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**INTERDISCIPLINARY APPROACH TO DIGITAL EDUCATION
IN PRIMARY EDUCATION**

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CONCEPTUAL FRAMEWORK OF THE RESEARCH

Relevance and importance of the topic. The digital transformation of society, driven by the accelerated development of information and communication technologies and reinforced by the educational experience during the COVID-19 pandemic, has led to a redefinition of the aims of education and a reconfiguration of curricular policies at both international and national levels. In this context, digital education has become one of the major priorities of European and national educational reforms, aimed at developing high-performing digital education ecosystems and fostering the digital competences required for active participation in the knowledge society. These orientations are reflected in the Digital Education Action Plan 2021–2027, the European Digital Competence Framework (DigComp), the Council Recommendation of the European Union on Key Competences for Lifelong Learning, the recommendations formulated in European Commission reports on digital education in schools in Europe (2019, 2023) and the Digital Decade (2023, 2025), as well as in national curricular documents and strategies concerning the digitalisation of education, including Romania's National Curriculum Reference Framework and the SMART.Edu 2021–2027 Strategy. Research and documents developed by the European Commission, UNESCO, and the OECD, together with the contributions of specialists in the field, demonstrate the need to develop digital competences from primary education onwards and highlight the role of interdisciplinary approaches in fostering transversal competences.

An analysis of educational policy documents and the specialised literature highlights the fact that, although the development of digital competences constitutes an explicit aim of the contemporary curriculum, the ways in which digital education is integrated into primary education differ significantly across European education systems. In numerous countries, digital competences are developed through dedicated subjects or interdisciplinary approaches, whereas in Romania they are promoted predominantly through a transversal approach, without a unified curricular framework specifically designed for digital education at primary level. Although digital competences are included in the graduate profile for primary education, there is a lack of a unified pedagogical model and a coherent methodological framework for their progressive development.

Recent reports of the European Commission, however, indicate that Romania records a low level of digital competences among the population and recommend strengthening their development through systematic curricular and methodological approaches from the early years of schooling.

The analysis of educational realities concerning the development of digital competences among primary school pupils highlights the existence of **contradictions** between:

- the digital competences stipulated in the graduate profile for primary education and the limited opportunities for developing these competences through the compulsory subjects specified in the Framework Plan of the Romanian national curriculum;

- the need for primary school pupils to participate in online learning activities, regulated through normative acts, and the insufficient level of digital competences, the lack of digital equipment, unequal access to technology, and disparities between urban and rural areas regarding school infrastructure and equipment (as confirmed by the findings of various studies and research reports);

- the need for the progressive and systematic development of pupils' digital competences and the absence of a dedicated digital education subject in the framework plan for Romanian primary education, together with the insufficient presence of curricular content related to digital technologies in the school curricula of compulsory subjects;

- the requirements of the graduate profile for primary education concerning the development of digital competences and the unequal opportunities for developing these competences, generated by disparities between urban and rural areas in terms of access to digital resources and the use of technologies in the educational process, as documented in research reports on school activities conducted online;

- the need to develop, from primary education onwards, behaviours involving the safe, responsible, and effective use of digital technologies and the insufficiently systematic nature of curricular approaches aimed at developing pupils' digital literacy.

In this context, the *scientific problem addressed by the research* consists in the insufficient theoretical and methodological foundation of the interdisciplinary integration of digital education in primary education and the need to develop a coherent pedagogical model aimed at the systematic and progressive development of pupils' digital competences.

The research object is the process of developing digital competences among primary school pupils through the interdisciplinary integration of digital education.

The aim of the research is to provide a theoretical and methodological foundation, develop, and experimentally validate a pedagogical model for the interdisciplinary integration of digital education in primary education, aimed at developing pupils' digital competences. To achieve this aim, the following *objectives* were established: to provide the theoretical and conceptual foundation of digital education and digital competences; to determine the psychopedagogical and methodological foundations of interdisciplinary integration; to develop the pedagogical model; to design the curricular and instructional methodology, materialised through

the optional subject Digital Education and its associated resources; and to experimentally validate the effectiveness of the model.

Research Hypothesis starts from the premise that the development of digital competences can be supported through the implementation of a pedagogical model of interdisciplinary integration, operationalized through the optional subject „Digital Education” and through the use of a scientifically grounded curricular and instructional methodology.

Research Methodology integrated theoretical, empirical, and scientific, statistical methods, including the pedagogical experiment, observation, testing, and descriptive and inferential statistical analysis.

Epistemological Framework of this research is based on the theoretical and practical perspectives presented in the works of several prominent authors such as: S. Angheluță, D. Bawden, M. Bocoș and V. Chiș, C. A. Bonfield, P. Botnariuc, A. Braicov, N. Burlacu, C. Ceobanu, L. Ciolan, T. Chiriac, S. Cristea, B. Croxall, C. Cucuș, S. Downes, P. Gilster, J. Howell, O. Istrate, S. Livingstone, O. Mândruț and L. Catană, M. Miled, I. Neacșu, V. Negruț and M. Arșith, K. Oliveira, M. Pavel, C. Redecker, J. Reyna, N. Selwyn, G. Siemens, A. Șandru and A. Gușă, L. Ursu, G. Văideanu, T. Veverița, R. Vuorikari and many others.

Scientific Novelty and Originality consist in the conception and theoretical-methodological foundation of a pedagogical model for the interdisciplinary integration of digital education in primary education, as well as in its operationalization through the optional subject „Digital Education”, the school curriculum, and the curricular and methodological resources developed.

The main result contributing to the advancement of knowledge in this field is the development, operationalization, and experimental validation of a pedagogical model for the interdisciplinary integration of digital education in primary education, complemented by a methodological framework for its implementation and aimed at the progressive development of students’ digital competencies.

The Scientific Problem Solved consists in the theoretical-methodological foundation and development of the pedagogical model for the interdisciplinary integration of digital education in primary education, as well as in the experimental validation of the model, in the second- and third-grade classes, through a methodological framework for implementation aimed at the progressive development of pupils’ digital competences.

The Theoretical Significance of the Research lies in the development of the conceptual and theoretical-methodological framework of the interdisciplinary integration of digital education in primary education, by substantiating the relationships between digital education, digital

competence, digital pedagogy, and competence-based curriculum, and by configuring an integrative pedagogical model.

The Applicative Value of the paper is supported by the development, operationalization, and validation of curricular and methodological products intended to develop digital competences among primary school pupils.

The Main Results submitted for consideration are: the theoretical-conceptual framework of digital education and digital competences; the pedagogical model for interdisciplinary integration; the design of the optional subject and the curricular resources; the experimental results and methodological recommendations for the integration of digital education into the primary education curriculum.

The Research Results were implemented within the pedagogical experiment conducted in two educational institutions in Botoşani County and disseminated through scientific conferences and publications. The research is reflected in seven scientific articles published in specialised journals, six presentations at international (3) and national (3) scientific conferences, and one curricular support material with ISBN intended for the implementation of the optional subject Digital Education.

The thesis is devoted to the theoretical-methodological foundation and experimental validation of a pedagogical model for the interdisciplinary integration of digital education in primary education, aimed at developing the digital competences of young school-age pupils. The research is aligned with the current directions for the modernization of education promoted at European and national levels, responding to the requirements concerning the development of key competences for lifelong learning and the use of digital technologies in the educational process. The research results contribute to the development of the conceptual and methodological framework of digital education and provide an experimentally validated pedagogical model for second- and third-grade classes, within the educational context under investigation.

Thesis Structure: introduction, three chapters, general conclusions and recommendations, bibliography comprising 203 titles, 8 appendices, 123 pages of main text, 26 figures, 52 tables.

CONTENT OF THE THESIS

The **Introduction** delineates and argues for the relevance and importance of the research topic, describes the situation in the field of digital education and the development of digital competences in primary education, formulates the research problem, establishes the aim, objectives, and research hypothesis, presents the research methodology and methods applied, highlights the scientific novelty and originality, the theoretical significance and applicative value of the results, as well as the main results obtained and the author's personal contribution. At the same time, the implementation and validation of the scientific results, the publications related to the thesis topic, and the structure of the paper are presented.

Chapter 1 „**Epistemological Landmarks Regarding the Integration of Digital Education in Primary Education**” provides a theoretical and epistemological foundation for the issue of integrating *digital education in primary education*, through the analysis of the main concepts, psychopedagogical landmarks, European and national frameworks, as well as the conditions under which technology can be effectively used in the educational process. The analysis carried out highlights the fact that the digital transformation of society brings about significant changes in the aims, contents, strategies, and learning contexts, which requires a reconsideration of the role of digital education in pupils' development.

Digital education is approached in the chapter as a complex component of contemporary education and not merely as a form of using technology in teaching activities. The transformations brought about by digitalisation influence the way in which teaching, learning, and assessment take place, changing the relationships between the teacher, the pupil, the content, and the learning resources. From this perspective, digital education can be considered a „*new education*”, as it responds to needs and challenges generated by the digital society and aims to develop the competences, values, and behaviours required for active and responsible participation in the contemporary environment.

