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TEACHERS' READINESS TO INTEGRATE DIGITAL TECHNOLOGY INTO THE TEACHING PROCESS

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Abstract

In recent years, the rapid development of digital technology has led to profound changes in the design and materialization of the educational process. The integration of digital technology into teaching and learning activities is no longer just a methodological option, but an essential skill for today's teachers. However, the level of teacher training varies considerably, influenced by several factors, including basic technical skills, attitudes toward technology, and experience with digital applications and platforms. In this context, a systematic analysis is needed of how teachers perceive and express their digital competences, as well as how those are reflected in their teaching practice. The purpose of the research was to assess the teachers' readiness to introduce and integrate digital technology into the teaching process. To do this, a bidimensional model has been developed that features two dimensions: digital literacy and experience in using digital technology. The model has been tested on a sample of 579 Romanian teachers, and the results show a relatively low level of digital literacy and experience with digital technology. The group analysis revealed significant differences between teachers from urban and rural areas.

Keywords: digital literacy, digital technology, exploratory research, teaching process

Introduction

The actual education is undergoing a period of profound reconfiguration and transformation, in line with the societal evolution and demands of a labor market dominated by digitization. Digital native students have different needs, expectations, learning rhythms, and methods, which require the adaptation of both content and teaching strategies. In this context, technology is no longer just an auxiliary tool but becomes a learning environment in itself, in which the teacher acts as a mediator of knowledge, a facilitator of learning, a creator of resources, and a designer of learning experiences. The intelligent integration of digital resources, the development of transversal competences, and the promotion of autonomous learning thus become essential benchmarks for relevant and sustainable education.

In Romania, digitization in education has become a strategic priority, both in public policy documents and in the modernization of school infrastructure. In this respect, between 2021 and 2027, the Ministry of Education implements the National Strategy for the Digitalization of Education in Romania - SMART-Edu (Modern, Accessible School, based on Digital Resources and Technologies) (<https://www.smart.edu.ro/>), which includes several areas of action: developing students' digital skills, developing teachers' digital competences, improving digital infrastructure and connectivity, disseminating open educational resources, improving cybersecurity etc. to build an educational ecosystem capable of responding to the new challenges of the digital world.

Under the National Recovery and Resilience Plan, Component 15 - Education / Reform 5, the Ministry of Education allocates funds to equip schools with digital equipment and to train teachers to develop digital skills through the training program *Digital Pedagogy and Innovation in the Contemporary School*. Romania is thus aligning with European guidelines on modernizing education through digitization, promoting the development of digital skills, equitable access to technological resources, and the integration of innovative teaching practices that harness the potential of new technologies.

Digital pedagogy involves much more than simply using digital tools in teaching. The integration and strategic use of technology requires a deep understanding of how technology can support active, collaborative, and differentiated learning, transforming digital tools from simple technical means into catalysts for educational progress. Currently, teachers use digital technology in the classroom, but not all of them manage to optimize the teaching and learning process fully. Also, the degree of familiarity with digital technology, as well as its actual use, varies, and there are few studies that measure this in the Romanian context.

Taking into account the above-mentioned considerations aligned with the recent policies of the Romanian Ministry of Education, this study aimed to explore the teachers' readiness for introducing and integrating digital technology into the teaching process. This research was carried out through the "*Digital Innovation in Pre-university Education*" project (<https://www.digiped.ro/>), managed by Valahia University of Târgoviște, Romania. In this project, the training sessions have been organized into 6 units, with teachers interacting with their trainers both in synchronous and asynchronous modes. The asynchronous channel was mediated through the *Moodle* platform, offering teachers the opportunity to access learning materials, interact with teachers and colleagues, and receive specific tasks (Gorghiu et al., 2009).

Related Work

The integration of digital technologies in education has considerable potential to optimize teaching and learning by facilitating student engagement, collaboration, autonomy, and learning self-regulation. Digital tools can increase students' interest and motivation to learn, allowing, at the same time, the personalization of each student's educational path (Zou et al., 2025). However, their effectiveness depends on coherent pedagogical integration, the level of digital competence of teachers and students, and rigorous planning. More challenges, such as distractions, cognitive overload, or inequalities in access, must be carefully managed so that digitization brings real benefits to all students (Forsström et al., 2025).

