

Article

The Digital Competences Necessary for the Successful Pedagogical Practice of Teachers in the Digital Age

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Abstract: The digital transformation of society is a reality. Technology is becoming integral to people's daily lives and children are growing up in the digital age. The education systems have to reflect and adapt to the new digital reality to effectively engage and prepare students for the future. Teachers have to possess digital competences at a high level, meaning that they are successfully able to use digital tools and technologies in their teaching practices. Digital competences include digital literacy, experience using educational software and platforms, and the ability to seamlessly integrate information and communication technologies (ICT) into the organization of educational activities. The current paper aims to study the opinion of teachers in Bulgarian schools regarding the possibilities of using digital technologies to achieve educational goals and the extent to which teachers integrate digital tools in their teaching activities. Teachers' opinions about the need for specific digital competences are important. The results of the survey show that teachers in Bulgaria actively use digital technologies in their daily teaching activities (84.8%) in order to create and provide learning content to students and to provoke their active participation, and is a convenient tool for evaluating their students' knowledge and skills and for providing effective feedback. The conducted research also identifies the necessary competences that teachers of the digital generation of learners need—skills and competences for developing authored electronic resources in various formats for students with different learning styles, as well as for working in online environments—individually and collaboratively with other teachers.



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1. Introduction

The digital transformation is integrating digital technologies into the activities of various societies, including education. Digital tools, platforms, and resources are used with the aim of enhancing both teaching and learning.

In the context of education, the digital transformation is becoming increasingly important. Technologies are becoming an integral part of peoples' daily lives, and students are growing up in the digital age. To effectively engage and prepare students for the future, education must reflect and adapt to the digital reality.

Modern society needs teachers with digital competences to apply digital technologies in the learning–teaching process effectively [1]. Teachers must support the formation of students' digital competences, which implies that they must also develop their own digital competence [2].

Digital competences include digital literacy, experience using educational software and platforms, and the ability to seamlessly integrate ICT into learning activities.

Possessing digital competences at a high level enables teachers to use digital tools and resources in order to improve their teaching practices. They can create interactive and engaging learning materials, access various online educational resources, and facilitate collaborative learning through digital platforms. The use of digital technologies not only

increases students' engagement but also promotes critical thinking, creativity, and problem-solving skills.

As educational institutions increasingly connect their activities with digital transformation, the need for teachers with digital competences becomes imperative. Acquiring digital competences is essential to prepare pre-service teachers to effectively use new technologies in the ever-changing learning environment of the 21st century.

Aims and Contribution

In the current paper, the existing frameworks for digital competence are systematized, focusing on teachers' digital competences.

The attitude of teachers towards the possibilities of digital technologies is an important starting point for their effective integration into the learning process. Based on their daily activities and the requirements for using digital technologies, teachers can define what digital competences they need to possess to be successful in their teaching activities. A survey was conducted among Bulgarian teachers, with the aim of establishing the degree of use of digital technologies and the goals they seek to achieve through their integration into educational activities. The focus is on establishing the sought-after digital competences teachers must possess to be in sync with the demands of today's digital society.

The remainder of the paper is organized as follows: Section 2 discusses the notion of the digital competences of pedagogical specialists and offers a related literature review; Sections 3 and 4 present the organization, methodology, and results of the conducted study, respectively; in Section 5, the results and their relevance to other similar studies are discussed; Section 6 reports the limitations of the research; and Section 7 concludes the study.

2. Digital Competences of Pedagogical Specialists

Digital competence is a key competence that every person needs to have in modern society, according to the Lifelong Learning Reference Framework developed by the European Commission. This framework outlines eight categories of key competences—literacy competence (communication in the native language); multilingual competence (communication in a foreign language); mathematical competence and competence in science, technology, and engineering; digital competences; personal, social, and learning to learn competence; citizenship competence; entrepreneurship competence; and cultural awareness and expression competence [3].

2.1. Related Literature Review

Many authors have given definitions of digital competence and teachers' digital competence.

Digital competence is the ability to effectively and responsibly use digital technologies, tools, and resources to access, evaluate, create, and transmit information [4]. It covers a range of knowledge, skills, and attitudes related to the effective use of digital technologies in various contexts, including education. Digital competence is based on skills in ICT to use computers to create, retrieve, assess, present, and exchange information and to communicate and participate in networks using the services and mechanisms of the internet [5], including digital and ICT literacy, and competences in the use of digital tools and resources [6].

Ref. [7] defines pedagogical digital competence as the ability to consistently apply the attitudes, knowledge, and skills necessary for planning and conducting teaching and ongoing assessment using ICT, based on theory, current research, and proven experience, to support students' learning [5]. Pedagogical digital competence, therefore, relates to technology, learning theory, subject matter, context, and learning, as well as knowledge, abilities, and attitudes.

According to [8], digital competence refers to a trainer's ability to use ICT in a professional context, considering the implications of a pedagogical–didactic nature for learning

strategies and students' digital formation. The author describes teachers' digital competence as the intersection of self-efficacy, learning strategies, motor skills, metacognition, and pedagogical–didactic elements and argues that it differs from that of other technology users.

Ref. [9] defines teachers' digital competence as an integrative education characterized by understanding and identifying information needs and processing educational information using digital technologies for effective educational and future professional activity.

Ref. [10] considers teachers' digital competence as the ability to apply and transfer their knowledge, strategies, skills, and attitudes about educational technologies in real and concrete situations in practice. As a result, students' learning and acquisition of digital competence will be facilitated, and teaching innovations can be implemented in accordance with the needs of the digital age. At the same time, teachers' professional development can be facilitated so as to be in concert with the changes in society and education.

Teachers' digital competences refer to their skills in using digital technologies, tools, and resources effectively to enhance teaching and learning in the classroom. They cover the knowledge, skills, and attitudes teachers need in order to integrate technology into their teaching practices. The high-level digital competence of teachers is defined by their ability to use digital devices, software applications, and online platforms to access, assess, create, and transfer information and knowledge in a way that improves educational outcomes and prepares students for the digital world. Digital competences also include the ability to critically evaluate and select digital resources, adapt teaching methods to incorporate technology into the learning process and support the development of students' digital literacy.

