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Preliminary Results from Norway, Slovenia, Portugal, Turkey, Ukraine, and Jordan: Investigating Pre-Service Teachers' Expected Use of Digital Technology When Becoming Teachers

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Abstract: Digital technology has become an important part of society and deserves attention and in-depth research, which is still lacking. The study presented in this paper includes international perspectives from six countries and examines which factors influence the use of digital technologies in future pedagogical work in primary schools. Specifically, we investigated how pre-service teachers assess their attitudes, knowledge, and skills towards digital technology, and we determined these factors' role in the pre-service teachers' future use of digital technologies in pedagogical work. For the purpose of the research, an online questionnaire was used, which contained open-ended questions, optional questions, and five-point Likert-type scales, and Spearman correlation and Stepwise linear regression statistical methods were used in the data analysis. The sample consisted of 573 full-time and part-time undergraduate pre-service teachers from the Faculties of Education's higher professional programmes in Norway, Slovenia, Portugal, Turkey, Ukraine, and Jordan. Data were collected between June 2021 and May 2022 and processed using IBM SPSS. The present research showed the significant importance of knowledge and skills about digital technologies and professional attitude towards digital tool factors for pre-service teachers' future professional use of digital technologies. The demonstrated intention of the future use of digital technologies showed the readiness of pre-service teachers regarding the inclusion of digital technologies in pedagogical work. Opportunities for further research are in the implementation of focus groups after surveying pre-service teachers, as well as regular measurements and the inclusion of other important constructs in the regression model.

Keywords: attitude; digital skills; digital technology; higher education; knowledge; professional digital competence; policies and practices; students

1. Introduction

Professional digital competence (PDC) refers to the specific competence necessary when digital competency is viewed within the context of a specific profession. Over the

last two decades, educational research has increasingly drawn attention to teachers' PDC. To investigate what competencies teachers need for teaching in digitalised classrooms, different frameworks have been developed, for example, DigCompEdu [1], Information and Communication Technology (ICT), the competency framework for teachers [2], and Technological, Pedagogical, and Content Knowledge (TPACK) [3].

The importance of digital education is highlighted in the European Commission's action plan for 2021–2027, emphasising that all learners needs to be equip with digital competence. This involves both skills, knowledge, and attitudes [4]. Attitudes are an important part of professional digital competence and a key factor in the successful integration of digital technologies in schools [5–8]. Johanson et al. [9] reported that several researchers in Norway have highlighted a lack of connection between what is stated about knowledge and skills concerning DT in international and national plans for teacher education, what takes place in school practice, and the pre-service teachers' experiences of learning knowledge and skills regarding DT in their teacher education.

Teachers need to be skilled in using digital technologies (DT) for educational purposes, and their main challenge is to foster the productive and relevant use of DT among students at all levels of education [10–12]. Findings of several authors emphasise that teacher education still depicts an overall lack of skills and knowledge among pre-service teachers and teacher educators regarding how to utilise DT in a pedagogical and didactical manner [13] (p. 253), [14]. Therefore, we conducted an international study to investigate the differences and similarities between countries in relation to this highly relevant topic.

The TPACK framework identifies three main knowledge areas to conceptualise the teacher knowledge necessary for teaching ICT. In addition to technological knowledge, the framework also includes knowledge areas defined as pedagogical knowledge and content knowledge. In this framework, we have focused on technological knowledge (TK) [3] within the context of primary education. Technical knowledge refers to teacher knowledge about traditional and new technologies that can be integrated into the curriculum.

This part of the TPACK model is then supplemented with a model of digital competence, differentiating between skills, knowledge, and attitudes as important components (Figure 1). This added model builds on an often-used concept and understanding of digital competence [10,15–17]. The main goal of this study is to explore the role of these factors in shaping pre-service teachers' expectations regarding their future use of digital technologies in their professional practice as primary school teachers.