Digital competence encompasses a set of interdependent skills for accessing, exploring, understanding, evaluating, producing, and responsibly disseminating information using digital technologies (Forsström et al., 2025). Yazon et al. (2019) considered that a central element is information manipulation, i.e., the ability to evaluate, organize, and apply digital data in a relevant and functional way. Zou et al. (2025) stated that nowadays students interact with an increasingly complex digital landscape; in this context, schools must develop the skills they need to critically evaluate information, collaborate, and create content in the digital environment.

Research on the integration of technology in education has generated several models and theories to assess teachers' digital competence. Mohebi (2021) analyzed several models frequently used in literature to explain the integration of interactive technologies in teaching: Teacher Thoughts and Action Process (TTAP), Theory of Planned Behaviour (TPB), Expectancy-Value Theory of Achievement Motivation (EVTAM), Substitution Augmentation Modification Redefinition (SAMR), Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), and Technological Pedagogical and Content Knowledge (TPACK).

The study of Mohebi (2021) argued that for the effectiveness of technology, teachers must be prepared not only technically but also pedagogically. Therefore, the training process needs to target both the development of technological skills (using tools) and the ability to pedagogically integrate technology into teaching, lesson planning, and assessment.

In line with Mohebi (2021), Fernández-Sánchez et al. (2022) found that although many teachers have positive attitudes toward technology, they tend to focus more on the tools used and less on the pedagogical value they bring. The study emphasized that the integration of technology must be driven by pedagogical objectives, not just by the pressure to adopt modern gadgets because others are doing it. Thus, there is a need for clearly defined pedagogical models to guide the integration of technology into the teaching process.

Research conducted by Aleksieva et al. (2025) analyzed how primary school teachers integrate technology into their daily work, seeking to compare stated intentions with actual classroom practices. Although teachers mentioned that they intended to promote student-centered approaches, encourage collaboration, and develop digital skills, direct observations illustrated that such objectives were only partially introduced into practice. The results highlight a consistent discrepancy between teachers' aspirations for adopting innovative approaches and the realities of their implementation in the classroom, where there remains a significant reliance on familiar and perceived safe technological tools.

Consoli et al. (2025) emphasize that integrating technology into the teaching process should not focus exclusively on the frequency of its use in teaching activities, but also on the quality of its incorporation into instructional practice. Thus, they developed and validated a tool (TIQS) to measure students' perceptions of how technology supports four dimensions of teaching quality: learning support, classroom management, individualized teaching, and cognitive activation. The results support the generic theory of teaching quality (Three Basic Dimensions, TBD - Praetorius et al., 2018) and suggest that it is necessary to explore the interactions between those dimensions to fully understand the effects of technological integration.

Raave et al. (2024) explored how and why teachers in Estonian schools integrate digital technology into their teaching and learning activities; they identified six teacher profiles based on how they integrate technology and their motivations: motivating facilitators, depth facilitators, efficiency engineers, engaging innovators, depth divers, and motivating traditionalists.

A recent study of Li (2025) explored the digital divide with respect to technology integration in Chinese primary schools and found significant differences between urban and rural areas. Since rural teachers showed lower proficiency and attitude, suggesting the effort should be made for an equitable policy making. A similar digital divide has been analyzed by Ahiaku et al. (2025), which was mainly due to the poor infrastructure of schools in rural areas, leading to a disconnection from the Internet.

Regarding the level of teachers' readiness to integrate digital technologies into the educational process, research conducted by Warsi & Rani (2024) and Laius & Orgusaar (2025) indicates that teachers generally recognize the role and positive impact of digital technologies on the effectiveness of teaching and on student outcomes. However, the effective integration of technology into teaching is often limited by a number of structural and professional factors, such as insufficient technological infrastructure, a lack of practical training opportunities in digital skills, and limited access to relevant professional development programs. In this context, the authors emphasize the need to strengthen teachers' digital competencies through systematic continuing education programs, supported by institutional investments in technological resources and educational policies that support the effective integration of digital technologies into contemporary teaching practices.