Teachers' digital competence is crucial in modern education. Digital technologies are an invariable part of teachers' daily work, necessitating the transformation of traditional educational practices and the integration of technologies into them [11]. This allows them to adapt to the evolving educational environment, where technology is important in facilitating the learning process. Educators with higher levels of digital competence are better equipped to deliver a quality learning process and effectively engage students.

The development of digital competence among teachers is directly related to the application of teaching and communication technologies (TAC) in the educational process. TACs refer to technologies specifically designed for educational purposes, focusing on enhancing teaching and learning processes. TAC includes tools and platforms that facilitate communication, collaboration, and knowledge sharing in educational settings. The evolution of ICT in classrooms and the training of teachers in utilizing new technologies are crucial for improving the teaching–learning process. The integration of ICT in education has transformed traditional teaching methods, emphasizing the need for ongoing teacher training and development in order to effectively incorporate technology in the classroom. In education, TAC enables interactive learning experiences, personalized instruction, and access to a wealth of educational resources.

Teachers' digital competence is a multifaceted and essential aspect of modern education. It affects the quality of teaching and learning and shapes students' readiness for the digital world. The development and assessment of teachers' digital competence is therefore crucial to ensure the effectiveness and relevance of education in the digital age.

2.2. Digital Competence Frameworks

The Teachers' Digital Competence Frameworks provide a structured approach to defining and understanding the digital competence needed by today's teachers. They provide a structured framework for identifying and developing the necessary skills, knowledge, and attitudes that teachers need in order to integrate technology into their teaching practices effectively.

The frameworks also serve as guidelines for educators, educational institutions, and policymakers to assess and support teachers' digital competence. They help establish what it means to be digitally competent as a teacher. By outlining key components and

competences, these frameworks provide a road map for professional development and continuous improvement in the use of technology for teaching and learning.

Frameworks for teachers' digital competence play a crucial role in shaping the professional development of teachers and promoting the effective integration of technology in education. They provide a foundation for educators to improve their digital competence, adapt to the evolving digital world, and improve student outcomes.

Some of the frameworks that provide a comprehensive overview of the key competences that teachers need to develop to effectively integrate technology into their teaching practices and improve student learning are as follows.

European Framework for the Digital Competence of Educators: DigCompEdu. The European Commission has developed the framework and has specified the digital competences a teacher must possess in today's society in order to practice their profession effectively [10]. Six areas of digital competence for educators are identified: professional engagement (including the use of technology for professional development and collaboration), digital resources (focusing on finding, evaluating, and creating digital learning resources), teaching and learning (including the use of technology to improve teaching methods and student engagement), assessment (including the use of digital tools for formative and summative assessment), empowering learners (emphasizing the fostering of digital literacy and critical thinking skills in students), and facilitating digital citizenship (focusing on the promotion of the responsible and ethical use of technology) [2]. The framework was designed to align with different countries' institutional and contextual requirements and is open for updating [12]. The DigCompEdu framework has been recognized internationally, consolidating its presence and impact beyond Europe [13].

Several researchers have highlighted the importance of DigCompEdu in evaluating and enhancing the digital competence of educators [14,15]. The DigCompEdu framework has been recommended as a common reference for European initiatives and policymaking concerning educators' digital competence across the European Union [16]. Its comprehensive nature and alignment with modern teaching requirements make it a valuable tool with which to train educators to effectively integrate technology into their professional practices [17].

UNESCO ICT Competency Framework for Teachers. This framework was created to help achieve digital literacy and reduce the digital divide [18]. Five key areas of digital competence for teachers are identified: digital literacy (including basic ICT skills and knowledge), deepening knowledge (including the use of technology to improve subject knowledge and pedagogical content knowledge), knowledge creation (focusing on the creation and adaptation of digital learning resources), knowledge sharing (including collaborating and sharing resources with other teachers), and knowledge protection (emphasizing the ethical and responsible use of technology). The framework serves as a guideline for educators to develop the necessary skills to integrate technology into their teaching practices and adapt to the demands of the digital age.

Educators' Digital Competence Framework. The aim of this framework, developed by UNICEF, is to focus on the potential of digital technologies to improve inclusive and quality education for all children and discover different ways of using digital technologies [19]. The framework includes four key areas: digital literacy; digital pedagogy; digital citizenship and digital wellbeing; digital content and resources, data and assessment; and professional development in building and improving teachers' digital competence. The framework emphasizes the importance of teachers' skills in the effective use of digital technologies, integrating them into teaching practices, promoting responsible digital behavior, and prioritizing students' digital wellbeing.

National Educational Technology Standards for Teachers (NETS-T). This framework was developed by the International Society for Technology in Education (ISTE) and provides tools with which to identify teachers' accomplishments [20] in the field of the effective integration of digital technologies in schools. The framework outlines a set of standards that define the digital skills and knowledge teachers need in order to use technology effectively

in their teaching practices. The standards include areas such as facilitating and inspiring students' learning and creativity, designing and developing digital learning, and modeling digital citizenship and responsibility.

All frameworks for teachers' digital competence have several things in common. They emphasize integrating technology into teaching practices, recognizing its potential to improve learning and student outcomes. The frameworks highlight the importance of pedagogy, digital literacy, the responsible use of technology, and continuous professional development as key components for teachers to manage the educational process effectively and to support students' learning in the digital age.

2.3. Research Questions

The main research questions of the conducted research are as follows:

RQ1: To ascertain the extent of the teachers' use of digital technologies. This question has two aspects: using digital technologies in teaching and learning and, on the other side, communicating and cooperating with other teachers and parents during administrative activities.

RQ2: What are the sought-after digital competences teachers think they need to succeed in the teaching profession?

Another interesting issue is that of the opinion of teachers on whether a university education is sufficient to acquire digital competences for working with information technologies (IT).

3. Materials and Methods

For the purposes of the research, a new instrument was developed—a questionnaire with thematically grouped questions. Different statistical methods were applied to collected data—descriptive and inferential statistical analyses.