The character of „new education” is supported by several *considerations*: the integration of digital technologies into the learning process, the diversification and increased flexibility of educational resources, the adaptation of learning to pupils' individual characteristics, the development of autonomy and the capacity for exploration, the facilitation of communication and collaboration, as well as the development of responsible behaviours in the digital environment. In this context, digital education contributes not only to the development of technical skills, but also to the development of the ability to select, evaluate, and process information, to the development of critical thinking, and to preparing pupils for lifelong learning. At the same time, it acquires an

important *axiological dimension*, as the use of technology involves responsibility, autonomy, and respect for others, protection of personal data, compliance with ethical and legal norms, and active and safe participation in the digital society.

A fundamental premise for the development of digital competences is *digital literacy*, which has evolved from the simple use of technological devices towards a complex set of abilities to access, evaluate, manage, interpret, and communicate information in digital environments. The contributions of D. Bawden, B. Croxall and P. Gilster highlight the critical and functional nature of digital literacy, which goes beyond familiarity with technology and approaches the concept of „new literacy”, resulting from the interaction between information literacy, media literacy, and ICT literacy [4, 13, 18]. In *primary education*, the early development of digital literacy is essential, as pupils’ familiarity with digital devices does not guarantee their ability to use them critically, creatively, safely, and responsibly in educational contexts [10]. The analysis of the Romanian curricular framework highlights the fact that, although digital competences are recognised as an important acquisition within the pupil profile, at primary level there is no distinct compulsory subject dedicated to digital education, its development taking place predominantly transversally, through existing subjects and through teachers’ initiatives [20, 22]. This situation justifies the need for systematic educational approaches that ensure the progressive development of digital literacy from the early years of schooling.

Digital competences constitute the central dimension of digital education and are approached as complex, dynamic, and transferable competences, based on the integration of knowledge, skills, and attitudes [3, 8]. According to DigComp 2.2, this involves the critical, responsible, safe, and creative use of digital technologies and is structured into five areas: information and data literacy, communication and collaboration, digital content creation, personal safety, and problem solving [29]. The subsequent update through DigComp 3.0 (2025) maintains this general structure and strengthens the perspective on the complex and evolving nature of digital competences by revising the formulations of competences and learning outcomes and by integrating current dimensions such as artificial intelligence, cybersecurity, digital well-being, digital rights and responsibilities, and combating disinformation [12]. The analysis also highlights *the axiological dimension of digital competences*, reflected in responsibility regarding information and personal data, compliance with ethical and legal norms, appropriate communication, critical thinking, and online safety. Therefore, the development of digital competences in primary education must go beyond the acquisition of technical skills and aim at developing autonomous, critical, and responsible behaviours, with pupils learning not only how to use technology, but also when, why, and under what conditions its use is appropriate.

The development of digital competences must take into account *the particularities of the cognitive, socio-affective, and moral development of pupils in primary education*. From J. Piaget's perspective, young school-age children are predominantly at the stage of concrete operations, which requires the use of intuitive, interactive, and action-oriented digital activities [25]. L. Vygotsky's socio-constructivist perspective highlights the role of social interaction and pedagogical mediation, justifying the use of collaborative activities and technologies that facilitate communication and cooperation [28]. At the same time, the use of digital resources must be balanced in order to support attention and engagement without negatively affecting concentration and self-regulation.

The socio-affective and moral dimension complements these landmarks. Successful experiences, collaboration, and the creation of digital products can support motivation and the sense of competence, while compliance with rules can be used to develop responsible behaviours in the digital environment [1, 11]. Contemporary research highlights that the development of digital competences is influenced not only by access to technology, but also by family and school support and by the quality of learning experiences [19, 26]. Therefore, the development of digital competences must be conceived as a progressive and age-appropriate process that integrates cognitive, operational, socio-affective, and axiological dimensions.

Another important landmark of the analysis is represented by *the European and national frameworks* concerning digital competences. At the level of the European Union, the Recommendation on Key Competences for Lifelong Learning (2006), updated in 2018, establishes digital competences as key competences [17]. This orientation is reinforced through DigComp 2.2, DigComp 3.0, and recent European policies concerning digital transformation and the Digital Decade [12, 16]. These documents support the need to develop digital competences at all levels of education and promote the critical, creative, safe, and responsible use of technology.

The comparative analysis of education systems highlights the fact that digital education is organised differently depending on the curricular choices of each state. In some systems, it is introduced as a distinct subject, while in others it is integrated transversally. Eurydice reports highlight the fact that, in most European systems, the development of digital competences begins as early as primary education, while their systematic assessment remains less frequent at this level [15]. In Romania, compared with systems such as those of the Republic of Moldova or Estonia, the curricular integration of digital education in primary education is more limited. The Republic of Moldova introduced the compulsory „Digital Education” module within the „Technological Education” subject as early as the first grade, while Estonia provides an example of the systematic integration of digital education into the curriculum [29].

At the national level, Romanian curricular documents promote the development of key competences and recognise the importance of digital competences. The National Curriculum Reference Framework and the Graduate Profile guide the progressive development of competences, including digital competences [22]. For primary education, the functional and responsible use of technologies, the creation of simple content, online collaboration, and compliance with safety and security rules are targeted. However, the absence of a distinct subject dedicated to digital education means that the use of these competences depends to a large extent on teachers' initiative and on the possibilities for transversal and interdisciplinary integration.

Continuing the analysis, *the digital educational ecosystem* is approached as an explanatory framework for the relationships between technology, infrastructure, resources, actors, and educational processes. Based on ecological development theory, general systems theory, and approaches to networked learning, the concept refers to a dynamic and interdependent network of components whose effectiveness depends on the correlation of digital infrastructure and resources with teachers' competences, pupils' needs, curricular objectives, and educational policies [6, 7, 9]. A central role is assigned to the teacher, as the educational value of technology is determined by their ability to select and integrate digital resources into teaching, learning, and assessment activities that are relevant to pupils [1, 14]. The analysis of the situation in Romania highlights progress in the development of infrastructure and the diversification of digital resources, but also the persistence of difficulties regarding equitable access to technology, teachers' digital competences, and its pedagogical integration, with more pronounced challenges in rural areas [16]. In this context, the SMART.Edu 2021–2027 Strategy supports the development of a digital educational ecosystem through the modernisation of infrastructure, the development of digital competences, and the expansion of educational resources [21].

The final part of the chapter analyses *the digitalisation of education in primary education*, highlighting both the benefits and the challenges of this process. The COVID-19 pandemic accelerated the use of digital technologies and highlighted the fact that access to devices and the internet is not sufficient to ensure effective digital education, as adequate digital competences, family support, and the pedagogical integration of technology are also required [27]. Among the main *benefits* identified are increased motivation for learning, diversification of resources, facilitation of differentiated and personalised learning, development of autonomy, and stimulation of collaboration [11, 29]. At the same time, *challenges* persist regarding unequal access to technology, differences between urban and rural areas, and the varying levels of digital and pedagogical competences, excessive screen use, and the reduction of direct interactions [11].

Therefore, technology must be used as a pedagogical means, within learning contexts adapted to age-specific characteristics and educational objectives.

The epistemological analysis carried out demonstrates that the integration of digital education into primary education constitutes a necessity determined by societal transformations and the evolution of educational paradigms. Digital education involves the development of digital literacy and digital competences, as well as the formation of responsible values and behaviours adapted to the cognitive, socio-affective, and moral characteristics of pupils [14, 24]. At the same time, the analysis of the Romanian curricular framework highlights the need to use a transversal and interdisciplinary approach to digital competence, given the absence of a distinct compulsory subject at primary level [20].

The ecosystemic perspective reveals that the development of digital competence depends on the interaction between the technological, curricular, pedagogical, and organisational dimensions, as well as on the involvement of educational actors. These findings substantiate the need to develop a pedagogical model for the interdisciplinary integration of digital education, aimed at using curricular content and digital technologies to progressively develop the knowledge, skills, and attitudes associated with digital competences [24]. The epistemological landmarks established in this chapter constitute the theoretical foundation for the design and implementation of the pedagogical model and for the experimental verification of its effectiveness in the following chapters.

Chapter 2, entitled „**The Pedagogical Model for the Interdisciplinary Integration of Digital Education in Primary Education**”, is devoted to establishing and developing the curricular and methodological framework for the development of pupils’ digital competences through an interdisciplinary approach. The approach starts from the perspective of *the competence-based curriculum*, in which learning content is selected and organised according to educational aims and the graduate profile [8, 10]. In this context, digital competences are approached as key and transversal competences, in accordance with national and European curricular documents and with the reference points provided by the European frameworks DigComp 2.2 and DigComp 3.0 [12, 15, 26].

The first part of the chapter analyses *the process of curricular design of the optional subject Digital Education*, starting from the correlation of educational aims, competences, content, teaching strategies, and assessment methods. Curricular design is based on the principle of coherence between the components of the curriculum and on their orientation towards the progressive development of digital competences [20]. Within the research, this perspective was

concretised through the development of an optional school subject intended for pupils in the second and third grades, organised within a flexible and pupil-centred curricular approach.