Two research questions guided this study:

RQ1: What is the level of teachers' readiness to introduce and integrate digital technology into the teaching process?

RQ2: Are there differences as regards digital literacy and experience with digital technologies between teachers from urban and rural areas?

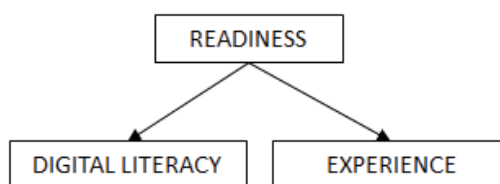
To answer these questions, a bidimensional model has been proposed that features two dimensions: digital literacy and teachers' experience of integrating digital applications into the teaching process. The model was tested on a sample of teachers enrolled in the above training program.

Research Methodology

Model and Operationalization

The teachers' readiness for integrating digital technologies into the teaching process (TR) has been conceptualized as a second-order factor that loads on two dimensions (first-order constructs): experience in using the digital technology (DL) and practice of integrating the digital technology into the teaching process (EXP). The research model is presented in Figure 1.

Figure 1
Research Model



The first dimension refers to basic knowledge, such as familiarity with technology and ease of use. The second refers to the experience of using technology in the teaching process, more specifically, the integration of various digital instruments and tools in teaching and assessment.

The constructs and measures are presented in Table 1.

Table 1
Questionnaire

Item	Question
DL1	How familiar are you with digital tools?
DL2	How easy do you find the integration of technology in the teaching process?
DL3	How easy do you find learning about new digital tools on your own?
EXP1	How often do you use educational platforms in your teaching?
EXP2	How often do you integrate digital assessments into the learning process?
EXP3	To what extent do you experiment with new technologies or applications in teaching?

Procedure and Sample

To collect data, the questionnaire was administered in April-October 2025 to teachers enrolled in the teachers' training program. Participant teachers were asked to answer questions concerning their skills and experience related to the use of digital technology on a 5-point

Likert scale. A total of 579 questionnaires have been received. After checking the responses for completeness, 138 were eliminated, resulting in a working sample of 441 observations.

Most of the participants (95%) are women (22 M/ 419 F). Regarding school experience, 71 have less than 8 years, 73 between 8 and 15 years, 187 between 16 and 25 years, and 110 over 25 years. A total of 261 teachers are from schools in the urban area, while 180 are from schools in the rural area.

Ethical considerations were respected throughout the research process. Participation was voluntary and based on informed consent. Teachers were informed about the purpose of the study, the anonymous nature of the questionnaire, and their right to withdraw at any time without repercussions. No personally identifiable information was collected, and all responses were treated confidentially. The data was stored securely and used exclusively for academic research purposes, in accordance with current data protection regulations.

Data Analysis

Unidimensionality of first-order constructs has been assessed by examining factor loadings. Convergent validity has been assessed according to the recommended thresholds in the literature (Fornell & Larcker, 1981; Hair et al., 2006), specifically in terms of loading magnitude, construct reliability (CR), and average variance extracted (AVE). Discriminant validity is less relevant here since the dimensions are expected to be highly correlated (Koufteros et al., 2009).

The model fit with the data has been assessed by using the following goodness of fit (GOF) indices, as recommended by Hair et al., 2006: chi-square (χ^2), degrees of freedom (df), χ^2/df , comparative fit index (CFI), non-normed fit index ($NNFI$), the goodness of fit index (GFI), root mean square error of approximation ($RMSEA$), and standardized root mean square residual ($SRMR$).

In this study, differences between urban/rural areas were analyzed. An invariance analysis has been carried out to assess whether the latent variables are equivalent across groups (Byrne, 2010; Vandenberg and Lance, 2000). Lack of invariance makes it impossible to state that differences are due to different perceptions and not to different interpretations of the evaluation instrument (Vandenberg and Lance, 2000).

The model was estimated with LISREL 9.3 for Windows (Mels, 2006), using the maximum likelihood estimation method.