3.1. Study Participants

Participants for the current study were selected from various schools in Bulgaria. The total number of teachers who took part in the survey was 92.

The demographic information is systematized in Table 1. Teachers between 40 and 49 years old comprise the highest relative proportion (36.96%), followed by teachers aged between 50 and 59 years (29.35%) and then those between 30 and 39 years (22.83%). Participants under the age of 30 (6.52%) and over the age of 60 (4.35%) have small relative proportions.

Table 1. Summary of demographic information (N = 92).

Age	Frequency	Relative Frequency (%)
Up to 30	6	6.52
30–39	21	22.83
40–49	34	36.96
50–59	27	29.35
Over 60	4	4.35

The distribution of teachers according to teaching experience is presented in Table 2. It is fairly even in the ranges 0–5 years (28.26%) and 21–30 years (27.17%), followed by teachers with 11–20 years of experience (21.74%). The share of teachers with more than 30 years of professional experience is the lowest (9.78%), and teachers with 6–10 years of teaching experience represent 13.04%.

In Bulgaria, the levels of education are defined in the Law on Pre-School and School Education [21], effective from 01.08.2016, and are basic and secondary education. Basic education takes place in two stages: primary (lasting four years) and presecondary (lasting

four years). The secondary level also lasts four years. The distribution of the participants according to this criterion is shown in Table 3 and is as follows: the highest share are teachers in secondary schools (42.39%), followed by those in presecondary schools (34.78%) and primary school (22.83%).

Table 2. Summary of professional experience (N = 92).

Professional Experience	Frequency	Relative Frequency (%)
0–5	26	28.26
6–10	12	13.04
11–20	20	21.74
21–30	25	27.17
Over 30	9	9.78

Table 3. Summary of levels of education (N = 92).

Educational Level/Stage	Frequency	Relative Frequency (%)
Primary	21	22.83
Presecondary	32	34.78
Secondary	39	42.39

The distribution according to the taught subjects is presented in Table 4 and is as follows (Table 4): the highest share is occupied by teachers of informatics, information technologies, and mathematics (53.3%), followed by humanities teachers (18.5%), primary school teachers who teach all subjects (16.3%), natural science teachers (8.7%). Art teachers (1.1%) and kindergarten teachers (2.2) have the lowest relative shares.

Table 4. Summary of taught subjects by teachers (N = 92).

Taught Subjects	Frequency	Relative Frequency (%)
Informatics, information technologies and mathematics	49	53.3
Natural science (including physics, chemistry, biology, human and nature)	8	8.7
Humanities (including languages, literature, history and civilization, philosophy, geography and economics)	17	18.5
Art (music and fine arts)	1	1.1
Primary school	15	16.3
Kindergarten	2	2.2

3.2. Data Collection

For the purposes of the research, a questionnaire was developed using Google Forms.

The survey questions are grouped thematically as follows: demographic characteristics and work experience, digital competences in teaching and assessment, digital competences in administrative work, and interaction with colleagues and parents.

Demographic information includes questions related to age, professional experience, levels of education, and taught subjects by teachers. All questions are closed except the subject-taught question which is open. The teachers' answers are categorized according to the subject area classifier.

The section on digital competences in teaching and assessment includes questions related to the extent of use, the reasons for integrating digital technologies in teaching

and assessment activities and the benefits that can be derived from their application in the learning process. Part of the questions reflects teachers' views on the need for digital competencies when seeking to create their electronic resources in various formats. Responses are based on a 5-point Likert scale (from never to always and from strongly disagree to strongly agree).

The section on digital competences in administrative work and interaction with colleagues and parents includes multiple-choice questions with the possibility of choosing more than one option. Questions with answers based on a 5-point Likert scale are also available.

The questionnaire includes questions related to the teachers' opinion about the extent to which future teachers training in the field of digital competences is sufficient. Open-ended questions are also included in the survey in order to identify what tools teachers use in their daily work (teaching and administrative).

The reliability of the questionnaire was tested using the Cronbach coefficient, the result of which indicates a high internal consistency (0.923).

The anonymous survey was distributed to groups of teachers via the Facebook social media platform. Several groups, created to provide methodical help and support to teachers and professors in higher schools, were carefully selected. Included among these groups was a group of teachers in primary education, several groups related to teachers of specific academic disciplines and several general pedagogical groups.

3.3. Statistical Methods

Descriptive statistical analysis was applied to the collected data to summarize the data. Tables and charts were used as visualization tools. Measures of central tendency (mean), frequency, relative frequency, and measures of dispersion (standard deviation) were calculated.

After descriptive statistics, inferential statistical analysis was applied to determine the presence or absence of a relationship/association between teachers' responses and their age, professional field, educational level/stage, or work experience. Fisher's exact test was preferred as an alternative to the chi-square test for statistical hypothesis testing, whose requirements are not considered valid. For datasets that require more computation time to calculate the correct p -value, the Monte Carlo method provides an unbiased estimate of the exact p -value that is reliable [22].

4. Results

Statistical data processing was performed using the software package SPSS Statistics version 26.

4.1. Results Related to Research Question One

The first research question is related to ascertaining the extent of teachers' use of digital technologies in teaching and learning and during administrative activities, i.e., in communication and cooperation with other teachers and parents.

Teachers actively use digital technologies in learning and teaching activities (Figure 1). Respondents who always apply digital technologies in their teaching activities have the highest relative share (44.6%), followed by those who often take advantage of their capabilities (40.2%). Only one teacher indicated that he/she never used digital technologies (1.1%), and one rarely used them (1.1%).

The question of the purposes of the use of digital technologies in teaching and learning activities by teachers is notable. The teachers' answers to the question "for what purpose do you use digital technologies in the learning process?" are systematized in Table 5. The total percentages of relative frequencies exceed 100%, as the respondents could choose more than one option, with an opportunity to add another answer.