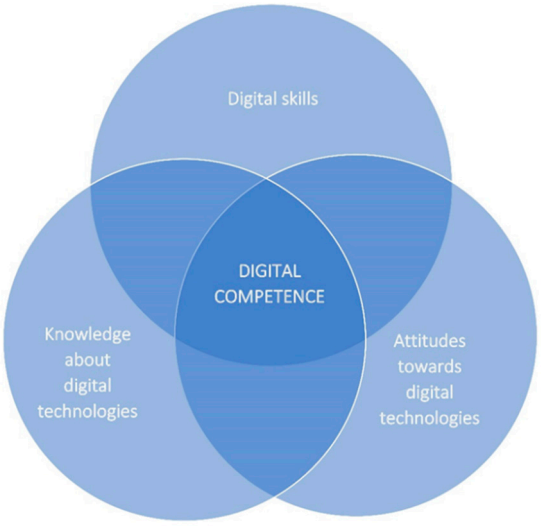

Figure 1. Model of digital competence and associated factors. Reproduced after Hämäläinen et al. [16] (p. 2) (CC BY 4.0).

In this article, instead of the term Information and Communication Technology (ICT), the term digital technology (DT) is used because it better reflects the circumstances of contemporary technology.

Research Question

How are knowledge, skills, and attitudes towards the use of DT related to pre-service teachers' future professional use of DT?

2. Background

2.1. Digital Competence (DC) in an Educational Context

Digital competence is the set of knowledge, skills, and attitudes (thus including abilities, strategies, values, and awareness) that are required when using DT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, and reflectively for work, leisure, participation, learning, socialising, consuming, and empowerment [15] (p. 3); see [18].

Digital competence and digital literacy are two terms used to describe technology-related capabilities. In England, Norway, Finland, Sweden, and the Dutch-speaking part of Belgium, the analysis of educational technology curricula at the primary school level showed that national governments' curricula define 'digital literacy' in diverging ways: e.g., that students should be digitally skilled, competent, and literate, as well as Information and Communication Technology (ICT)-competent and -capable. Different terms are used, and each of their definitions contains different semantic meanings, ranging from the use of basic ICT skills to complex problem-solving abilities. This permissive use of concepts in national educational technology curricula supports Markauskaite's [19] view that the notion of digital literacy is poorly understood in formal education, and many terms are used to describe various sets of technology-related capabilities. Furthermore, no clear descriptions are given about the interpretation of curriculum goals as skills, competencies, knowledge, or attitudes [18,20,21].

In explaining the use of 'digital competency' rather than 'digital literacy', authors argue that digital literacy is more often used in European policy and initiatives relating to e-inclusion, whereas competence is employed more frequently in an educational context [18,22]. Other authors argue that digital competence can be regarded, as conceptualised in the work of the Key Competences working group [23,24], as an underpinning element of digital literacy. Digital literacy involves the successful usage of digital competence within life situations [25] (p. 256). It follows therefore from the literature that digital literacy defines a broader concept and includes digital competences.

Many authors confirm the view of digital competences as the 'integrated and functional use of knowledge, skills about DT and attitudes towards DT' [10,15,16,18,20,22,26–31].

In 2017, the term 'digital competence' was explicitly context-defined for teachers as professional digital competence (PDC) and introduced through the PDC Framework for Teachers, which defines an extensive and complex understanding of teachers' PDC [32]. The TPACK [3,33] appears to represent a referential framework when Norwegian researchers are conceptualising and defining technological concepts and DT. In different ways, they aim for concepts and definitions that are broad and include the multitude of challenges and possibilities created by DT development [34]. The studies that have the most explicitly developed items for measuring student teachers' overall digital competences are Røkenes and Krumsvik [31], Instefjord and Munthe [10], Gudmundsdottir and Hatlevik [28], and Thorvaldsen and Madsen [30]. Descriptions of the methods and questionnaires used point to measurement, which is mostly performed through the self-reporting of elements like skills, usage, and attitudes [34].

Thorvaldsen and Madsen [30] (p. 5285) referred to the definitions of Tømte and Olsen [35] and Lund et al. [11], and from these, they derived three defined aspects of digital competence understanding: pedagogic and didactic, subject-specific, and technological. The latter is compliant with the TPACK framework [28,30,33].