Research Results

Model Testing Results

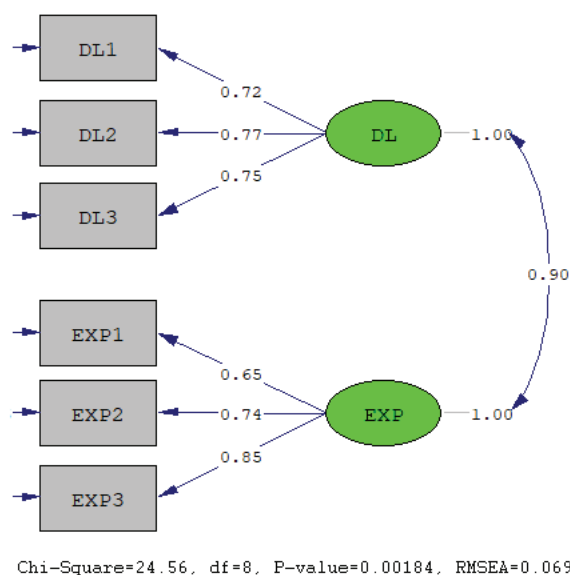
The mean values of digital literacy measures are relatively low, lying in the range 3.46-3.60, a little bit higher than the neutral value, which shows that many teachers are not familiar with digital technology and find it difficult to use. The frequency of using educational platforms and integrating digital assessments in the learning process is around the neutral value, showing that this is not a current practice. The frequency of integrating technology in the teaching process is 3.50, a little bit higher than the latter measures, but still relatively low. The convergent validity, descriptives, and factor loadings are presented in Table 2.

Table 2
Convergent Validity, Descriptives, and Factor Loadings (N = 441)

Construct	CR	AVE	Item	M	SD	Loading
DL	.791	.558	DL1	3.60	0.79	0.72
			DL2	3.55	0.83	0.77
			DL3	3.46	0.94	0.75
EXP	.783	.564	EXP1	3.10	0.94	0.65
			EXP2	2.98	0.90	0.74
			EXP3	3.50	0.76	0.85

Factor loadings are all over 0.6, showing unidimensionality and a good relationship between the construct and its measures. As presented in Table 2, composite reliability (CR) is greater than 0.7, and the average variance extracted is greater than 0.5, thus showing good convergent validity.

Figure 2
Model Estimation Results (N=441)



The results of model testing are presented in Figure 2. Testing the bidimensional model revealed an acceptable fit of the model with the data: $\chi^2 = 24.56$, $df = 8$, $p = .00184$, $\chi^2 / df = 3.19$, RMSEA = 0.069, CFI = 0.985, NNFI = 0.979, GFI = 0.982, SRMR = 0.0255.

Invariance Analysis

Before starting invariance analysis, the model should be tested for each group. The results presented in Table 3 show a good fit of the model with the data for both urban and rural samples.

Table 3

Model Estimation Results for the Urban (N=261) and Rural (N=180) Samples

Samples	χ^2	DF	CFI	NNFI	GFI	RMSEA	SRMR
Urban	10.92	8	0.994	0.989	0.982	0.045	0.0268
Rural	15.31	8	0.988	0.977	0.981	0.053	0.0276
Unconstrained	26.33	16	0.994	0.989	0.982	0.054	0.0208

In the first step, a multi-group CFA (MGCFA) has been conducted to check if the scale is invariant across areas. MGCFA is based on testing a hierarchical series of nested models, starting with a baseline (unconstrained) model that fits both samples together, from which a baseline chi-square value is derived. Model testing results showed a good fit of the unconstrained model with the data.

The next step was to test the metric invariance by constraining the loadings to be equivalent. The model comparison in Table 4 shows a nonsignificant chi-square difference ($\Delta\chi^2 = 4.461$, $\Delta DF = 4$, $p = 0.347$), which means that the model has been perceived in the same way in each group.

Testing the scalar invariance was done by constraining the intercepts to be equivalent. The model comparison showed a significant chi-square difference ($\Delta\chi^2 = 13.625$, $\Delta df = 6$, $p = .034$). Therefore, the depreciation of CFI has been examined according to the criterion of Cheung and Rensvold (2002). Since the depreciation is higher than 0.01, the model doesn't have scalar invariance. Nevertheless, the metric invariance enables the analysis of differences between observed variables.