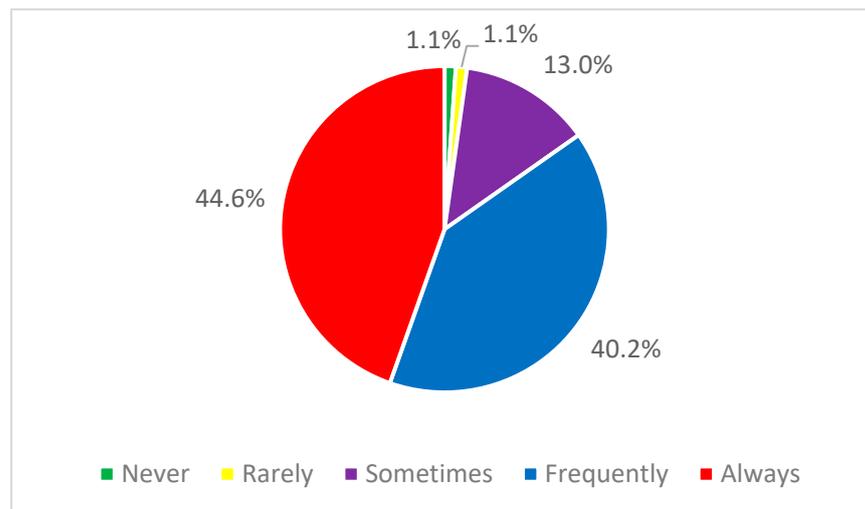


Figure 1. Frequency of use of digital technologies.

Table 5. Purpose of using digital technologies in teaching and learning activities.

Purpose of Using Digital Technologies	Frequency	Relative Frequency (%)
Create and provide learning content for students	81	88.04%
Monitor students’ progress	39	42.39%
Assess students’ knowledge and skills	50	54.35%
Provide effective feedback	45	48.91%
Provide personalized learning	30	32.61%
Guarantee active participation of learners	58	63.04%
Others	10	10.87%

The share of teachers who use digital technologies as a convenient tool and channel to create and provide learning content to students is highest (88.14%). The active participation of learners is an important goal and reason for using digital technologies for 63.04% of respondents. The technologies are suitable for assessing students’ knowledge and skills for 54.35% of teachers. Providing effective feedback (48.91%), monitoring students’ progress (42.39%), and providing personalized learning (32.61%) are other reasons for integrating digital technologies in teaching practice.

In addition, 73.9% of teachers give tasks and assignments to students that require the use of information technologies (M = 3.90, SD = 0.839). For 83.7% of them, it is important to stimulate students if they express a desire to use digital technologies in learning activities (M = 4.29, SD = 0.859).

Another aspect to the integration of digital technologies is, in various activities, directly or indirectly related to the learning process and to administrative activities. The teachers’ answers to the question “what digital tools for collaboration with other teachers do you use?” are systematized in Table 6. The total percentages exceed 100%, as the respondents could choose multiple options, with an opportunity to add another answer.

Online office packages, which allow teachers to work on shared documents and access them from any place and through different devices, are the most frequently used tool (59.78%). Electronic calendars are a preferred tool of 31.52% of teachers, allowing synchronization of administrative activities. For 29.35% of respondents, tools for project management are very useful in their activities. A relatively high percentage of teachers do not use modern digital technologies in their daily activities (22.83%).

Communication with parents is part of the professional duties of teachers. The study is interested in what tools teachers use for communication and interaction with parents. The teachers’ answers to the question “what tools for communication and interaction with parents do you use in your work?” are systematized in Table 7. The total percentages

exceed 100%, as the respondents could choose multiple options, with an opportunity to add another answer.

Table 6. Digital tools used by teachers for collaboration with other teachers.

Collaboration Tools	Frequency	Relative Frequency (%)
Online office packages	55	59.78%
Electronic calendars	29	31.52%
Tools for project management	27	29.35%
Do not use	21	22.83%
Others	6	6.52%

Table 7. Communication channels used by teachers.

Communication Channels	Frequency	Relative Frequency (%)
Own website	19	20.65%
Own blog	5	5.43%
Correspondence by e-mail	41	44.57%
Instant messaging (chat) applications	64	69.57%
Electronic platform with parental access	56	60.87%
I do not use digital technologies	5	5.43%
Phone	2	2.17%
Facebook group	1	1.09%

The results show that instant messaging (chat) applications are the preferred communication channel with parents for 69.57% of teachers. The electronic platforms with access for parents are used by 60.87% of teachers, followed by email correspondence (44.57%). Not many teachers have the necessary skills to maintain their own websites (20.65%) and blogs (5.43%) to use them as channels for information exchange and communication with parents. The traditional communication channel with parents by telephone is in the background (2.17%), replaced by new technologies.

The study examined teachers' opinions regarding the possibilities and benefits of using digital technologies in the educational process. A 5-point Likert rating scale was used, allowing respondents to express their level of agreement or disagreement with the statements, ranging from 1 (strongly disagree) to 5 (strongly agree) answering the question "in your opinion, what are the benefits of using digital technologies in the learning process?"

The frequencies, relative frequencies, means (M), and standard deviations (SD) of the responses are presented in Table 8.

The analysis of the results shows that the teachers identify the possible advantages and benefits of using digital technologies in the teaching process (average values are above 3.8). The highest agreement items correspond with "adding game elements to the learning process", positively reported by 86.9% (M = 4.32, SD = 0.755), and "provide more effective feedback to students", according to 86.9% (M = 4.28, SD = 0.894). For 81.5% of teachers (M = 4.16, SD = 0.905), digital technologies enable "more active participation of students in learning activities". There is agreement among 72.8% of respondents (M = 4.02, SD = 0.994) with the statement that integrating digital technologies "enhances motivation to learn". The lowest percentage supports the statements that digital technologies allow "more objective assessment of students' knowledge and skills", 67.4% (M = 3.82, SD = 1.058), and "more effective tracking of students' progress", 70.7% (M = 3.93, SD = 1.036).

Of significant importance for the study is the opinion of teachers regarding when and whether they should use digital technologies in the learning process. Respondents were able to choose multiple answers to the question "in your opinion, when to use digital technologies in the learning process?", with the total percentages exceeding 100% (Table 9).