Janssen et al. [22] identified twelve different competence building blocks that encompass digital competence. The DigiComp 2.2 offers a similar set of dimensions. While the dimensions have undergone refinement and updating, the framework maintains the overall structure of five competence areas: information and data literacy, communication and collaboration, digital content creation, safety and problem solving [36].

A parallel contemporary means for assessing educators' digital competence-DIGIGLO is a 29-item instrument that, in addition to the 6 areas and 22 competences included in DigCompEdu, considers a further two areas related to the environment in which educators work: 'Digital environment' and 'Extrinsic digital engagement' [37].

Furthermore, no clear descriptions are given about the interpretation of curriculum objectives as skills, competences, knowledge, or attitudes. Therefore, several Nordic researchers have selected the term 'digital competence' instead of other similar terms [18,20,21].

In general, PDC encompasses a double challenge for teachers because they need to be skilled in using digital technologies for certain professional tasks, and their main challenge is to foster productive and relevant use of DT among students at all levels of education [10–12]. Expressed in other words, the relation to technology develops both teachers' and pre-service teachers' professional skills and their expertise in the future, facilitating students' learning [30]. Quality teaching requires developing an understanding of the complex relationships between technology, content, and pedagogy. Using this understanding is essential to developing appropriate, context-specific strategies and representations. Productive technology integration in teaching needs to consider all three factors within the complex relationships of the TPACK system at which changes in any one of the factors must be 'compensated' by changes in the other two [3]. Digital education policies are only successful if and where it has been possible to obtain teachers' participation, acceptance, engagement, and ownership of the process [38].

2.2. The Importance of Attitudes as a Component of Digital Competence

In addition to knowledge and skills, attitudes are an important component of competences (Figure 1). Professional attitude (ATT) towards digital tools is a factor that influences pre-service teachers' (i.e., early childhood education and pre-service teachers) use of digital technologies in their classrooms [39–42]. Basaran and Yalman [43] examined the effects of the pre-service teachers' attitudes towards the Web, i.e., general, communication, pedagogical knowledge, pedagogical self-efficacy (WEB-PCK), and instruction. They collected research data among 416 pre-service teachers attending Turkey's state education faculty and analysed the attitude scale, applied to determine the participants' attitudes towards WEB-PCK. It was found that gender differences still existed for both university students and adult users in terms of the evaluation of internet access and its use, attitudes towards the internet, and internet use frequency and efficacy [43–48]. The study found that if students have learning management system (LMS) usage skills and knowledge, the perception of distance education is a useful, easy, and enjoyable way of learning [43].

Teachers' internet experiences also influence their intention to use DT. For example, their attitudes toward ICT have been found to be affected by their knowledge/experience of ICT [49]. Teachers who feel confident in their computer ability also tend to have positive views on the use of ICT in the classroom and vice versa [50–52].

So and Kim [53] found that even if teachers have the knowledge and skills to use technology (attitudes towards practices, referred to as espoused theory), they were incapable of using it in practice (actions in practice, referred to as theory in use) [54]. Several studies are based on a survey where Theory of action has been applied as the theoretical framework [55]. Building on this makes it possible to analytically differentiate between theory in use (actions in practice) and espoused theory (attitudes towards practices) [53,56]. Based on these studies and Mou and Kao's study [57], we can summarise that there is a probable correlation between teachers' ICT experiences and their beliefs about the integration of DT.

2.3. Skills and Knowledge about Digital Technologies

Developing student skills and knowledge about DT requires trained teachers with their corresponding skills, knowledge, and teaching methods. In this sense, it is necessary that the teachers develop their pedagogical content knowledge, which includes an appropriate level of what we call digital competence. Teaching digital competence is the result of combining knowledge and technological skills, knowledge of the methodological possibilities offered by technological resources, and the attitude one has towards the exploitation of DT to transform and improve education [29] (p. 1529), [58].

Several authors concluded that measures for the development and implementation of DT in education can be effective only if the teacher has a positive attitude towards the DT's benefits and potential [18,29,54,58,59]. Based on the literature review, Mou and Kao [57] assumed that very few studies have examined in-service or pre-service teachers' ideas or attitudes about incorporating DT into their teaching practice.