An important component of the chapter is devoted to *the content* of the Digital Education subject and its organisation from an interdisciplinary perspective. Educational content is approached as curricular resources that contribute to the development of competences, going beyond the perspective of predominantly informative transmission of knowledge. *Interdisciplinarity* is analysed as a principle of curricular organisation and as a means of overcoming disciplinary fragmentation by establishing functional connections between content, methods, competences, and learning experiences [5, 11]. From this perspective, both conceptions concerning ***the interdisciplinary organisation of content*** and those highlighting *the orientation of interdisciplinarity towards competence development and the transfer of learning outcomes across domains are employed* [19].

The theoretical foundation of the interdisciplinary nature of the proposed pedagogical model is established with reference to several typologies. From B. Nicolescu's perspective, interdisciplinarity can be analysed in terms of its applicative, epistemological, and disciplinary-generating degrees [23]. The model developed within the research falls ***predominantly within the applicative degree***, as it makes use of the transfer of content, methods, and resources between subjects for the purpose of developing digital competences, while also presenting certain epistemological elements. At ***the structural and operational levels***, interdisciplinarity is used both through the curricular design of the subject and through the organisation of learning activities.

Another perspective used to substantiate the model is the centripetal–centrifugal typology. According to this classification, centripetal interdisciplinarity starts from subjects and seeks the convergence of their contributions towards a common objective, while the centrifugal dimension involves the transfer of acquired learning outcomes to various contexts and domains [20]. The analysis of the developed model leads to its characterisation as a interdisciplinary model with ***a predominantly centripetal structure and centrifugal effects***: school subjects contribute to the development of digital competence, while the digital competences acquired are subsequently transferred and used in learning activities across different domains and in life situations.

Based on the theoretical and curricular foundation, the ***Pedagogical Model for an Interdisciplinary Approach to Digital Education in Primary Education*** (abbreviated as MPAIED) was developed, as presented in Figure 1.

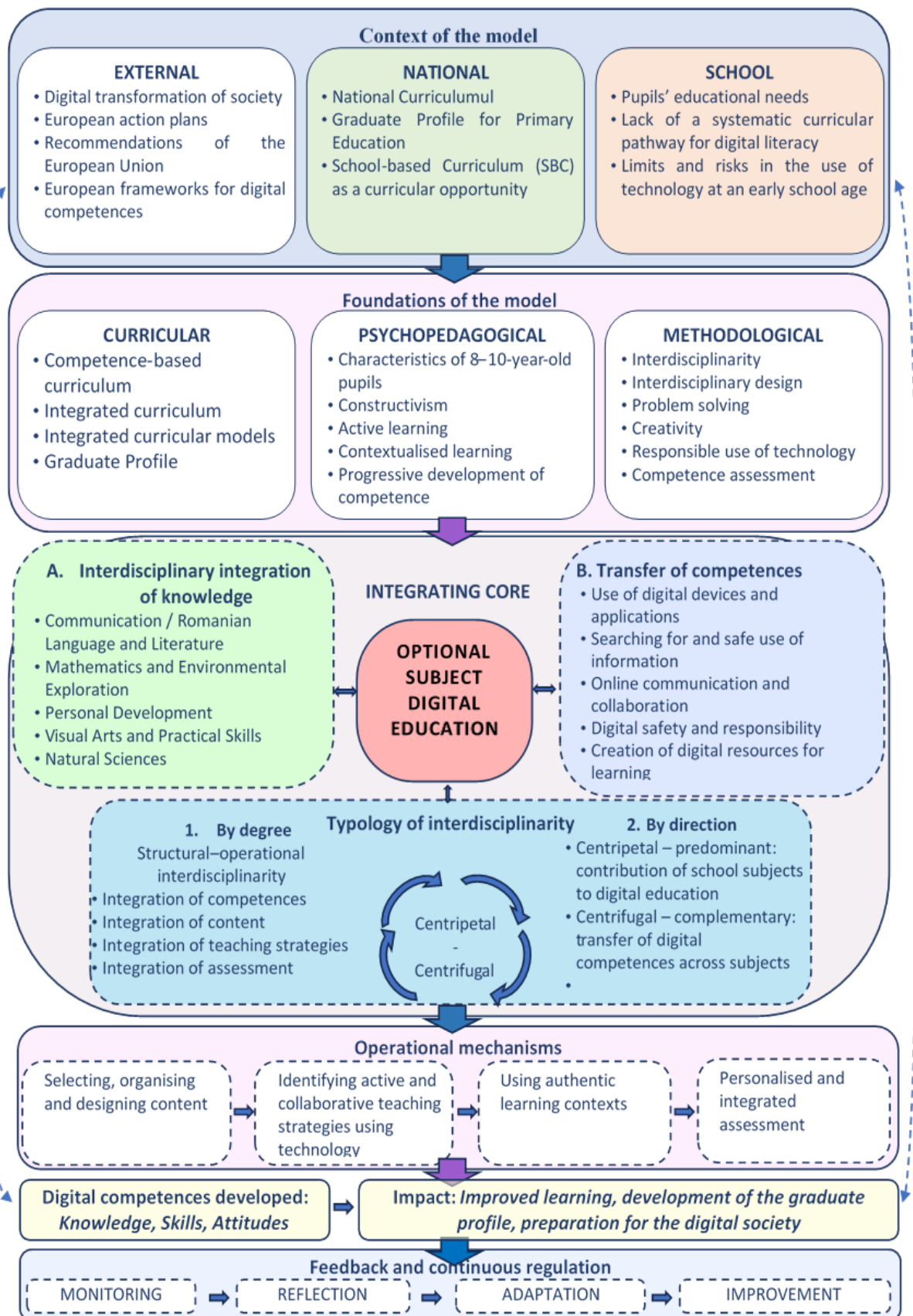


Figure 1. Pedagogical Model for the Interdisciplinary Approach to Digital Education in Primary Education

The model is competence-centred and pupil-centred and integrates the curricular, psychopedagogical, methodological, and technological dimensions of digital education. Its psychopedagogical foundation draws on the principles of active, collaborative, and experiential learning, adapted to the cognitive, affective, and social characteristics of pupils aged between 8 and 10 years. Within this framework, **the Digital Education subject** is configured as an **integrative curricular core**, around which connections are organised with subjects such as Romanian Language and Literature, Mathematics and Environmental Exploration, Natural Sciences, Civic Education, Personal Development, and Visual Arts and Practical Skills.

The original element of the model consists in articulating the two directions of interdisciplinary integration: the convergence of content and learning outcomes from different subjects towards the development of digital competence and the subsequent transfer of the digital competences developed to other curricular and life contexts. Through this configuration, the model goes beyond the simple thematic association of subjects and proposes a curricular organisation oriented towards the transfer and functional use of learning outcomes.

An important result of the research approach is the *development of the school curriculum* for the optional subject Digital Education, intended for the second and third grades. The school curriculum was developed with reference to digital competences and the level descriptors in the Graduate Profile [22], as well as to European benchmarks concerning key competences and digital competences [26, 29]. Since, at the time of designing the pedagogical intervention, there was no distinct national school curriculum for digital education in primary education, the general competences of the subject were derived from the descriptors of digital competence and adapted in relation to pupils' age-specific characteristics and the specific features of the primary curriculum.

The developed curriculum organises the content into four major thematic units: *The Digital Universe*, *Safety in the Digital World*, *Digital Tools, Applications and Resources* and *I Live in the Digital Universe*. These follow a progression from familiarisation with the digital environment and devices, to the safe and responsible use of technology, the development of skills in using applications, and, finally, the creation and use of pupils' own digital resources. The content is interdisciplinary correlated with the learning outcomes acquired in other subjects and is designed to enable the transfer of knowledge and competences across varied learning contexts.

In developing the content and learning activities, emphasis was placed on transforming technology from a simple auxiliary tool into a driver of active learning, creation, communication, collaboration, and problem solving. The integration of digital technology is thus associated with

the reconfiguration of the way educational content is selected, structured, and used, in accordance with a pedagogical perspective centred on the pupil and on competences [2].

Assessment was designed in accordance with the specific nature of the competences targeted, making use of systematic observation of pupils' behaviour, practical assessments, as well as the personal digital portfolio, these having a formative or progress-monitoring role. Emphasis was placed on pupils' individual progress, on demonstrating learning outcomes in application-based contexts, and on the use of formative assessment to regulate the learning process.

Another level of the operationalisation of the model is represented by *annual planning and unit-of-learning planning*. Annual planning aimed to correlate specific competences with content, establish their sequence, and allocate the necessary time. Learning unit planning enabled the relationships between competences, content, learning activities, resources, and assessment methods to be detailed, providing the operational framework for translating the pedagogical model into teaching practice.

Therefore, the main contribution of Chapter 2 consists in the development and foundation of a pedagogical model for an interdisciplinary approach to digital education, concretised through an optional subject, a school curriculum, interdisciplinary content, and methods of planning, teaching-learning, and assessment adapted to pupils in primary education. The model integrates digital competences into the structure of the curriculum and creates conditions for their transfer across subjects and learning contexts. The theoretical, curricular, and methodological foundation presented in this chapter provides the basis for the next stage of the research, devoted to the experimental implementation and validation of the effectiveness of the proposed pedagogical model.