Table 8. Teachers’ opinions regarding the benefits of digital technologies in education.

According to You, Digital Technologies Allow:	Mean	SD
More effective feedback to students	4.28	0.894
More objective assessment of students’ knowledge and skills	3.82	1.058
More effective tracking of students’ progress	3.93	1.036
More active participation of students in learning activities	4.16	0.905
An increase students’ motivation to learn	4.02	0.994
The addition of game elements to the learning process	4.32	0.755

Table 9. Teachers’ opinions regarding the use of digital technologies in learning.

	Frequency	Relative Frequency (%)
Always	18	19.57%
According to the specific situation (lesson, topic, group of students, etc.)	61	66.30%
Only when technology can add value to the learning process	46	50.00%
Only when it is necessary	7	7.61%
Never	0	0.00%

The results show that 66.30% of teachers use digital technologies depending on the specific situation and when technologies can add value to the learning process (50.00%). The use of digital technologies is not an end in itself for teachers. and they do not use technology only to be in sync with the trends associated with the digitization of education. They find it meaningful to use them only if there will be a benefit from their application. taking into account the characteristics of the learners, the lesson, the learning content, etc.

The statistical hypotheses for the presence or absence of a relationship/association between teachers’ responses and their age, professional field, educational level/stage or work experience were tested.

The Monte Carlo method revealed the existence of an association between the age variable and the teachers’ answers to the statement “digital technologies allow more effective tracking of students’ progress”—the Monte Carlo estimate of the *p*-value is 0.019 with 99% confidence interval (lower bound—0.018 and upper bound—0.020), as shown in Table 10.

Table 10. An association between age and teachers’ answers.

	Chi-Square Tests					
	Value	df	Asymptotic Significance (Two Sided)	Monte Carlo Significance (Two Sided)		
				Significance	99% Confidence Interval	
				Lower Bound	Upper Bound	
Pearson chi-square	45.720 a	16	0.000	0.001 b	0.001	0.001
Likelihood ratio	30.805	16	0.014	0.009 b	0.008	0.010
Fisher’s exact test	26.151			0.019 b	0.018	0.020
N of valid cases	92					

a. Eighteen cells (72.0%) have an expected count less than five. The minimum expected count is 0.04. b. Based on 100,000 sampled tables with starting seed 2,000,000.

A more significant percentage of teachers under the age of 40 years strongly agree that digital technologies enable more effective tracking of students’ progress. Among teachers over the age of 40 years, there are some who express disagreement with the possibilities of technologies to effectively support teachers in this direction or who do not express agreement or disagreement with this statement.

The Monte Carlo method revealed the existence of an association between the variable educational level/degree and the teachers’ answers to the question “do you give

assignments that require using digital technologies by students?”—the Monte Carlo estimate of the *p*-value is 0.001 with 99% confidence interval (lower bound—0.001 and upper bound—0.001), as shown in Table 11.

Table 11. An association between educational level/degree and the teachers’ answers.

	Chi-Square Tests					
	Value	df	Asymptotic Significance (Two Sided)	Monte Carlo Significance	Monte Carlo Significance (Two Sided) 99% Confidence Interval	
					Lower Bound	Upper Bound
Pearson chi-square	22.720 a	8	0.004	0.001 b	0.001	0.002
Likelihood ratio	26.201	8	0.001	0.001 b	0.001	0.001
Fisher’s exact test	21.548			0.001 b	0.001	0.001
N of valid cases	92					

a. Eight cells (53.3%) have an expected count less than five. The minimum expected count is 0.23. b. Based on 100,000 sampled tables with starting seed 92,208,573.

The Monte Carlo method revealed the existence of an association between the educational level/degree variable and the teachers’ answers to the question “do you encourage students when they want to use digital technologies during learning activities?”—the Monte Carlo estimate of the *p*-value is 0.039 with 99% confidence interval (lower bound—0.037 and upper bound—0.040), as shown in Table 12.

Table 12. An association between educational level/degree and teachers’ answers.

	Chi-Square Tests					
	Value	df	Asymptotic Significance (Two Sided)	Monte Carlo Significance	Monte Carlo Significance (Two Sided) 99% Confidence Interval	
					Lower Bound	Upper Bound
Pearson chi-square	16.086 a	8	0.041	0.022 b	0.021	0.024
Likelihood ratio	15.670	8	0.047	0.043 b	0.041	0.045
Fisher’s exact test	13.637			0.039 b	0.037	0.040
N of valid cases	92					

a. Eight cells (53.3%) have an expected count less than five. The minimum expected count is 0.23. b. Based on 100,000 sampled tables with starting seed 92,208,573.

Teachers at the secondary school stage confidently express their agreement that they give assignments that require the use of digital technologies to their students and stimulate them if they express a desire to use digital technologies during educational activities. A lower degree of agreement with these statements is observed among teachers at the primary and presecondary levels. This result can be explained by the age characteristics of the students and the nature of the academic work at these levels of education.

4.2. Results Related to Research Question Two

The second research question is in regard to the teachers’ opinion about the sought-after digital competences that teachers need to succeed in teaching.

The frequencies, relative frequencies, means (M) and standard deviations (SD) of the teachers’ responses to the questions “in your opinion, is it necessary for teachers to have skills to create their own electronic resources for lessons and class work in the form of:” are given in Table 13.

Table 13. Necessary skills to create different types of electronic learning resources.