2.4. National Contexts of DT Policies and Practices

The nations involved in the present study provide a range of different contexts regarding national expectations, infrastructures, and teacher education systems. All six nations' investigated national contexts of DT policies and practices are encouraged by centrally directed educational policies. The content of the different programmes are affected by different cultures and traditions. This is also evident when comparing differences regarding what primary school children are expected to learn in each country. Such diverse countries also represent the basis for identifying common good practices on which we can build further cooperation and understanding of cultural differences between nations.

Further, we focus on digital skills in primary school curricula and teacher education programmes. The education systems of the selected countries use their own national definition of digital competence. The national definitions of Norway, Slovenia, Portugal, Turkey, and Ukraine are based on different European definitions, and in general, these definitions originate in curriculum or top-level strategy documents related to digital competence. In the education systems of the selected countries, there are top-level regulations or recommendations that promote the inclusion of teacher-specific digital competences in initial teacher education (ITE). In Norway and Turkey, teacher-specific digital competencies are included and mandatory for the development of ITE programmes in other countries (Slovenia, Portugal, Ukraine, and Jordan), where teacher-specific digital competencies are included but not mandatory (Table 1).

Table 1. Skills about the use of DT in primary school and teacher education programmes.

Nation	Digital Skills in Primary School	Digital Skills in Teacher Education Programmes
Norway	• The use of DT * and development of digital skills are integrated into different (compulsory) subjects that have different roles in terms of the development of the basic skills;	• In ITE programmes, graduated teachers must possess digital skills appropriate to the profession [60,61]; • Norway has even developed distinct digital competence frameworks for teachers, which provide a complete mapping of the essential competences, including those related to the pedagogical use of technologies [32];
Slovenia	• The development of digital competencies is part of every basic and secondary curriculum—integrated into compulsory subjects;	• Teacher-specific digital competences are included but not mandatory in ITE programmes; • Ongoing reform at all levels of education with the purpose of modernising the curricula to reasonably include the digital competences and basic content of computer science and informatics, and sustainable development competences and financial literacy; • Teachers' digital competencies must be assessed before entering the profession [62];

Table 1. *Cont.*

Nation	Digital Skills in Primary School	Digital Skills in Teacher Education Programmes
Portugal	• The primary education curriculum includes structured disciplinary knowledge, along with the necessary skills and attitudes that all students should acquire/develop in each component of the curriculum [63]; • Digital competence is included as a cross-curricular theme and also addressed as a separate compulsory subject;	• Formal policies and practices for student-teacher programmes do not have an obligation to include digital technologies and the development of digital competencies in the curricula for teacher training. However, most higher education institutions have a curricular unit related to the pedagogical use of technologies;
Turkey	• DT and skills are recognised as crucial components of education and the workforce; • Digital skills and technologies are integrated into the national curriculum of Turkey for primary and secondary education. The most recent curriculum reform in 2018 includes a specific focus on digital competencies in various subjects;	• The policy recognises that technology is a vital tool for effective teaching and learning, and thus pre-service teachers must be equipped with the necessary skills to integrate technology into their classrooms [64]; • Formal policy and practice for student-teacher programme requirements state that graduated teachers must possess digital skills appropriate to the profession;
Ukraine	• Ukraine has taken steps towards digitalisation in education, including the development of a Digital Skills Framework for primary and secondary education, which outlines the digital competencies that students should have at different stages of their education; • To a large extent, this accelerated development was facilitated by the rapid spread of the COVID-19 pandemic. With the beginning of the war in February 2022, the issue of digitisation of education became even more necessary, as most educational institutions operate remotely;	• The development of digital skills for pre-service teachers is regulated by the Ministry of Education and Science. The Ministry has developed a number of policies and initiatives aimed at ensuring that pre-service teachers are adequately prepared to teach in the digital age;
Jordan	• The development of digital competencies is integrated into the primary school curriculum both as a standalone subject and in conjunction with other subjects; • Despite efforts to integrate DT into the education system, effective implementation is still limited in Jordan.	• In Jordan, the development of digital skills for pre-service teachers is regulated by the Ministry of Education (MOE); • One of the main policies is the 'Teacher Edu-cation Development Program', which aims to provide pre-service teachers with the necessary knowledge and skills to effectively integrate digital technologies into their teaching. The program includes courses on topics such as digital literacy, instructional design using technology, and digital assessment.

