DIDACTICA DANUBIENSIS

Digital Pedagogy in Initial Teacher Education for Primary Education: From Digital Literacy to Interactive Educational Design

Doinița Popa[1]

Abstract: The article examines the role of digital literacy and interactive educational design in the initial training of primary school teachers. Drawing on European and international frameworks (DigCompEdu, DigComp 2.2, ISTE, UNESCO, TPACK), the study highlights the main dimensions of digital competence: technical and informational foundations, ethics and digital well-being, communication and collaboration, self-assessment, and continuous professional development. The paper argues for a shift from competences to pedagogy by integrating technology into the teaching–learning process, emphasizing the teacher's role as facilitator and educational designer. Finally, it proposes principles and tools for interactive educational design, relevant for preparing future teachers and aligning education with the challenges of the digital society.

Keywords: digital literacy; initial teacher education; DigCompEdu; digital pedagogy; interactive educational design

1. Introduction: From Emergency to Systemic Quality

The pandemic has accelerated the integration of technologies in education, but the transition from "using tools" to quality digital pedagogy requires a coherent framework in initial teacher training. In primary education, where the educator-student relationship and the design of learning experiences are decisive, technology must serve active learning, inclusion, and the development of transversal

[1] Senior Lecturer, PhD, Danubius International University of Galati, Romania, Address: 3 Galati Blvd., 800654 Galati, Romania, Corresponding author: doinitapopa@univ-danubius.ro.

competences, not become an end in itself. The European frameworks for digital competence for teachers (DigCompEdu) and for citizens (DigComp 2.2) provide clear benchmarks for this approach.

2. Conceptual and Policy Framework

2.1. DigCompEdu and DigComp 2.2 describe 22 competencies in six areas – from professional practices and digital resources to teaching, assessment, and developing students' digital skills – and apply to all levels of education, including primary. It serves as a reference tool for designing initial training curricula and for self-assessing professional progress. DigComp 2.2 complements the landscape with over 250 examples of knowledge, skills, and attitudes for citizens, including those related to emerging technologies (e.g., AI-based systems).

2.2. ISTE Professional Standards for Educators

The ISTE Standards for Educators translate digital competencies into concrete roles (e.g., Designer, Facilitator, Analyst, Leader), guiding future teachers towards designing relevant, authentic, and equitable learning experiences. In initial training, these standards can structure the objectives and assessment of pedagogical practice.

2.3. Generative AI: Guidelines and Caution

The UNESCO Guide (2023) recommends a human-centered approach to generative AI in education: clear policies, professional training, data protection, and fair assessments. In initial training programs, future teachers need both AI literacy (responsible prompting, source checking) and AI pedagogy (activities that leverage AI for feedback, differentiation, resource design), with attention to bias and equity. UNESCOcdn.table.media

3. Digital literacy in Initial Training

Digital literacy is today one of the essential skills for the teaching profession, being fundamental for the preparation of future teachers who will work with digital native students, in an educational environment marked by technology, connectivity, and open resources. It is not reduced to a simple familiarization with digital tools, but constitutes a complex set of knowledge, attitudes, and practices that integrate technical, ethical, communicative, and reflective dimensions.

3.1. Technical and Informational Fundamentals

The first pillar of digital literacy is technical and informational fundamentals. Future teachers must acquire solid data management skills – from storing and organizing information, to selecting and validating digital resources. A crucial component is the critical search for information, which involves discerning between credible and unreliable sources, as well as the ability to combat the phenomenon of disinformation. In addition, cybersecurity elements (strong passwords, device protection, and prevention of online attacks) are becoming minimum conditions for responsible functioning in the digital environment. Last but not least, digital literacy requires knowledge of the copyright and licensing regime, especially in relation to the use and creation of Open Educational Resources (OER), which facilitate free access to quality educational materials.

3.2. Ethics and Digital Well-Being

A second dimension concerns ethics and digital well-being. In a world where every activity leaves traces online, future teachers must become aware of their own digital footprint, but also of the implications it has on their professional identity and reputation. The protection of minors' data is central, as teachers manage sensitive information about children and their families daily. At the same time, digital literacy must cultivate the balance between online and offline life, helping future teachers to develop healthy routines for using technology, but also to transmit this model to students. In addition, the concept of a digital psychological contract between school and family is also emerging, which involves explicit and implicit rules regarding online communication, data management, and mutual expectations regarding the use of technology.

3.3. Online Communication and Collaboration

A third pillar refers to online communication and collaboration skills. Future teachers must know and effectively use Learning Management System (LMS) platforms and other digital collaborative spaces, which facilitate both teaching and interaction between colleagues. At the same time, respecting the rules of netiquette (respectful and effective communication in virtual space) is indispensable for maintaining a positive educational climate. Particular attention must be paid to communication between school and family, which is increasingly carried out through digital tools (communication platforms, mobile applications, online groups). This dimension is vital for building a relationship of trust between teachers, parents, and the community.

3.4. Self-Assessment and Continuous Development

Finally, digital literacy involves cultivating self-reflection and a commitment to continuous professional development. Tools such as SELFIE for Teachers (developed by the Joint Research Centre of the European Commission) allow future teachers to diagnose their current level of digital competence, identify areas where improvements are needed, and build personalized learning plans. This process can be strengthened by maintaining a reflective journal, where students document the evolution of their relationship with technology, good practices, and difficulties encountered. This dimension is essential for future teachers to understand digital literacy as an ongoing process, not as a stage completed during initial training.