Types of Learning Resources	Mean	SD
Presentations	4.73	0.471
Audio and video materials	4.49	0.703
Electronic tests	4.63	0.641
Blogs	3.73	0.939
Wiki systems	3.63	0.910
Games or with elements of gamification	4.16	0.893
Websites	3.89	0.883

The descriptive statistics analysis shows that teachers consider the importance of skills and competences when developing their own electronic learning resources for lessons and class work (mean values are above 3.6). The highest percentage of agreement is observed for creating “presentations”—positively reported by 98.9% ($M = 4.73$, $SD = 0.471$). According to 93.5% ($M = 4.63$, $SD = 0.641$), creating “electronic tests” is among the necessary skills teachers must possess to quickly and easily assess students’ knowledge. For 90.2% ($M = 4.49$, $SD = 0.703$), competence in the creation of “audio and video materials” is important to satisfy the different learning styles of students and present the learning content in different formats. Of the respondents, 80.4% ($M = 4.16$, $SD = 0.893$) agree that creating electronic resources in the form of “games or with elements of gamification” is among the sought-after competencies of teachers. The lowest percentage of teachers supports the statements about the need for skills and competencies to create “wiki systems”—48.9% ($M = 3.63$, $SD = 0.910$); “blogs”—54.4% ($M = 3.73$, $SD = 0.939$); and “websites”—61.9% ($M = 3.89$, $SD = 0.883$). This fact is expected as such resources require more in-depth IT knowledge and skills and more time for development, and, usually, are the product of the collaborative work of many users.

The need to switch to online learning during the COVID-19 pandemic necessitated the use of different virtual environments and synchronous learning in virtual classrooms. For the respondents in this survey, it is very important for teachers to have the necessary digital competence to work in an online environment. Descriptive statistics analysis showed mean values for these competences above 4.75. The competences include sharing presentations and screens and organizing and managing students’ work in smaller teams within the virtual room.

Collaboration with other teachers in a digital environment requires new digital competences at a high level. The descriptive statistics analysis of teachers’ answers to the question “In your opinion, future teachers should have the competence to:” is presented in Table 14. The teachers consider the importance of such skills and competences, which contribute to a more effective implementation of collaborative activities (average values are above 4).

Table 14. Necessary competences for collaboration.

In Your Opinion, Future Teachers Should Have the Competence to:	Mean	SD
Work with online office suites	4.70	0.550
Use electronic calendars	4.18	0.901
Work with project management systems	4.21	0.846
Use cloud services for information storage	4.54	0.653
Use different digital channels to communicate with colleagues and parents	4.42	0.730

The favorable agreement item corresponds to having competences to “work with online office suites”, being positively reported by 95.6% ($M = 4.70$, $SD = 0.550$). As a result, 91.3% of teachers ($M = 4.54$, $SD = 0.653$) agreed to “use cloud services for information storage”. Working with cloud-based collaboration services allows all teachers to access shared learning and information resources from anywhere, anytime, with any device, facilitating their work. For 85.8% ($M = 4.42$, $SD = 0.730$) of teachers, the competences of

“use different digital channels to communicate with colleagues and parents” can support real-time communication. No less important for teachers are the competences that facilitate teamwork on projects, including the use of project management systems and electronic calendars—with respective agreements of 79.4% (M = 4.21, SD = 0.846) and 76% (M = 4.18, SD = 0.901).

The statistical hypotheses were tested for the presence or absence of a relationship/association between the variables. No association was observed between teachers’ responses and their age, professional field, educational level/stage, or work experience.

The teachers’ opinion on whether university education is sufficient to acquire digital competencies for teaching and whether there is a need for additional training is also an object of interest for researchers.

The descriptive statistics analysis (Table 15) shows that 51.1% of the teachers consider that “the training at the university is not sufficient for the acquisition of the necessary digital competences” for their pedagogical practice. For only 27.2% of respondents are the training activities included in the educational programs sufficient to acquire basic digital competencies (M = 2.76, SD = 1.093). For 88% of them, “regular training activities are necessary to increase the digital competencies of teachers” (M = 4.32, SD = 0.864).

Table 15. University education’s sufficiency in acquiring digital teaching competences.

In Your Opinion:	Mean	SD
The training at the university is not sufficient for the acquisition of the necessary digital competences by future teachers	2.76	1.093
It is necessary to conduct regular training to increase the digital competence of teachers	4.32	0.864

The respondents were not familiar with the self-assessment tool, based on the European Digital Competence Framework for Educators (40%), and had not tested the level of their digital competences (85.56%), as shown in Figure 2. This fact shows that the universities’ educational programs do not include enough purposeful activities to form, improve, and test the teachers’ digital competences according to existing frameworks. Educational institutions should take measures and actions regarding teachers’ awareness of the availability of such tools and the purpose of their use.

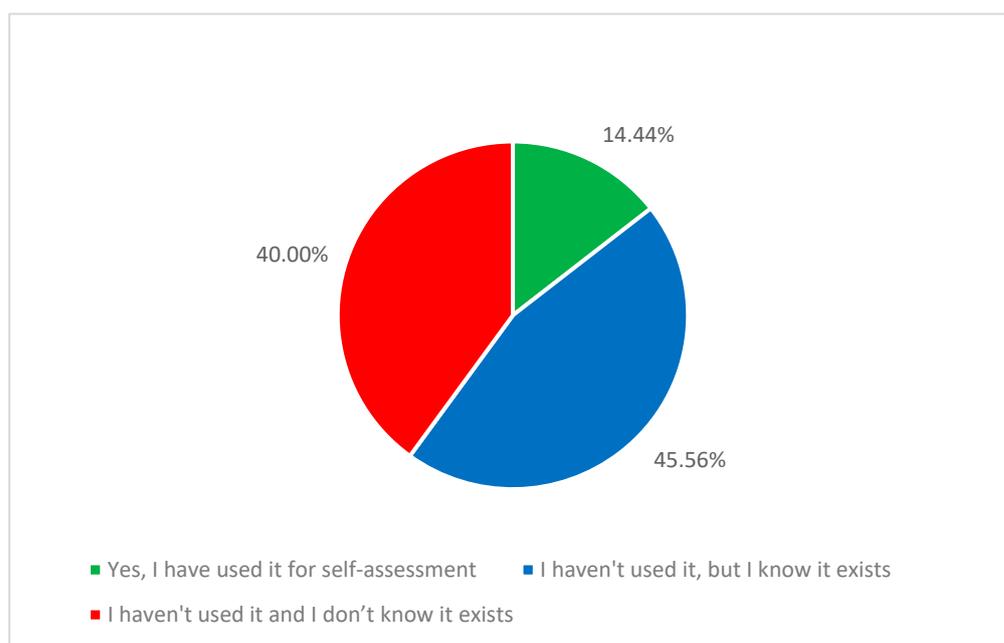


Figure 2. Knowledge and use of the self-assessment tool based on the DigCompEdu framework.