Chapter 3 „**The Experimental Approach to the Validation of the Pedagogical Model for the Interdisciplinary Integration of Digital Education in Primary Education**” is devoted to the experimental approach through which the effectiveness of the Pedagogical Model for an Interdisciplinary Approach to Digital Education (MPAIED), developed for primary education, was verified. While the previous chapters analysed the epistemological and curricular landmarks of digital education and established the curricular and methodological framework of the optional subject „Digital Education”, this chapter focuses on translating the model into school practice and validating it through a pedagogical experiment conducted in the second- and third-grade classes. The experimental approach was based on the problem identified during the period when courses were conducted exclusively online, when the difficulties encountered by young pupils in using technology for educational purposes highlighted the need for the systematic development of digital competences from primary education onwards.

The purpose of the pedagogical experiment was to assess the effectiveness of the interdisciplinary pedagogical model in developing the digital competences of pupils in the second and third grades, by comparing the results of the experimental group with those of the control group. *The general research hypothesis* assumed that the development of digital competences relevant to improving learning in different formats is supported under the conditions of introducing the optional subject Digital Education into the school-based curriculum and implementing an interdisciplinary pedagogical model, operationalised through a school curriculum and integrated content specific to the primary education level. For its verification, *12 statistical hypotheses* were operationalised, related to three dimensions: knowledge, self-assessed skills, and attitudes.

The research design and experimental framework describe the four stages of the research conducted during the period 2020–2024: orientation, design, implementation/experiment, and validation. The orientation stage, carried out during the 2020–2021 school year, included the study of specialised literature, educational policy documents, and the school curriculum. During the design stage, conducted in 2021–2022, the proposals for the optional subject were approved, the pedagogical model for the second- and third-grade classes was developed, the curriculum proposal, assessment instruments, teaching plans, and course materials were developed, and the curriculum was approved. Implementation took place during the 2022–2023 school year through pre-testing, intervention, and post-testing, while validation in 2023–2024 involved the processing, analysis, and interpretation of data and the formulation of conclusions.

The approach had an operational and experimental character, and *the pedagogical experiment constituted the main method* for validating the model. The experimental design, presented in Figure 2, was quasi-experimental, of the *pretest–intervention–posttest* type, with an experimental group and a control group.

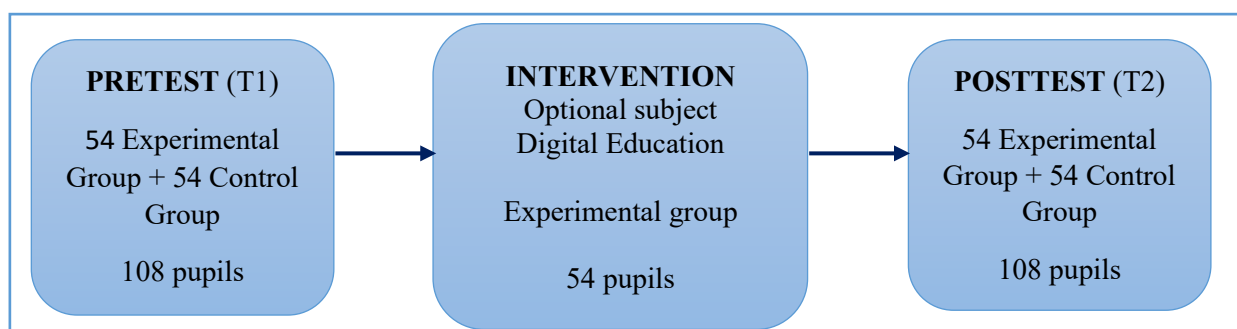


Figure 2. Synthesised Experimental Design: pretest – intervention – posttest

The independent variable was the pedagogical intervention based on MPAIED and operationalised through the optional subject Digital Education, the curriculum, the related activities and curricular resources, while *the dependent variable* was the level of digital

competences of pupils in the second and third grades. These were analysed through three operational dimensions: digital knowledge, self-assessed digital skills, and attitudes towards the use of technology.

The research sample, presented synthetically in Table 1, comprised 108 pupils in the second and third grades, from educational institutions in rural areas. The 108 pupils were divided into two equal groups: 54 in the experimental group and 54 in the control group. The experiment was conducted both in single-grade classes and in multigrade classes, and eight primary education teachers voluntarily participated in its implementation, four of whom were involved in the distribution of the tests, while four participated throughout the entire study period.

Table 1. Synthetic Structure of the Research Sample

Group	Number of pupils	Structure	Intervention
Experimental	54	Grades 2 and 3	Framework Plan + optional subject <i>Digital Education</i>
Control	54	Grades 2 and 3	Framework Plan
Total	108	Grades 2 and 3	Pretest + posttest

The assessment of digital competences was carried out through an *initial* and *final assessment test*, administered to both groups. The instrument targeted three components: theoretical knowledge, self-assessment of the perceived level of digital skills, and attitudes towards technology. A total of 23 items were used: items 1-5 for pupil knowledge, items 6–10 for knowledge, 11–18 for self-assessment of the perceived level of digital skills, and 19–23 for attitudes. Multiple-choice, structured-response, scaled-response, and binary-response items were included. In developing the test, the dimensions of knowledge and the cognitive processes described in L. Anderson's revision of Bloom's taxonomy were taken into account [2, p. 65]. Statistical processing was carried out using SPSS, employing descriptive statistics and inferential tests, including the independent-samples t-test, the paired-samples t-test, and Levene's test. The responses to each item were scored, and the total score obtained allowed the results to be classified into one of the four levels of assessment: unsatisfactory, satisfactory, good, and very good, in accordance with the assessment system used in primary education, based on the criteria presented in Table 2.

Table 2. Assessment Criteria Used for the Three Dimensions

Dimension	Maximum score	Performance levels
Knowledge	10 points	0–1 unsatisfactory; 2–4 satisfactory; 5–7 good; 8–10 very good
Self-assessed skills	32 points	0–9 unsatisfactory; 10–15 satisfactory; 16–25 good; 26–32 very good
Attitudes	5 points	0–2 negative; 3–5 positive

The pedagogical intervention consisted of introducing the study of the optional subject „*Digital Education*” in the second and third grades, over the course of one school year. The subject

was developed around *MPAIED*, with the central principle being the integration of digital education in a functional relationship with learning outcomes derived from the other school subjects. The model did not treat technology exclusively as an auxiliary lesson tool, but organised content and activities specific to digital education in connection with learning outcomes from Romanian Language and Literature, Mathematics and Environmental Exploration, Natural Sciences, Civic Education, Visual Arts and Practical Skills, and Personal Development. At the same time, the digital competences developed were transferred and used in learning contexts specific to the other subjects.

The course materials are structured into four learning units, presented in Table 3, correlated with the general and specific competences and with the basic content of the curriculum.

Table 3. Structure of the Pedagogical Intervention by Learning Units

Unit	Main content	Formative focus
The Digital Universe	Elements of the digital environment; the computer; the Internet	Digital literacy
Safety in the Digital World	Protection of devices and resources; personal safety	Responsible and safe behaviour
Digital Tools, Applications and Resources	Word; PowerPoint; Paint; content creation	Practical skills and creativity
I Live in the Digital Universe	The digital world; the responsible user; digital technology in my life	Consolidation, transfer and reflection

The didactic progression followed the transition from knowledge and familiarisation with concepts and tools to understanding, interpretation and analysis, and subsequently to application, exploration and experimentation. This progression was reflected through the sequences „Let's Find Out!”, „Let's Observe!”, „Let's Apply!” and „Let's Practise!”.

In the unit „The Digital Universe”, the activities focused on developing fundamental concepts related to information, digital devices, computer components, their role, and accessing online resources. Interdisciplinary connections were established by relating digital concepts to learning outcomes developed in Romanian Language and Literature, Mathematics and Environmental Exploration, Civic Education, and Visual Arts. The activities employed heuristic conversation, guided observation, demonstration, and practical exercise.

The unit „Safety in the Digital World” was oriented towards developing competences concerning the responsible and safe use of technologies. The content was integrated with Civic Education, Personal Development, and Mathematics and Environmental Exploration. Pupils analysed authentic and simulated situations, identified risks and rules for protecting devices and data, and applied their knowledge through educational games and interactive resources. The use of the Interland educational game provided a context for assessment and immediate feedback.

The unit „Digital Tools, Applications and Resources” had a predominantly applicative character and aimed to develop the ability to use Microsoft Word, PowerPoint, and Paint applications and to create digital products. Pupils wrote texts, created tables and diagrams, presentations, and graphic representations based on content studied in other subjects. Assessment drew on the analysis of digital products included in individual portfolios.

The unit „I Live in the Digital Universe” had a role of consolidation and transfer. Pupils created posters, multimedia presentations, review diagrams, and other digital resources on interdisciplinary topics, explored Google Maps and Google Earth, and participated in collaborative activities and educational games. Individual digital portfolios constituted a means of documenting progress and the responsible, creative, and functional use of technology.

The didactic scenarios were designed based on the principles of interdisciplinarity, student-centred learning, and the use of technologies in authentic contexts. The structure of the activities included the use of prior learning outcomes, the integration of content from different subjects, active-participatory strategies, practical exercises, and continuous assessment through products. Heuristic conversation, guided observation, demonstration, problematisation, practical exercise, educational games, brainstorming, and project-based learning were used. The lesson models presented in Appendix 6 drew on the ERRE model – Evocation, Realisation of Meaning, Reflection, Extension, associated with the stimulation of critical thinking and the meaningful integration of information.