* Note: digital technology (DT).

In most countries (Norway, Slovenia, Turkey, and Ukraine), the development of digital skills is included in different compulsory school subjects, but in Portugal and Jordan, they also have a standalone subject (Table 1).

3. Materials and Methods

The survey was developed to study the dynamics between elements of theory in use and espoused theories based on the theory of action as justified by our leading partner UiT the Arctic University of Norway [53,55,56]. This was performed by constructing

the following variables as an indication of theory in use—measuring the use of digital tools (USE) and knowledge and skills about DT (DKS)—as well as measuring attitudes (ATT) as an indication of espoused theory [56]. Therefore, the attitudes (ATT) construct is considered as an independent construct because it is evident from the literature that it is an important factor. The attitude of teachers towards DT has a significant influence on the attitude of students towards the current and future use of DT in classroom work and social interactions [10,18,49–52,54,58,59]. Descriptive (construct averages), Spearman correlation, and Stepwise linear regression statistical methods were used in the data analysis. The sample consisted of 573 full-time and part-time undergraduate pre-service teachers from the Faculties of Education's higher professional programmes in Norway, Slovenia, Portugal, Turkey, Ukraine, and Jordan, of which 122 were men (21.29%) and 410 were women (71.55%). According to the authors' beliefs, gender does not affect the research of the listed constructs and the dependent single variable AT—Application of digital tools in future work. Data were collected between June 2021 and May 2022 and processed using IBM SPSS Statistics 28 (Table 2).

Table 2. Population and sample.

Organisation (Nation)	Data Collected	N	n	Resp.%
UiT the Arctic University of Norway and NLA University College (Norway)	Spring sem. 2022	241	185	76.76
University of Primorska (Slovenia)	Spring sem. 2022	150	85	56.67
ISEC Lisboa (Portugal)	Spring sem. 2022	100	95	95
Erciyes University (Turkey)	Acad. y. 2021/22	105	74	70.48
H. S. Skovoroda Kharkiv National Pedagogical University (Ukraine)	Spring sem. 2021	98	74	75.5
Al-Hussein Bin Talal University (Jordan)	Acad. y. 2021/22	79	62	78.48

Note: N—population, n—sample. The lower response rate of Slovenia is a consequence of the involvement of very young regular students who are not keen on answering online questionnaires.

For the research, an online questionnaire was used, which contained open-ended questions, optional questions, and five-point Likert-type scales (from 1: Strongly disagree, to 5: Strongly agree). The questionnaire was developed and tested by Madsen and Thorvaldsen [56] at UiT the Arctic University of Norway. The questionnaire was used for the first time on a sample of pre-service teachers among the six participating nations. The survey has been tested across both contexts and time. So far it has proven to be a valid tool for the different contexts previously tested [56,65–68].

An English survey template was used to translate the questionnaire into the different languages involved. Nettskjema, an online tool was used to build and distribute the survey. This is a Norwegian tool developed for higher education, to design and secure data collection online [69].

We used closed-ended questions to obtain demographic and computer use frequency data. The question of past digital tools use was an open-ended question, and the remaining questions were answered using a five-point Likert-type scale of views. These issues were thematically divided into four constructs: application of digital tools in future (AT, single variable), knowledge and skills about DT (DKS, 8 variables), professional attitude (ATT, 8 variables), and Use of digital tools in the expected future pedagogical work of pre-service teachers (USE, 16 variables) (see Appendix A).

3.1. McDonald's Omega and Cronbach's Alpha Coefficient

Cortina [70] (p. 102) stated that if the number of a construct's items is greater than 10, a Cronbach's Alpha greater or equal to 0.7 is preferred. However, if the number of a construct's items is smaller than 10, a Cronbach's Alpha greater than 0.5 is preferred. McDonald's Omega [71,72] and Cronbach's Alpha were used as a measure of the internal consistency of the questionnaire (Table 3).