4. From skills to pedagogy: frameworks for integrating technology

The integration of technology into the educational process cannot be limited to the acquisition of basic digital skills. For future teachers, technical mastery is only a first step; the real challenge lies in translating these skills into coherent, effective, and student-centred pedagogical practices. In this sense, digital literacy is transformed into digital pedagogy, that is, into a systematic vision of how technology supports learning, teaching, and character formation.

Reference frameworks developed at the European and international levels provide a guide for this transformation. For example, DigCompEdu (European Framework for the Digital Competence of Educators) proposes a model structured around six areas: from the use of digital resources and the creation of interactive learning environments, to digital assessment practices and the development of students' digital skills. In the logic of this framework, future teachers are not just users of technology, but become educational designers who plan activities based on collaboration, creativity, and problem-solving, with technology as support.

Another relevant example is TPACK (Technological Pedagogical Content Knowledge), which emphasizes the balance between three types of knowledge: content knowledge (what the teacher teaches), pedagogical knowledge (how he teaches), and technological knowledge (with what tools he teaches). For future teachers, this framework emphasizes the idea that technology has no value in itself, but only becomes meaningful when it is harmonized with teaching methods and learning objectives. In addition to these international benchmarks, the European Commission promotes tools such as SELFIE for Teachers, which support teachers'

self-reflection on their own level of digital competence and suggest directions for development. For teacher students, the use of such a tool during their initial training creates the premises for a professional culture based on reflection, adjustment, and continuous learning.

Thus, the transition "from skills to pedagogy" means a paradigm shift: technology is not an external accessory to the educational process, but a learning environment in itself, organically integrated into the didactic design. A future digitally literate teacher knows not only to use an LMS or select an online resource, but also to design lessons in which technology fosters active student participation, collaboration, critical thinking, and creativity. In this way, reference frames become not simple assessment tools, but benchmarks for an authentic digital pedagogy, capable of responding to both the needs of today's students and those of a society in continuous transformation.

5. Interactive Educational Design: Principles and Tools

In the context of contemporary education, interactive educational design is becoming a central element for the training of future teachers. It does not just mean integrating digital tools into a lesson, but implies a pedagogical vision in which technology is used to create dynamic, participatory, and relevant learning experiences for students.

5.1. Principles of Interactive Educational Design

A first fundamental principle is that of student-centeredness. Digital activities must start from the needs, pace, and learning styles of children. Instead of technology being an "accessory" to teaching, it must create opportunities through which students explore, construct knowledge, and collaborate.

The second principle is interactivity. A successful digital lesson is not limited to displaying content on a screen, but requires students to be actively involved – solving problems, participating in simulations, creating their own materials, or providing feedback in real time.

A third principle refers to immediate and personalized feedback. Digital environments allow the teacher to provide students with instant answers to work tasks, identify difficulties, and adjust the activity on the spot. In this way, students are motivated to progress and take ownership of their learning.

Finally, a key principle is the balanced integration of technology. Not all lessons need to be fully digitalized, but teachers need to know when and how interactive

tools add value: to stimulate curiosity, to diversify methods, or to support differentiated learning.

5.2. Tools for Interactive Educational Design

To put these principles into practice, future teachers need to be familiar with a range of accessible and versatile digital tools:

- Interactive presentation platforms (e.g., Nearpod, Genially, Mentimeter) – which transform classic exposition into a dialogue through surveys, quizzes, and collaborative exercises.
- Educational exercise and game applications (e.g., Kahoot!, Quizizz, Wordwall) – which support knowledge consolidation through friendly competitions and immediate feedback.
- Online collaboration tools (e.g., Padlet, Jamboard, Miro) – which allow students to create concept maps, visual projects, or digital stories together.
- Augmented and virtual reality resources (e.g., Merge Cube, Google Expeditions) – which bring otherwise impossible experiences to the classroom (exploring the solar system, the human body, or historical sites).
- Learning Management Systems (LMS) (e.g., Google Classroom, Moodle, Edmodo) – essential for organizing resources, communicating with parents, and tracking student progress.

5.3. The Role of the Teacher in Interactive Design

In an interactive educational design, the role of the teacher is transformed from a simple transmitter of knowledge to a facilitator of learning. The teacher creates activity scenarios, anticipates difficulties, and offers personalized support. At the same time, the teacher has the responsibility to guide students towards the responsible use of technology, teaching them how to communicate ethically, protect personal data, and manage their time spent online.

5.4. Educational Impact and Value

Interactive educational design brings major benefits:

- increases student motivation and involvement;
- supports learning through collaboration and projects;
- facilitates understanding through visualization and experimentation;

- develops transversal skills (critical thinking, creativity, digital communication).

Thus, for future teachers, mastering the principles and tools of interactive design is not just a technological competency, but an essential condition for meeting the needs of the generation of students raised in the digital age.

6. Conclusions

The accelerated transformations of the digital society require the integration of digital literacy and interactive educational design as central elements in the initial training of teachers. It is not enough for future teachers to acquire technical skills in the use of technology; it is necessary to develop a digital pedagogy that harmonizes competencies with teaching methods and educational objectives.

The analysis of international frameworks (DigCompEdu, DigComp 2.2, ISTE, UNESCO, TPACK) demonstrates that digital literacy is not an isolated dimension, but a complex process that includes technical and informational foundations, ethics and digital well-being, communication and collaboration, as well as self-assessment and continuous professional development. These components must be translated into pedagogical practices adapted to the needs of students, in which the teacher plays the role of facilitator and educational designer.

In this sense, the proposal of a curricular module of 8–10 ECTS credits can provide a structured framework for the training of digital skills and their transposition into educational practice. Thus, future teachers will be prepared not only to use technology, but to integrate it creatively, ethically, and reflectively, contributing to building a school relevant to the challenges of the present and the future.

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