Assessment throughout the intervention functioned as a process of monitoring and regulating learning, with an emphasis on individual progress and the transfer of competences across different contexts.

The initial analysis aimed to establish the baseline level of the two groups and to verify their comparability prior to the intervention. The first part of the instrument focused on the context in which pupils had access to technology and the way in which they acquired experience in using it. The mobile phone was the most frequently accessed device, being mentioned by 48% of the pupils in the control group and 63% of those in the experimental group. The family environment represented the main context for learning to use devices: 68% of the pupils in both groups indicated the home. At the same time, the educational use of technology was limited before the intervention, with preferred activities mainly consisting of games and music.

Regarding *theoretical knowledge*, at **pretest** the majority of pupils in both groups were at the unsatisfactory level: 30 pupils in the experimental group and 27 in the control group. No pupil reached the very good level. The means were similar, $M = 2,30$ in the experimental group and $M = 2,44$ in the control group, and the difference was not statistically significant. For *self-assessed*

skills, 26 pupils in the experimental group and 23 in the control group were at the unsatisfactory level, with no pupils at the very good level. The means were $M = 10,28$ and $M = 11,35$, respectively, with the difference being statistically non-significant. At the *attitudinal level*, 35 pupils in the experimental group and 40 in the control group displayed positive attitudes; the means were $M = 3,61$ and $M = 3,70$, with no statistically significant difference. Therefore, the first three hypotheses confirmed the initial comparability of the groups, a necessary condition for assessing the effect of the experimental intervention.

Comparatively, the distribution of pupils across the performance levels corresponding to the three dimensions assessed at pretest is presented in Figure 3, which highlights the number of pupils in the experimental group and the control group.

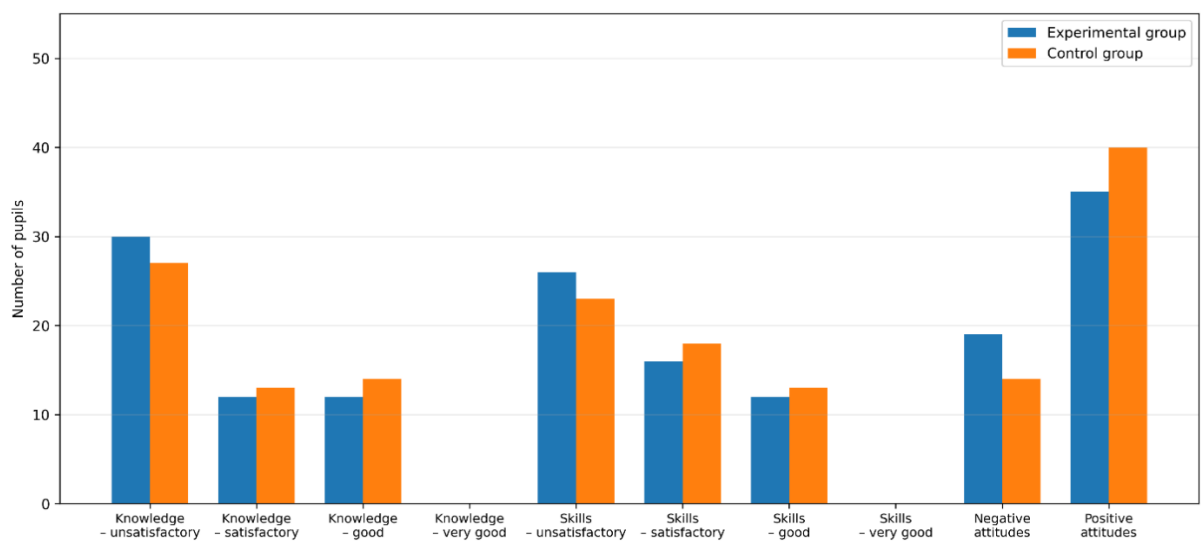


Figure 3. Distribution of pupils from the experimental and control groups across performance levels at pretest

The results of the **experimental group** highlight a consistent evolution across all three investigated dimensions. The mean values recorded at pretest and posttest, as well as the magnitude of progress for each of the three dimensions, are synthesised in Table 4.

Table 4. Evolution of Mean Scores in the Experimental Group

Dimension	Experimental T1	Experimental T2	Mean difference
Knowledge	$M = 2.30$	$M = 8.74$	+6.44
Self-assessed skills	$M = 10.28$	$M = 21.11$	+10.83
Attitudes	$M = 3.61$	$M = 4.22$	+0.61

In the case of *theoretical knowledge*, at pretest, 30 pupils were at the unsatisfactory level, 12 at the satisfactory level, and 12 at the good level, with no pupils at the very good level. At posttest, the distribution changed substantially: only 3 pupils remained at the unsatisfactory level, 7 at the satisfactory level, 16 reached the good level, and 28 reached the very good level. The mean

score increased from $M = 2,30$ to $M = 8,74$, and the paired-samples t-test indicated a statistically significant difference, $t(53) = 22,866$, $p < 0,001$. The result supports Hypothesis 4.

For the *self-assessed level of digital skills*, the distribution shifted towards the higher levels. Whereas at pretest 26 pupils were at the unsatisfactory level, 16 at the satisfactory level, and 12 at the good level, at posttest only 5 pupils remained at the unsatisfactory level and 5 at the satisfactory level, while 27 reached the good level and 17 the very good level. The mean score increased from $M = 10,28$ to $M = 21,11$, and the difference was statistically significant, $t(53) = 15,49$, $p < 0,001$. Hypothesis 5 is thus supported, with the results demonstrating an increase in pupils' perception of their own practical capacities to use technology.

The *attitudinal dimension* showed a favourable evolution. The number of pupils with a positive attitude increased from 35 to 49, while the number of pupils with a negative attitude decreased from 19 to 5. The mean increased from $M = 3,61$ to $M = 4,22$, and the paired-samples t-test indicated a statistically significant difference, $t(53) = 5,384$, $p < 0,001$. Hypothesis 6 is supported and indicates a consolidation of a more favourable and responsible attitude towards the use of technology.

The analysis of the **control group** provides the necessary basis for comparison. The evolution of the mean scores for the three dimensions in the control group is synthesised in Table 5.

Table 5. Evolution of Mean Scores in the Control Group

Dimension	Control T1	Control T2	Interpretation
Knowledge	$M = 2.44$	$M = 2.70$	Limited progress; statistically significant difference; H7 not supported
Self-assessed skills	$M = 11.35$	$M = 11.65$	No statistically significant difference; H8 supported
Attitudes	$M = 3.70$	$M = 3.78$	No statistically significant difference; H9 supported

In the case of *theoretical knowledge*, the number of pupils at the unsatisfactory level decreased from 27 to 26, the satisfactory level remained at 13, while the good level increased from 14 to 15; no pupil reached the very good level. The mean increased from $M = 2,44$ to $M = 2,70$. The paired-samples t-test indicated a statistically significant difference, but the magnitude of the progress was small. Consequently, Hypothesis 7 was assessed as unconfirmed, since, although a statistically significant change was recorded, it does not support the hypothesis concerning the maintenance of the initial level of knowledge and has a small magnitude in relation to the progress observed in the experimental group.

In the case of *self-assessed digital skills*, the control group recorded limited changes: the number of pupils at the unsatisfactory level decreased from 23 to 21, those at the satisfactory level increased from 18 to 19, and those at the good level from 13 to 14. No pupil reached the very good

level. The mean increased from $M = 11,35$ to $M = 11,65$, and the difference was not statistically significant, $t(53) = -1,315$, $p = 0,194$. Hypothesis 8 is supported, with the results indicating the absence of a significant change in the self-assessed level of digital skills in the control group.

At the *attitudinal level*, the control group showed an increase from 40 to 41 pupils with a positive attitude and a decrease from 14 to 13 pupils with a negative attitude. The mean increased from $M = 3,70$ to $M = 3,78$, and the difference was not statistically significant, $t(53) = 1,070$, $p = 0,289$. Hypothesis 9 is supported, with the results indicating the relative stability of the attitudinal level in the absence of the experimental intervention.

The comparison of the results of the two groups at **posttest** constitutes the decisive stage for assessing the effectiveness of the intervention. The differences between the groups for the three dimensions at the posttest are synthetically illustrated in Figure 4, which presents the distribution of pupils across performance levels.

