with content knowledge and instructional strategies. **SECTIONS** supports informed technology selection by considering pedagogical objectives, learner characteristics, accessibility, and institutional conditions, while **PICRAT** evaluates the educational impact of digital technologies by focusing on learner engagement and instructional transformation.

The comparative review further demonstrates that no individual framework independently addresses all dimensions of educators' informational-digital competence. Instead, their sequential integration establishes a coherent developmental pathway that connects competence assessment, pedagogical planning, technology selection, and evaluation of learning outcomes. This integrated approach addresses an important conceptual gap identified in the existing literature, where these frameworks are generally examined separately rather than as components of a unified methodological system.

The proposed framework also provides practical guidance for teacher education institutions and professional development programmes. The instructional scenario presented in **Table 2** illustrates how the integrated model can be implemented in authentic educational practice, demonstrating that digital competence

development should be viewed as a continuous professional process rather than a collection of isolated technological skills.

Overall, the findings confirm that the integration of **DigCompEdu, TPACK, SECTIONS, and PICRAT** strengthens both the theoretical foundations and practical implementation of educators' informational-digital competence. The proposed model therefore offers a structured methodological framework capable of supporting teacher preparation, instructional innovation, and evidence-based digital transformation across diverse educational contexts.

Conclusion

This study proposed and theoretically substantiated an integrated conceptual framework for developing educators' informational-digital competence through the sequential combination of **DigCompEdu, TPACK, SECTIONS, and PICRAT**. Drawing upon systematic literature review, comparative analysis, and conceptual modelling, the research demonstrates that these internationally recognized frameworks perform complementary rather than competing functions within the process of technology integration.

The study contributes to the existing body of knowledge in three principal ways. First, it synthesizes four widely recognized international frameworks into a unified methodological sequence that supports teachers' professional digital competence development from assessment to evaluation. Second, it addresses an important conceptual gap in the literature by demonstrating how these frameworks can operate together within a coherent instructional process rather than as independent models. Third, it provides an illustrative practical application that demonstrates the feasibility of implementing the proposed framework within educational practice, particularly in early childhood education.

From a practical perspective, the integrated framework may support curriculum developers, teacher educators, school leaders, and policymakers in designing systematic professional development programmes aimed at strengthening teachers' informational-digital competence. The proposed model also offers methodological guidance for selecting educational technologies, planning technology-enhanced instruction, and evaluating the effectiveness of digital learning environments.

Despite these contributions, the study has several limitations. As a conceptual investigation, it is based on the synthesis of existing literature rather than empirical validation. Consequently, the effectiveness of the proposed framework should be examined through quantitative, qualitative, and mixed-methods research involving teachers from different educational levels and cultural contexts.

Future research should investigate the implementation of the integrated framework in teacher education programmes, explore its influence on teachers' professional digital competence and instructional practices, and evaluate its impact on learners' engagement and educational outcomes. Cross-cultural comparative studies may also provide further evidence regarding the adaptability and effectiveness of the proposed model in different educational systems.

In conclusion, the integration of **DigCompEdu, TPACK, SECTIONS, and PICRAT** represents a theoretically grounded and practically applicable approach to developing educators' informational-digital competence. By combining competence assessment, pedagogical integration, technology selection, and evaluation of learning impact within a single methodological framework, the proposed model contributes to advancing both research and practice in contemporary digital education.

Declarations

Author Contributions

Sabina Rahimova conceived and designed the study, conducted the literature review, performed the comparative and conceptual analyses, developed the integrated DigCompEdu–TPACK–SECTIONS–PICRAT framework, interpreted the findings, prepared the manuscript, critically revised its intellectual content, and approved the final version for publication.

Funding

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Institutional Review Board Statement

The study was conducted in accordance with internationally recognized principles of academic integrity and ethical research. As this research employed a conceptual design based exclusively on publicly available scientific literature, international policy documents, and official educational frameworks, it did not involve human participants, personal data, biological materials, or experimental interventions. Consequently, approval from an Institutional Review Board was not required. The study was conducted in accordance with the ethical principles for educational research recommended by UNESCO and the Committee on Publication Ethics (COPE) (UNESCO, 2018; COPE, 2023).

Informed Consent Statement

Informed consent was not required because the study did not involve human participants or the collection of primary empirical data.

Data Availability Statement

The data supporting the findings of this study consist exclusively of publicly accessible scientific publications, official international policy documents, and educational competence frameworks cited in the reference list. Additional analytical materials generated during the comparative review are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares no conflict of interest regarding the publication of this article.

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Ethical Approval

The research was conducted in accordance with internationally accepted ethical standards for educational and social science research. The study adhered to the principles of academic integrity, transparency, intellectual honesty, appropriate citation, and respect for intellectual property rights. Ethical considerations followed the recommendations of UNESCO concerning responsible educational research and the Committee on Publication Ethics (COPE, 2023; UNESCO, 2018).

Disclaimer

The interpretations, analyses, and conclusions presented in this article are solely those of the author and do not necessarily reflect the official views or policies of any educational institution, governmental authority, or international organization cited in this study.

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