Table 3. McDonald's omega and Cronbach's alpha.

Cons.	Items	All	Norway	Slovenia	Portugal	Turkey	Ukraine	Jordan
USE	16	0.824/0.725	0.846/0.850	0.850/0.857	0.681/0.710	0.815/0.833	0.870/0.873	0.845/0.851
DKS	8	0.719/0.706	0.693/0.705	0.743/0.731	a./0.555	0.762/0.739	0.702/0.664	0.730/0.742
ATT	8	0.696/0.832	0.714/0.717	0.732/0.743	a./0.409	0.683/0.739	0.554/0.664	0.780/0.779

Note: USE—use of digital tools in the expected future pedagogical work of pre-service teachers; DKS—knowledge and skills about DT; ATT—professional attitude towards DT in education. All is the McDonald's omega and Cronbach alpha of all nations together (e.g., USE 0.824/0.725). For all the values in Table 3, McDonald's omega ranks first and Cronbach alpha ranks second. a. Omega cannot be estimated, due to negative or zero item covariances. Poor working conditions for in-service and pre-service teachers in Portugal may affect both test results. Cronbach alpha for the whole questionnaire is 0.854. McDonald's omega for the whole questionnaire is 0.912.

Previously Cronbach's alpha has been used when estimating internal consistency within multi-item scales, but in later literature the McDonald's omega has been argued to serve as a better measure [71–73]. We are therefore applying both in this study.

The results regarding internal consistency were found to be sufficient to conduct further statistical analyses, within the range of 0.7 and 0.9 [74] except for Portugal (Table 3). This is viewed as the most appropriate measure of reliability when applying Likert-scale statements [74].

Studies by Alarcón et al. [37], Instefjord and Munthe [10], Urrea-Solano et al. [14], Voogt et al. [8], Thorvaldsen and Madsen [30], and Gudmundsdottir and Hatlevik [28] showed the internal consistency of the instruments for measuring knowledge and skills about DT and attitudes towards DT, i.e., digital competence. The latter is measured and, in that context, 'comparable' to the instrument used in the present research (Table 3).

3.2. Normality Assumption

Normality tests were performed on all nations' data and among Norway, Slovenia, Portugal, Turkey, Ukraine, and Jordan's data individually. According to Kolmogorov–Smirnov's and Shapiro–Wilk's tests, data are not normally distributed. For that reason, we used Spearman's nonparametric measure of rank correlation analysis.

4. Results and Discussion

4.1. Construct Averages

The regression analysis was conducted based on the single dependent variable Application of digital tools in future (AT). The results based on the single variable was also compared to the results of the constructs to further validate the AT construct as an indicator of the respondents' expected use of digital tools in future work. As shown in Table 4, AT is a better indicator for the respondents' reported future use when compared with the average of the construct reporting on the respondents' expected future use (USE; based on 16 digital tools). When using the single variable as a measure for the respondents use, tools are not explicitly defined. This allows the respondents to reply regardless of limitations that possibly could follow a predefined selections of tools. The correlation and regression analysis of both constructs, which are not presented in this paper, showed that the AT construct has greater explanatory power.

Table 4. All nations' averages and SD for construct variables.

Nation:	AT (1 var.)	Nation:	USE (16 var.)	Nation	DKS (8 var.)	Nation	ATT (8 var.)
Jordan	3.60 (0,983)	Norway	3.13 (0.936)	Slovenia	3.44 (0.495)	Jordan	3.40 (0.654)
Ukraine	3.81 (0,771)	Slovenia	3,26 (0,975)	Jordan	3.59 (0.522)	Ukraine	3.44 (0.470)
Slovenia	4.00 (0,724)	Portugal	3,27 (0,789)	Ukraine	3.60 (0.497)	Norway	3.55 (0,560)
All	4.23 (0,805)	All	3.31 (0,958)	All	3.72 (0.484)	Slovenia	3.57 (0.493)
Portugal	4.34 (0.594)	Ukraine	3.37 (0,972)	Portugal	3.75 (0.372)	All	3.60 (0.501)
Turkey	4.42 (0.707)	Jordan	3.37 (1,089)	Norway	3.91 (0.509)	Portugal	3.67 (0.350)
Norway	4.59 (0.687)	Turkey	3.48 (0.987)	Turkey	4.02 (0.510)	Turkey	3.99 (0.478)