5. Discussion

The findings from the analysis of the collected data show consistency with other studies investigating teachers' digital competences.

According to [23], the attitude towards technology and frequency of use of digital tools are major determinants of digital competence. The current study results show that teachers actively use digital technologies in learning activities. This corresponds to Area 3 of the DigCompEdu framework: teaching and learning, and to the teaching subsection—competences for implementing digital devices and resources in the teaching process to enhance the effectiveness of training [24]. The highest relative proportion are teachers who always integrate digital technologies into their teaching practice, followed by teachers who often take advantage of their opportunities. The positive fact is that very few teachers rarely or never use technology in their teaching practice. This is consistent with [23], who report a positive and significant effect of the use of digital technologies on all the competences they analyzed. A similar positive attitude and a high degree of use of digital tools is also outlined in [25]. In contrast, the survey of [26] shows that the level of skills in using digital technologies in the organization of the educational process is quite mediocre, as less than half of the respondents regularly use such tools and rate their experience of working with virtual educational environments as positive.

In the current study, the highest proportion of teachers use digital technologies to create and deliver learning content to students, regardless of whether they are developed by themselves or use available digital resources. This corresponds with Area 2: digital resources, of the DigCompEdu framework and includes competences from the sections regarding selecting digital resources and creating and modifying digital content [24]. The teachers consider electronic resources to be a convenient tool for transferring knowledge to students, which is consistent, to a certain extent, with the findings of [23], that the competence of selecting digital resources is, on average, the most developed among teachers, but that that of creating digital resources is below average. The authors explain that selecting digital resources is the most frequent and necessary activity in teaching. Moreover, it is based on pedagogical skills rather than specific digital competences. Similar findings are supported by [25]—two-thirds of the teachers in their survey use digital tools to search for and find educational resources, as well as to develop their own educational content in different formats (text, presentations, audio, pictures, video, games, blogs, wiki, quizzes, tests, etc.). Comparable conclusions are arrived at in [26], where the most popular tool for distance learning among teachers is the choice of teaching materials and the preparation of tasks for students. The authors of [27] report that, among the most highly rated elements of the different competence areas are those related to the use of digital resources and the creation and modification of digital assets. These results are in contrast with [28], where the competence “creating digital content using digital technologies” was seen to have a relatively lower mean response compared with other items.

Digital technologies are a convenient tool for assessing students' knowledge and skills according to the teachers in the current study. This corresponds with Area 4: assessment, of the DigCompEdu framework, and the subsection regarding assessment strategies—competences for using digital technologies for formative and summative assessment [24]. This is consistent with the findings of [25], where the teachers were found to actively use digital assessment technologies (quizzes, tests, questions, exercises, assignments, web missions) to assess students' progress within formative assessment, but that only very few were found to use them for summative assessment. In contrast are the results obtained in the study of [23], where the assessment competence is the weakest. The authors' explanation is that teachers are still reluctant to use different assessment formats and approaches that require the integration of digital technologies.

Providing effective feedback, monitoring student progress, and providing personalized learning opportunities are among the main reasons for using digital technologies pointed out by the teachers in the current study. This corresponds with Area 3: teaching and learning, of the DigCompEdu framework, and the subsection regarding guidance—

competences for using digital technologies and services to enhance the interaction with learners. It also corresponds with Area 4: assessment, and the subsection regarding feedback and planning, with competences for using digital technologies that provide targeted and timely feedback to learners [24]. In contrast are the results of [25], who report that more than half of teachers used little or no digital tools to provide guidance and feedback to students. Similar lower mean values of feedback competences are accounted for in their study [27].

Another aspect of teachers' use of digital technologies is in various activities that support the learning process directly or indirectly, as well as administrative activities. An important part of teachers' duties is the collaborative work on projects that requires the use of tools for their management, which corresponds with Area 1: professional engagement, of the DigCompEdu framework, and the subsection regarding professional collaboration—use of digital technologies that permit one to collaborate with other teachers, share and exchange of knowledge and experience [24]. The results of the current study reveal a relatively high percentage of teachers who do not use digital technologies in collaborative work with their colleagues—both in the development of learning resources and in project work. Similar results, indicating a lower percentage of respondents who can create and manage content using collaboration tools at the professional user level are reported in [29]. Ref. [27] also announces lower averages in the area of professional collaboration among teachers. In contrast is the study of [25], which observes a high percentage of teachers using technologies for digital communication and collaboration (web conferencing, digital sharing, and group collaboration tools, interactive whiteboards, software for project management, wiki tools and social media).

Communication with parents is part of teachers' professional duties and corresponds with Area 1: professional engagement, of the DigCompEdu framework, and includes competences for organizational communication—use of digital technologies to improve communication with learners, parents, and third parties [24]. The most frequently used channels of connection and communication are instant messaging (chat) applications, electronic platforms to which parents have access, and e-mail correspondence. The relative share of teachers with the necessary skills to maintain their own website or blog and use them as a channel for information and communication with parents is small.

The development of information technology has led to a change in the nature and character of learning resources. In a digital educational environment, multimedia components such as text, audio, graphics, video, animation, 3D models, and augmented and virtual reality are powerful tools for presenting learning content. By combining their advantages, teachers can provoke activity and motivate students to achieve educational goals [30]. To achieve positive results in learning, it is important to guarantee appropriate designs, formats and combination of multimedia learning materials taking into account students' needs and cognitive differences [31,32]. Inefficient use of diverse resources can lead to ineffective learning [33].