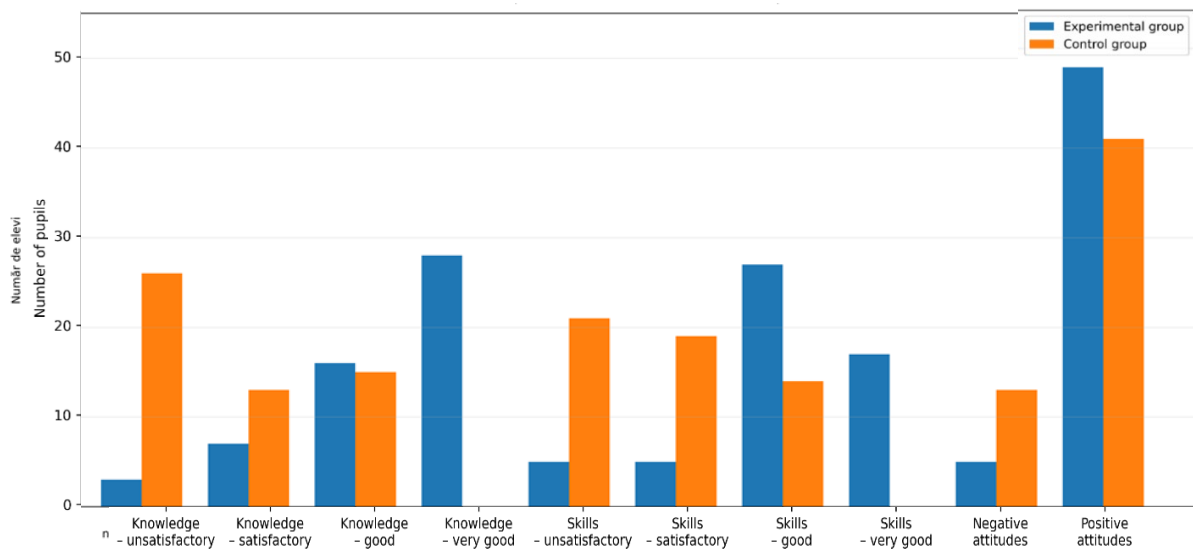


Figure 4. Distribution of Pupils from the Experimental and Control Groups by Performance Levels at Posttest

In the case of *theoretical knowledge*, the experimental group obtained $M = 8,74$, while the control group obtained $M = 2,70$. In the experimental group, 28 pupils reached the very good level and 16 the good level, whereas in the control group no pupil reached the very good level and 26 pupils remained at the unsatisfactory level. The difference between the groups was statistically significant, supporting Hypothesis 10.

For *self-assessed digital skills*, the experimental group obtained $M = 21,11$ at posttest, compared with $M = 11,65$ in the control group. In the experimental group, 27 pupils reached the good level and 17 the very good level, whereas in the control group 21 pupils remained at the unsatisfactory level, 19 at the satisfactory level, and 14 at the good level, with no pupils at the very

good level. The difference between the groups was statistically significant, supporting Hypothesis 11.

With regard to *attitudes*, 49 pupils in the experimental group displayed a positive attitude, compared with 41 in the control group. Only 5 pupils in the experimental group displayed a negative attitude, compared with 13 in the control group. The posttest means were $M = 4,22$ and $M = 3,78$, and the difference between the groups was statistically significant, supporting Hypothesis 12.

The results obtained highlight a differentiated evolution of the scores **in the two groups**, with more pronounced increases in the experimental group across all three dimensions assessed.

At the percentage level, the differences between the two groups are particularly suggestive. The percentage distribution of pupils across performance levels at **pretest and posttest** is presented in Figure 5, highlighting the progress of the experimental group and the relative maintenance of performance levels in the control group.

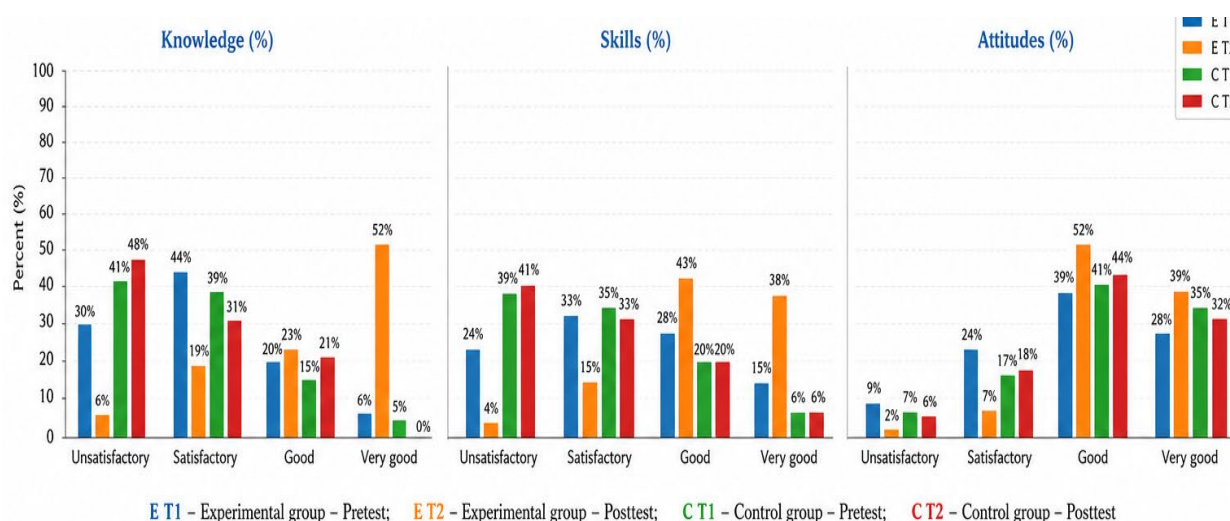


Figure 5. Percentage Distribution of Pupils by Performance Levels at Pretest and Posttest

Regarding *theoretical knowledge*, 52% of the pupils in the experimental group reached the very good level, whereas no pupil at this level was recorded in the control group; the unsatisfactory level was 6% in the experimental group, compared with 48% in the control group. For self-assessed skills, 81% of the pupils in the experimental group were at the good and very good levels, compared with 26% in the control group. Regarding attitudes, 91% of the pupils in the experimental group displayed positive attitudes, compared with 76% in the control group. These percentage differences complement the results of the statistical tests and support the pedagogical interpretation of the effect of the intervention.

The experimental verification of the pedagogical model was carried out through the 12 operational hypotheses, grouped into three categories: (1) the initial comparability of the groups, (2) the evolution of the experimental and control groups, and (3) the differences between the groups at posttest. The first three hypotheses confirmed the initial comparability of the groups. Hypotheses 4–6 highlighted significant progress in the experimental group in terms of knowledge, self-assessed skills, and attitudes. In the case of the control group, Hypotheses 8 and 9 were confirmed, while Hypothesis 7 was assessed as unconfirmed due to a statistically significant difference. The final three hypotheses highlighted differences in favour of the experimental group at posttest for all dimensions. The synthesised results of the verification of the 12 hypotheses are presented in Table 6.

Table 6. Summary of the Verification of the 12 Research Hypotheses

Hypothesis	Verification focus	Result
I1	Comparability of the groups at pretest – knowledge	Confirmed
I2	Comparability of the groups at pretest – self-assessed digital skills	Confirmed
I3	Comparability of the groups at pretest – attitudes	Confirmed
I4	Development of knowledge in the experimental group	Confirmed
I5	Development of self-assessed digital skills in the experimental group	Confirmed
I6	Development of attitudes in the experimental group	Confirmed
I7	Stability of knowledge in the control group	Not confirmed
I8	Stability of self-assessed digital skills in the control group	Confirmed
I9	Stability of attitudes in the control group	Confirmed
I10	Differences at posttest – knowledge	Confirmed
I11	Differences at posttest – self-assessed digital skills	Confirmed
I12	Differences at posttest – attitudes	Confirmed

Overall, 11 of the 12 hypotheses were confirmed, while one was unconfirmed. The central result is supported by the convergence of several types of evidence: the initial comparability of the groups, increases in the mean scores in the experimental group, the redistribution of pupils towards higher performance levels, differences between the groups at posttest, and the relative stability of the results in the control group. This convergence provides a consistent argument for the effectiveness of the pedagogical model and for the value of the proposed curricular intervention.

The results of the experiment must be interpreted in relation to the conception of the pedagogical model, which aimed at the integrated development of knowledge, skills, and attitudes. The increase in the level of theoretical knowledge indicates the acquisition of fundamental concepts and rules concerning the digital environment, devices, applications, and safety. The increase in the level of self-assessed skills reflects the consolidation of pupils' perception of their own abilities to use digital tools, in the context of practising these skills through the completion of tasks and the creation of digital products. The attitudinal progress indicates that the intervention

was not limited to the technical dimension, but also supported the development of more responsible behaviours and a more favourable attitude towards the use of technology in learning.

The experiment also highlighted the importance of systematic didactic design. The intervention did not consist of a succession of isolated digital activities, but of a curricular pathway organised around competences, content, learning activities, and assessment. The sequence of the four units enabled progression from familiarisation and knowledge to application, creation, and transfer. Continuous assessment, practical tasks, and the portfolio provided multiple contexts for demonstrating competences and observing progress.

From the perspective of validation, the results support the general hypothesis of the research and the interdisciplinary pedagogical model provides a curricular and methodological solution that can be transposed into educational practice, with the adaptations required by the particularities of each class and each school context.

The paper concludes with general conclusions and recommendations, which synthesise the main results of the scientific approach and reflect the achievement of the aim and objectives of the research, as well as the experimental verification of the hypothesis. The conclusions draw on the results of the theoretical analysis, the development and operationalisation of the pedagogical model for the interdisciplinary integration of digital education, and the pedagogical experiment conducted in the second and third grades. At the same time, the author's personal contributions are highlighted, with emphasis on the theoretical significance and applicative value of the results, on the possibilities of using the model in educational practice, and on the prospects for developing and extending research in the field of digital education.