Note: AT—application of digital tools in future work (AT); SD—standard deviation in parentheses; USE—use of digital tools in the expected future pedagogical work of pre-service teachers; DKS—knowledge and skills about DT; ATT—professional attitude towards DT in education; All—the average of all nations together. Nations are ordered in ascending order of nations' averages.

Using effect sizes to compare nations with the highest score to the one with the lowest score shows that the differences are large for both AT, DKS, and ATT constructs. The difference in effect size is smallest for the USE construct. The largest differences between nations are found when comparing their level of ATT, self-perceived DKS, and AT (Table 5).

Table 5. Differences between nations based on effect size.

Construct	Effect Size (d)
USE (16 variables)	0.36
ATT (8 variables)	1.03
DKS (8 variables)	1.15
AT (single variable)	1.16

Note: Cohen [75] classified effect sizes as small (d = 0.2), medium (d = 0.5), and large (d $\geq$ 0.8). Cohen's d specifically measures the effect size of the difference between two averages.

When we look at the averages of individual nations according to the results of the variables, a slightly different picture from that found in Table 4 is revealed.

4.2. Regarding the Single Dependent Variable—Application of Digital Tools in Future (AT)

Comparing the averages of all nations' points indicates that pre-service teachers across Europe will often use DT in future teaching. In Norway, Turkey, Portugal, and Slovenia, most pre-service teachers agree and strongly agree that they will often use DT in future teaching. Ukraine and Jordan have a somehow solid proportion of agreement, but the data dispersion is high. Ukraine also has somehow lower proportions in neutral and strongly agreeing. There are also lower proportions in Jordan for strongly disagree to strongly agree.

4.3. Regarding the Predictor Construct Knowledge and Skills about DT (DKS)

Table 6 presents the averages of individual nations by construct variables. A familiarity with digital tools that can help diversify teaching somehow differs between nations, but all averages are relatively close to the national average, except for Slovenia, which deviates most. Self-confidence in the use of digital tools is relatively equal across nations and relatively close to the national average. Regarding the first two variables, Slovenia deviates most, which could be an indicator of the currently ongoing process of integrating digital competencies into the Slovenian curricula. With the claim: 'I find it easy to become familiar with new digital tools', only Portugal and Turkey agree. All other nations' results are under the nations' overall average, with Slovenia's average being lowest.

Table 6. Construct knowledge and skills about DT—nations averages.

Construct Variables	Norway	Slovenia	Portugal	Turkey	Ukraine	Jordan	Average
I am familiar with digital tools that can help diversify teaching	4.29	3.48	4.15	4.15	3.96	3.82	4.037
I am, in general, confident when using digital tools	4.25	3.48	4.06	4.18	3.84	3.95	4.012
I find it easy to become familiar with new digital tools	3.75	3.62	4.20	4.07	3.72	3.73	3.839
I can use digital tools which are appropriate for the subjects I am teaching	3.91	3.56	4.00	4.24	3.82	4.11	3.925
It is difficult to use digital tools as an educational resource within my subject	4.23	3.56	3.74	3.92	3.45	3.15	3.791

Table 6. *Cont.*

Construct Variables	Norway	Slovenia	Portugal	Turkey	Ukraine	Jordan	Average
When I am using digital tools, it is difficult to adjust the content to the individual students needs	3.41	3.04	3.59	3.69	3.28	2.65	3.319
I have no clear idea of learning outcome when using digital tools in my teaching	4.15	3.35	3.43	4.15	3.32	3.61	3.749
I use digital tools when giving feedback to students	3.32	3.48	2.86	3.82	3.46	3.76	3.396