Table 4

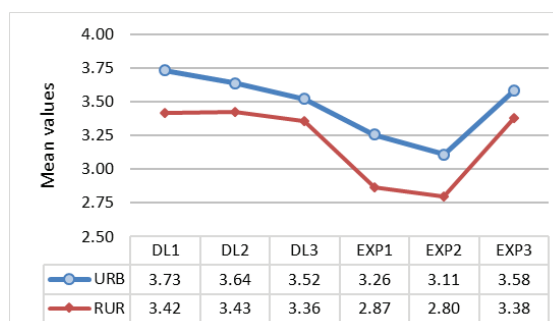
Model Comparison

Model	χ^2	df	CFI	$\Delta\chi^2$	Δdf	ΔCFI	p
unconstraint	26.33	16	0.994				
Metric invariance	30.79	20	0.994	4.462	4	0.000	0.347
Scalar invariance	44.42	26	0.980	13.63	6	-0.014	0.034

Analysis of Group Differences

The mean values of variables in each group are presented in Figure 3. As could be noticed, teachers from the urban area reported much higher digital literacy and experience than teachers from the rural area.

Figure 3
Area Differences



A one-way ANOVA (1, 439, 440) showed that the differences are significant for DL1 ($F_{17.27}, p < .001$), DL2 ($F = 6.96, p = .009$), EXP1 ($F = 19.30, p < .001$), EXP2 ($F = 13.06, p < .001$), and EXP3 ($F = 7.41, p = .007$). The only variable for which the difference is not statistically significant is DL3 (learning about new technologies).

Discussion

This study provides an important contribution by exploring how teachers perceive and express their digital competences, as well as how those competences manifest themselves in daily teaching practice. The results show that the two-factor structure of the model is well supported, highlighting distinct differences and trends across educational settings, and providing a holistic perspective on how technology is currently integrated into Romanian schools.

The two-dimensional model of teacher training for the integration of digital technology into education covered both digital literacy and practical experience in using technological tools. Through this approach, the study provides an understanding of how the level of digital competence influences teaching strategies, openness to innovation, and the ability to adapt to the demands of contemporary education. The results highlight differences between educational environments, but also areas of convergence, thus contributing to a coherent picture of the current state of technology integration in Romanian schools.

With respect to digital literacy, the obtained values indicate that many teachers are not familiar with digital technology and find it difficult to use. The frequency of use of educational platforms and the integration of digital assessments into the learning process is around neutral, which shows that this is not a common practice. The frequency of integrating technology into the teaching process is slightly higher than the latter measures, but still relatively low.

Although teachers have had to use technology in the teaching process during the pandemic, digital literacy means much more than simply using devices in teaching. Digital literacy involves a complex set of skills, attitudes, and practices that enable the conscious, pedagogical, and ethical integration of technology into the educational process. Teachers with developed digital skills understand how technology works and its learning potential; critically select digital resources, assessing their quality, relevance, and credibility; uses digital tools pedagogically, not just technically, i.e., integrates them to improve learning, differentiation, assessment, or collaboration; develops strategies for online communication and collaboration with students, parents, and colleagues; adheres to the principles of digital safety, protecting personal data and promoting responsible behavior in the online environment; creates and adapts digital content, using tools that stimulate critical thinking, creativity, and student autonomy; reflects on their own digital practices, continuously updates their skills, and follows the

evolution of educational technologies. These competences must be developed through coherent professional development programs, a conclusion that aligns with the results of several studies (Consoli et al., 2025; Mohebi, 2021; Fernández-Sánchez et al., 2022).

The second dimension of the proposed model - the experience of technology integration - involves more than the occasional use of digital tools and refers to how the teacher manages to use technology coherently, relevantly, and intentionally to support learning, in lesson planning, in choosing optimal teaching strategies, in feedback, and evaluation. The mean values of measures are relatively low, proving the relevance of the program. As expected, digital literacy exhibits larger mean values, except for the last item, which shows the teachers' interest in experimenting with new technologies and the motivation to change something in their teaching methods.

Another finding is given by the invariance analysis, which reveals significant differences between teachers from urban and rural areas. In the former case, teachers are more familiar and experienced with integrating digital technologies into the teaching process. This digital divide is a critical issue that has also been highlighted in recent studies (Ahiaku et al., 2025; Li, 2025).