Teachers consider the importance of competences for developing their own electronic learning resources in the format of presentations, audio, and video materials. Presenting learning content in various formats satisfies the different learning styles of students. This corresponds with Area 2: digital resources, of the DigCompEdu framework and includes competences for creating and modifying digital content considering the specific learning objective, context, pedagogical approach, and learner group [24]. According to the teachers, the competences for developing electronic tests using various tools are important if one is to be able to objectively, quickly, and easily assess students' knowledge. The use of games and gamification in learning activities is among the current trends in education. A high percentage of respondents consider the competences involved in creating such educational resources among the key competences that teachers should possess. Through games and gamification, learners' motivation can be increased, and their interest in the learning content and activities in the classroom can be enhanced and provoked. Similar attitudes are also observed in the study of [25]. The authors report a high degree of appreciation of

digital competences related to the use of digital tools for editing, creating, and managing educational resources, as well as video conferencing tools, webinars, video platforms, and sharing tools. The results are in line with the findings of [29], where respondents report their ability to create multimedia content in different formats using different digital tools and environments and the importance of such competencies for the implementation of teaching activities not only at the basic user level but also at the independent user level.

The teachers in the current study do not consider the use of collaborative tools such as their own wiki systems, blogs, and websites to be a priority competence. One of the possible reasons is that creating educational resources with such tools requires more in-depth IT knowledge and skills, takes more time, and implies cooperation with teachers and students. This finding is supported by [29], in which a lower percentage of respondents is observed to be able to develop complex multimedia content in different formats using different digital tools and environments or to create a website using a programming language at the professional user level.

Work in virtual environments and synchronous learning in virtual classrooms has become a daily routine and an option for continuing the learning process in emergency situations. For this reason, it is very important for teachers to have the necessary digital competences to manage work in online environments. The relevant activities include presenting lessons, sharing screens, and organizing and managing students' work in smaller teams within the virtual classroom. In [26], the authors report that the respondents have positive experience working with virtual educational environments.

Digital competence is necessary for current and future teachers, as in their hands lies the media literacy and education of children and adolescents to ensure they become digitally competent [27]. In the modern information society, it is extremely important for teachers to have the necessary knowledge and skills to be competent in digital technologies and to purposefully and effectively integrate them into the educational process. At the same time, they are also responsible for passing on such knowledge, skills, and competences to their students [27]. Modern teachers should help form and develop their students' digital competences and prepare them for active participation in the digital society.

Issues related to preparing future teachers for work in a digital educational environment are at the forefront. The formation of the digital competences necessary for their daily pedagogical practice should be set as a primary goal in educational programs.

Educators' digital skills include the selection of appropriate technologies for the learning process and the ability to relate them to the content and goals of education, thereby transforming technologies into tools that promote enhanced learning outcomes and achievement. It is important for teacher education to consider pedagogical digital aspects that explain how to plan and implement a technologically supported learning process [34].

In [9], the authors experimentally prove that the digital competence of future teachers develops through the following pedagogical conditions: availability of the digital environment of higher education institutions, use of ICT to activate and support the educational and cognitive activity of students, and ensuring the development of digital competence of future teachers in distance learning is up to date.

To develop the digital competences of future teachers, several key elements are needed:

- Comprehensive training programs should be developed and implemented to cover a wide range of digital skills and knowledge relevant to teaching.
- Integrating digital competences into teachers' educational programs with technology-focused courses and modules that provide hands-on experience.
- Personalized guidance and support through mentoring and training delivered by experienced tutors.

In addition, communities and social networks for collaborative learning and experiential learning opportunities can enhance the development of digital competences. Ongoing professional development, access to resources, support, and a focus on continuous improvement are essential for teachers to effectively integrate technology into their teaching practices. The support and encouragement for integrating digital technologies in education

by school administrations and governmental organizations at regional and national levels is crucial for the development of teachers' digital competences at a high professional level [23].

6. Conclusions

The use of digital technologies is a daily routine for teachers. They use various tools, services and applications for everyday teaching, formative and summative assessment of students, and for self-study and collaboration with students [25].

The results of the current study show that Bulgarian teachers use digital technologies in their daily teaching activities to create and provide learning content to students and to provoke their active participation, and is also used as a convenient tool for assessing their knowledge and skills. Another aspect of teachers' use of digital technologies is in various activities that support the learning process, communication with parents as well as administrative activities.

Providing effective feedback, monitoring student progress and offering personalized learning opportunities are among the main reasons for using digital technologies given by teachers in the present study.

Teachers' digital competence is an essential aspect of modern education as it affects the quality of teaching and learning and shapes students' readiness for the digital world. The development and assessment of teachers' digital competence is therefore crucial to ensure the effectiveness and relevance of education in the digital age.

The conducted research identifies the necessary competencies that teachers of the digital generation of learners need—skills and competences for developing electronic resources in different formats, as well as for working in an online environment in collaboration with other teachers.

Different research studies have confirmed the results of the current study regarding the requirements for the specific digital competences that teachers need to develop. Today's teachers must possess high-level digital competences to create quality educational resources in various formats tailored to learner needs and educational goals. They need digital technologies in order to give instant feedback to students, track and monitor their activity and progress, and offer timely support. Collaboration, interaction, and communication in the digital environment are the keys to achieving efficiency in both learning and administrative activities.

The frameworks and regulations describe the digital competences teachers need in a digital society, but this is not enough. The issues related to the formation of digital competences should be addressed in the curricula of educational organizations. They should offer flexible study programs to prepare future teachers to work in a digital environment. There is a need for an orderly system, including specific educational activities that support the formation of teachers' digital competences in accordance with the existing frameworks and national regulations.

7. Limitations of the Study

Some limitations of the present study should be noted. First, there are limitations in terms of sample size, as the study was conducted among a relatively small number of teachers with a relatively predominant share of those teaching the subjects of informatics, information technologies and mathematics. Secondly, it should be taken into account that, despite the ideas for the universal introduction of digital technologies in Bulgarian schools, there are many that do not have the necessary technical equipment. This is one of the reasons why some teachers cannot take a stand on the issues related to the specific application of digital technologies in education and to assess the need for the digital competency of teachers.

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G.K.; project administration. G.K.; funding acquisition. G.K. All authors have read and agreed to the published version of the manuscript.

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