GENERAL CONCLUSIONS AND RECOMMENDATIONS

1. The research conducted highlighted the importance of digital education as an integrative dimension of contemporary education and the need to develop digital competences from the primary education level. The analysis of the theoretical-conceptual, curricular, and normative framework demonstrated the transversal nature of digital competences and the need to overcome the limited approach to technology as a mere teaching tool.
2. One of the original contributions of the research consists in the development of the Pedagogical Model for an Interdisciplinary Approach to Digital Education (MPAIED), grounded in the competence-based curriculum paradigm, the principles of interdisciplinarity, and the psychopedagogical particularities of pupils in primary education. The model positions the optional school subject Digital Education as an integrative curricular core, around which content, learning experiences, and learning outcomes derived from different school subjects are used.
3. An important applicative contribution is represented by the design and implementation of the optional subject Digital Education for the second and third grades, as well as by the development of the curricular and methodological resources necessary for conducting teaching-learning-assessment activities. The content was organised in an interdisciplinary manner and oriented towards the integrated development of the knowledge, skills, and attitudes required for the responsible, effective, and creative use of digital technologies.
4. The results of the pedagogical experiment highlighted significant progress among the pupils in the experimental group, particularly with regard to theoretical knowledge, self-assessed digital skills, and attitudes towards the use of technology. The comparison of the results obtained at pretest and posttest revealed a favourable evolution of the experimental group: the mean score for knowledge increased from $M = 2,30$ to $M = 8,74$, for self-assessed skills from $M = 10,28$ to $M = 21,11$, and for attitudes from $M = 3,61$ to $M = 4,22$. In the control group, the changes recorded were limited. The results thus support the effectiveness of the pedagogical model and the proposed curricular intervention.
5. The analysis of the twelve operational hypotheses revealed differentiated results. Eleven of the hypotheses were confirmed, while one was unconfirmed. The hypotheses concerning the initial comparability of the groups and the evolution of the pupils in the experimental group were confirmed, whereas the results obtained for the control group did not support, in all cases, the hypotheses formulated regarding the absence of changes between pretest

and posttest. These results confirm the need to interpret statistical significance and the educational relevance of the observed differences concomitantly.

Overall, the research results support the general hypothesis, according to which the development of digital competences among primary school pupils can be fostered through the introduction of an optional subject in Digital Education and the implementation of an interdisciplinary pedagogical model, operationalised through a school curriculum constructed according to the same integrative logic.

The research presents certain **limitations**, determined by the sample size, the duration of the intervention, and the contextual nature of the implementation. These limitations do not invalidate the value of the results obtained, but indicate the need for further research conducted on larger samples, over longer periods, and in diverse school contexts.

Based on the research results, **it is recommended** to strengthen digital education in primary education, including through the use of the optional curricular offer and the development of programmes adapted to the age-specific particularities of pupils. It is also recommended to develop assessment instruments that enable the most objective possible measurement of digital knowledge, skills, and attitudes, to develop continuing professional development programmes for teachers aimed at the pedagogical integration of digital technologies, and to expand research on the development and retention of digital competences across the different stages of primary education.

REFERENCES

1. ALEXANDRU, M. E., SCODA, A.-D. Dezvoltarea competențelor digitale. Provocări și perspective actuale. În: *Revista de Pedagogie*. București: Centrul Național de Politici și Evaluare în Educație, 2020, vol. LXVIII, nr. 2, pp. 87–103. ISSN 0034-8678. DOI: 10.26755/RevPed/2020.2/87.
2. ANDERSON, L.W., KRATHWOHL, D.R. (eds.). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. New York: Longman, 2001. 352 p. ISBN 978-0321084057.
3. ARDELEAN, A., MÂNDRUȚ, O. (coord.). *Didactica formării competențelor*. Arad: „Vasile Goldiș” University Press, Centrul de Didactică și Educație Permanentă, 2012. 240 p. ISBN 978-973-664-578-5.
4. BAWDEN, D. *Digital Literacies: Concepts, Policies and Practices*. New York: Peter Lang Publishing, Inc., 2008, pp. 17-32. ISBN 978-1-4331-0168-7.
5. BĂDEANU, L. *Interdisciplinaritatea*. [online]. 23 apr. 2019 În: *Edict – Revista Educației*. [Citat: 21.05.2021]. Disponibil: <https://edict.ro/interdisciplinaritatea/>.
6. BROWN, J. S. Growing Up Digital: How the Web Changes Work, Education, and the Ways People Learn. Change. În: *The Magazine of Higher Learning*. vol. 32, nr. 2, pp. 10–20. ISSN 0009-1383.
7. BURLACU, N., IRIMICIUC, S.D. Validarea conceptului STE(A)M din perspectiva modelelor ecosistemice de învățare. În: *Proceedings of the 15th National Conference of Virtual Learning*, 2018, pp. 120–126.
8. CIOBANU, C., CUCOȘ, C., ISTRATE, O., PÂNIȘOARĂ, I.O. *Educația digitală*. Ediția a II-a revăzută și adăugită. Iași: Polirom, 2022. 512 p. ISBN 978-973-46-8938-5.
9. CHIRIAC, T. Pedagogia digitală: Dimensiuni și repere conceptuale. În: *Proceedings of the 31th Conference on Applied and Industrial Mathematics, Education CAIM 2024*, Oradea, Romania, September 19-22, 2024. pp. 78-85. ISSN 3061-3477.
10. COROI, M. D. Impactul unui opțional de Educație digitală asupra formării competențelor digitale la elevii din ciclul primar. În: *Acta et Commentationes, Sciences of Education*, Nr. 4(42), 2025. Chișinău: Universitatea Pedagogică de Stat „Ion Creangă”, 2025. pp. 91-102. ISSN 1857-0623. CZU: 373.3:004. DOI: 10.36120/2587-3636.v42i4.91-102.
11. COROI, M. D. Implementation of digital education in primary school from an interdisciplinary perspective. *International Conference on Virtual Learning*, vol. 21, pp. 213-224, 2026. ISSN 2971-9291, ISSN-L 1844-8933. Disponibil: <https://doi.org/10.58503/ievl-v21y202618>.
12. COSGROVE, J., CACHIA, R. *DigComp 3.0: European Digital Competence Framework. Fifth Edition*. [online]. Luxembourg: Publications Office of the European Union, 2025. ISBN 978-92-68-32677-0. DOI: 10.2760/0001149. [Citat: 22.09.2026]. Disponibil: <https://publications.jrc.ec.europa.eu/repository/handle/JRC144121>.
13. CROXALL, B. MLA Digital Pedagogy Unconference, 2013. În: *BRAUN, A., MARZ et al. (eds.). Rethinking Education in the Digital Age*. Bruxelles: EPRS, 2020.
14. DUBINEANSCHI, T. Oportunități de valorificare a învățării personalizate la nivelul primar de învățământ. În: *Știință și educație: noi abordări și perspective. Materialele Conferinței Științifice Naționale cu Participare Internațională, 24–25 martie 2023. Volumul II*. Chișinău:

- Universitatea Pedagogică de Stat „Ion Creangă”, 2023, pp. 280–284. ISBN 978-9975-46-729-2. DOI: 10.46727/c.v2.24-25-03-2023.p280-284.
15. EUROPEAN COMMISSION, EURYDICE. Key Data on Digital Education in Europe. Luxembourg: Publications Office of the European Union, 2023. ISBN 978-92-9482-711-2.
16. EUROPEAN COMMISSION. *Romania 2025 Digital Decade Country Report*. [online]. Brussels: European Commission, 2025. [Citat: 29.05.2026]. Disponibil: [Romania 2025 Digital Decade Country Report](#).
17. EUROPEAN COMMISSION. *Recommendation of the European Parliament and of the Council of 18 December 2006 on key competences for lifelong learning*. [online]. Official Journal of the European Union, L 394/10, 30 dec. 2006 [Citat: 12.07.2021]. Disponibil: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32006H0962>.
18. GILSTER, P. Digital Literacy. New York: Wiley Computer Publishing, 1997. 244 p. ISBN 978-0-471-16520-4.
19. ISTRATE, O., VELEA, S., CEOBANU, C. Pedagogie digitală. Iași: Polirom, 2025. ISBN 978-630-344-115-3.
20. MINISTERUL EDUCAȚIEI. Repere pentru proiectarea, actualizarea și evaluarea Curriculumului Național. Cadru de referință al Curriculumului Național. București: Monitorul Oficial, 2021. OME nr. 3239/2021.
21. MINISTERUL EDUCAȚIEI. Strategia privind digitalizarea educației din România – SMART.Edu. București: Ministerul Educației, 2021 [online]. [Citat: 15.07.2022]. Disponibil: <https://www.edu.ro/SMARTedu>.
22. MINISTERUL EDUCAȚIEI. Profilul de formare al absolventului. București: Monitorul Oficial al României, Partea I, Nr. 1099/6.XII.2023. OME nr. 6731/2023.
23. NICOLESCU, B. Transdisciplinaritatea. Manifest. Iași: Junimea, 2007. 177 p. ISBN 9789733712237.
24. PAVEL, M. Digital pedagogy: concepts, theories and models. *Acta et Commentationes. Științe ale Educației*. Chișinău, 2025, vol. 41, nr. 3, pp. 34–43. ISSN 1857-0623. DOI: 10.36120/2587-3636.v41i3.34-43.
25. PIAGET, J. Psychology and Pedagogy. New York: Viking Press, 1972.
26. REDECKER, C. *European Framework for the Digital Competence of Educators: DigCompEdu (EUR 28775 EN)*. [online]. Luxembourg: Publications Office of the European Union, 2017 [Citat: 16.10.2024]. Disponibil: <https://doi.org/10.2760/159770>.
27. TUNEGARU, C. Online Schooling in Rural Areas in Romania during the Pandemic: Teachers’ Perspectives. *Revista de Pedagogie*, 69(2), (2021). pp. 101-120. <https://doi.org/10.26755/RevPed/2021.2/101>.
28. VYGOTSKY, L. S. Mind in Society: The Development of Higher Psychological Processes. Cambridge, MA: Harvard University Press, 1978.
29. VUORIKARI, R., KLUZER, S., PUNIE, Y. *DigComp 2.2: The Digital Competence Framework for Citizens. With new examples of knowledge, skills and attitudes*. [online]. Luxembourg: Publications Office of the European Union, 2022. ISBN 978-92-76-48882-8. DOI: 10.2760/115376. [Citat: 14.08.2023]. Disponibil: <https://publications.jrc.ec.europa.eu/repository/handle/JRC128415>.