In Romania, urban area teachers generally benefit from better infrastructure, consistent high-speed internet, and more frequent peer-to-peer professional development. In this respect, it is expected that urban area schools (especially in major cities) may develop a *culture of innovation* framework, where digital tools are woven into the curriculum. On the other hand, unfortunately, in many situations, rural teachers still fight with an important level of *technological isolation*. Even if the schools are digitally equipped, a lack of technical support or localized training leads to using technology mainly for administrative tasks rather than transformative teaching.

However, despite the relatively low mean values and significant differences, teachers show a promising level of interest in familiarizing themselves with new technologies. This convergence may reflect a common intrinsic motivation for professional development, awareness of the importance of digital literacy, or the existence of comparable institutional expectations regarding the development of technological skills in both urban and rural schools. It is also important to think about the impact on students' outcomes: if a teacher is not experienced (or even familiar) with digital tools, the students miss out on digital literacy skills (required for the actual labor market) or access to collaborative projects and various digital resources.

To improve the teachers' digital skills, it is crucial to extend their continuous professional development to the following stage, which particularly introduces specific classroom contexts designed for different levels of school education. Training should focus on the intersection of technology, pedagogy, and subject matter, providing sensory and motivational experiences while addressing students' learning needs and expanding their digital literacy. These findings are consistent with the results of other recent studies (Warsi & Rani, 2024; Laius & Orgusaar, 2025).

This study is exploratory and has inherent limitations related to the research sample since the participants represent a cohort of teachers selected by one institution. Another limitation concerns the small number of variables. Further research could include other variables that influence the teacher's readiness for integrating digital technologies into the teaching process: the teacher's self-efficacy, the anxiety felt when forced to adapt to rapidly changing digital environments (as internal factors), or the institutional leadership support and the school's technical conditions and environment (as external factors).

Conclusions and Implications

The current research aimed to examine how teachers relate to technology in their teaching activities. The integration of technology into the teaching process is no longer

merely a methodological option but a necessity driven by the profound transformations of the contemporary educational environment and the demands of the digital society. Although educational institutions in Romania have been equipped with digital devices in recent years, the level of teacher preparedness varies considerably, influenced by several factors: basic technical skills, attitudes toward technology, and experience with digital applications and platforms. The two-dimensional model developed in this study focused on two important dimensions: teachers' digital literacy and their experience using digital technology in teaching. The results revealed a relatively low level of digital literacy and experience, confirming the findings of other studies conducted in recent years in other countries.

The integration of technology into educational practice is an essential and valuable endeavor that must be carried out with a strategic and pedagogical approach to optimize the teaching, learning, and assessment process and to enhance the relevance and adaptability of education to the demands of the modern world. An effective teacher today must transition from being a *regular user* of technology to a *designer of digital learning experiences*.

In this context, the development of teachers' digital competencies must be a priority for the education system, and this process must be supported through continuing education programs, institutional investments in technological resources, and educational policies that encourage the effective use of technology in teaching.

The research findings open up new avenues for future investigations regarding: analyzing the impact of continuing education programs on the development of teachers' digital competencies and on the effective integration of educational technologies into teaching practices; identifying the institutional and pedagogical factors that influence the integration of digital technologies into educational practices; investigating the role of educational policies and school leadership in facilitating the integration of technologies into the educational process. Furthermore, longitudinal studies tracking the evolution of teachers' digital competencies over time and how these influence the transformation of educational practices would be useful.

Acknowledgements

The research was supported by the project entitled "Digital Innovation in Pre-university Education", managed by Valahia University of Târgoviște between 2025 and 2026, with the declared main aim of training 6000 teachers in integrated digital education and digital transition. The authors thank all colleagues for their involvement and work.

Declaration of Interest

The authors declare no competing interests.

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Received: *January 24, 2026*

Revised: *March 19, 2026*

Accepted: *April 06, 2026*

Cite as: Gorghiu, G., Santi, E. A., & Pribeanu, C. (2026). Teachers' readiness to integrate digital technology into the teaching process. *Problems of Education in the 21st Century*, 84(2), 315–326. <https://doi.org/10.33225/pec/26.84.315>

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