LIST OF THE AUTHOR'S PUBLICATIONS ON THE RESEARCH TOPIC

Articles in Scientific Journals:

1. COROI, M. D., CHIRIAC, T. Ecosisteme de educație digitală în învățământul primar: perspective comparative. In: *Revista de Știință, Inovare, Cultură și Artă „Akademos”*, 2026, nr. 1(80), pp. 162-172. ISSN 1857-0461. CZU: 373.3:004(498:478). (Categorie B) DOI: <https://doi.org/10.52673/18570461.26.1-80.20>.
2. COROI, M. D. Impactul unui opțional de Educație digitală asupra formării competențelor digitale la elevii din ciclul primar. În: *Acta et Commentationes, Sciences of Education, Nr. 4(42)*, 2025. Chișinău: Universitatea Pedagogică de Stat „Ion Creangă”, 2025. pp. 91-102. ISSN 1857-0623. CZU: 373.3:004. DOI: 10.36120/2587-3636.v42i4.91-102. <https://orcid.org/0000-0002-5837-6874>.
3. COROI, M. D. Competența digitală în învățământul primar european: direcții strategice, implementare națională și comparații de modele curriculare. / Digital competence in European primary education: strategic directions, national implementation and comparisons of curricular models În: *Acta et Commentationes, Sciences of Education, Nr. 3(41)*, 2025. Chișinău: Universitatea Pedagogică de Stat „Ion Creangă”, 2025. pp. 135 – 146. ISSN: 1857-0623. CZU: 373.3:004:37.091. DOI: 10.36120/2587-3636.v41i3.135-146. <https://orcid.org/0000-0002-5837-6874>.
4. COROI, M. D. The role of digital education in the school curriculum. În: *Journal of Romanian Literary Studies, Issue no. 37/2024*. Arhipelag XXI Press, Târgu Mureș, România, 2024. p. 426 – 432. ISSN: 2248-3004. <https://www.asociatia-alpha.ro/Jrnl/037-2024/Jrnl-037-058.pdf>.
5. CHIRIAC, T. COROI, M. D. Structurarea conținuturilor în predarea interdisciplinară a educației digitale la clasele primare./ Structuring Content in the Interdisciplinary Teaching of Digital Literacy in Primary School. p. 34 – 39. În: *Revista Didactica Pro nr. 4 (146) august 2024*. Chișinău: Centrul Educațional Pro Didactica, 2024. ISSN: 1810-6455. https://www.prodidactica.md/revista/Revista_146_Cuprins.pdf.

Articles in Proceedings of Conferences and Scientific Events:

1. COROI, M. D. Implementation of digital education in primary school from an interdisciplinary perspective. *International Conference on Virtual Learning*, ISSN 2971-9291, ISSN-L 1844-8933, vol. 21, pp. 213-224, 2026. <https://doi.org/10.58503/icvl-v21y202618>.
2. COROI, M. D. Modelul curricular de educație digitală pentru clasele primare. / Digital education curriculum model for primary grades. CZU: 373.3.091.214:004. In: *Probleme actuale ale științelor umanistice: Materiale ale Conferinței științifice anuale a doctoranzilor cu participare internațională*, 11 mai, 2023, Chișinău.
3. COROI, M. D. Abordarea conținuturilor de învățare prin intermediul tehnologiei. / The approach of learning content through technology. CZU: 37.01:004 DOI: 10.46728/c.v2.25-03-2022.p252-258. În: *Probleme ale științelor socioumanistice și ale modernizării învățământului: Materialele conferinței științifice naționale cu participare internațională*. 25 martie, 2022. Seria XXIV. Volumul II. Chișinău: CEP UPSC, 2022. 324 p. ISBN: 978-9975-46-651-6.
4. COROI, M. D. Accesul școlarului mic la educația digitală în învățarea online. / Young student's access to digital education in online learning. CZU:373.3:004. p.308 – 312. În: *Educația privind drepturile copilului: experiențe și perspective în învățământul preșcolar și primar: Materiale ale*

conferinței științifice internaționale, 26.11.2021. Chișinău: CEP UPS, 2022. 427 p. ISBN: 978-9975-46-617-2.

5. COROI, M. D. Importanța alfabetizării digitale în învățământul primar / The importance of digital literacy in primary education. CZU: 373.3.025:004 DOI: 10.46728/c.18-06-2021.p177-181. În: Condiții pedagogice de optimizare a învățării în post criză pandemică prin prisma dezvoltării gândirii științifice: Materialele conferinței științifice internaționale, 22 iunie, 2021. Chișinău: S. n., 2021 (CEP UPS "Ion Creangă"). 310 p. ISBN: 978-9975-46-541-0.

Other Works:

1. COROI, M. D. Curriculum la decizia școlii: Educație digitală. Programă școlară. Suport de curs clasele a II-a și a III-a. / Curriculum at the school's discretion: Digital education. School curriculum. Course material for grades 2 and 3. Piatra – Neamț: Cetatea Doamnei, 2024. 64 p. ISBN: 978-606-643-712-7.

ANNOTATION

Coroi Marinela Diana

Interdisciplinary Approach to Digital Education in Primary Education

PhD thesis in Educational Sciences, Chişinău, 2026

Thesis structure: introduction, three chapters, general conclusions and recommendations, bibliography comprising 203 references, 8 appendices, 123 pages of main text, 26 figures, and 52 tables. The research findings have been published in 14 scientific papers.

Keywords: digital education, digital pedagogy, digital literacy, digital education ecosystem, digital competence, e-learning, online learning, curriculum, contents, interdisciplinary approach.

Field of study: Educational Sciences. School Didactics (by levels and subjects).

Research aim: to provide the theoretical and methodological foundation, develop and experimentally validate a pedagogical model for the interdisciplinary integration of Digital Education in primary education, oriented towards the development of pupils' digital competences.

Research objectives: (1) establishing the theoretical-conceptual framework of digital education and digital competence in primary education, (2) determining the psychopedagogical and methodological foundations of the interdisciplinary integration of digital education; (3) developing the pedagogical model for the interdisciplinary integration of digital education; (4) designing the curricular and didactic methodology for its implementation through the optional subject Digital Education; (5) experimentally validating the effectiveness of the model and the developed methodology.

Scientific novelty and originality consist in: (1) conceiving and substantiating an original pedagogical model for the interdisciplinary integration of digital education in primary education; (2) operationalising the model through the curricular and methodological design of the optional subject Digital Education; (3) experimentally validating the effectiveness of the model in the second and third grades, with a view to the progressive development of pupils' digital competences through the interdisciplinary integration of content specific to the field of digital technologies.

The main result contributing to the advancement of knowledge in this field is the development, operationalization, and experimental validation of a pedagogical model for the interdisciplinary integration of digital education in primary education, complemented by a methodological framework for its implementation and aimed at the progressive development of students' digital competencies.

Theoretical significance of the research lies in developing the conceptual and theoretical-methodological framework concerning the interdisciplinary integration of digital education in primary education and in substantiating the pedagogical principles support the development of digital competences among primary school pupils.

The practical value of the research results from the development and operationalisation of the optional subject Digital Education, the school curriculum, didactic planning documents, and the related curricular and methodological resources, as well as from the experimental validation, in the second and third grades, of the applicability of the pedagogical model in real educational contexts.

Implementation of research results was carried out within the pedagogical experiment implemented on the basis of the experimental sample, which included pupils from the second and third grades of Avrămeni Secondary School No. 1 and Manoleasa Secondary School No. 1, Botoşani County, Romania. The theoretical and practical results were disseminated through methodological and scientific activities organised within the Teachers' Pedagogical Circle or published in specialised journals and presented at international and national scientific conferences.

COROI, MARINELA DIANA

**INTERDISCIPLINARY APPROACH TO DIGITAL EDUCATION
IN PRIMARY EDUCATION**

**Speciality: 532.02 - School Didactics by Educational Levels and Subjects
(Information and Communication Technology)**

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