Most nations are relatively close to the nations' average, however, and it seems that most nations must put some effort into practicing digital tools. An agreement about using appropriate digital tools has been reached by Turkey, Jordan, and Portugal, which are above the nations' average, whereas Norway and Ukraine are under and relatively close, and Slovenia is most under. The results point to the assumption that there is still room for understanding and the implementation of digital tools. Difficulty in using digital tools is perceived as an issue by Norway and slightly less by Turkey, which is above the nations' average, while Portugal, Slovenia, Ukraine, and Jordan are relatively neutral towards the statement and below the average. Most nations are neutral towards the difficulty to adjust the content to individual students' needs. Only Jordan does not agree with this statement. Nevertheless, the nations' average reflects neutrality. Norway and Turkey agree with the claim of 'I have no clear idea of learning outcome when using digital tools in my teaching' and are above the nations' average, which is relatively neutral. Other nations define themselves as neutral and below average. Most nations are somehow neutral towards the use of digital tools when giving feedback to students. Only Portugal does not agree with the statement and is the most below the nations' average. This could point to the fact that Portugal's formal policy and practice for pre-service teacher programmes have no obligation for DT to be included in the curricula in training.

We can observe in most responses to variables that implicit neutrality reflects part of the pre-service teachers completely agreeing, disagreeing, or completely disagreeing with the statement. The survey's results are in line with the findings of several authors that teacher education still depicts an overall lack of skills and knowledge among pre-service teachers and teacher educators regarding how to utilise DT in a pedagogical and didactical manner [13] (p. 253) [14]. The results show that future teachers present a somehow medium level of digital competence and have some difficulties with adjusting DT and content [76]. Many authors observe that pre-service teachers often feel that they are not sufficiently well equipped for teaching and learning with DT in classrooms [6,77–79].

According to Spante et al. [80], pre-service teachers and teacher educators should develop the competence to choose and use appropriate DT in education and the opportunity to develop digital competence during their education and through workplace training. Research shows that DT usage does not lead to the improvement or development of advanced digital competence as such. European measurements currently concentrate more on measuring access and use than skills (i.e., quality of use) or competence (i.e., knowledge, skills, attitudes, and strategies for use) [81].

Demeshkant et al. [82] argued that DigCompEdu is compatible with the TPACK theory and needs to be effectively integrated for teachers to improve their digital professional development. Therefore, there is a need to combine these two research approaches and produce a valid and reliable tool for measuring academic teachers' digital competence. However, because TPACK focuses on teacher understanding, it cannot be immediately and directly and generally extended to the evaluation of technology use with students in schools and higher education institutions [83].

A fundamental question for educators is thus how to understand and relate to pre-service teachers' different levels of digital experiences and competences within different circumstances (e.g., online, HW and SW, intrinsic and external factors), and further, how to empower pre-service teachers to follow a proactive engagement with developing their own digital competencies for life. Pre-service teachers are digitally competent when entering higher education studies, whether it is for undergraduate study or further learning. Current debates in this area do not offer a conclusive answer, with many complex demographics and other factors playing a role in determining whether and when students master essential digital competencies. Generally, it is recognised that higher education has not fully embraced digital competences as a core, fundamental literacy [84].

4.4. Regarding the Predictor Construct Professional Attitude towards Digital Technology in Education (ATT)

The variables' average from the construct, professional attitude towards DT in education, can be seen in Table 7. Regarding the six nations' measurement of the ATT construct, it seems that a variety of results pointed to strengths and challenges in the future use of DT. Namely, most nations agreed with the claim: 'When I use digital tools in my teaching, I find it adds value'. Only Jordan and Ukraine remained neutral and under the nations average.

Table 7. Construct professional attitude towards DT in education—nations' averages.

Construct Variables	Norway	Slovenia	Portugal	Turkey	Ukraine	Jordan	Average
When I use digital tools in my teaching, I find it adds value	4.03	4.07	4.04	4.57	3.53	3.87	4.023
The use of digital tools is essential for good teaching	2.72	3.34	3.72	4.35	3.61	3.81	3.415
Society's expectations of the impact of digital tools are exaggerated	2.92	3.08	2.94	3.10	2.95	2.84	2.965
Expectations related to the use of digital tools in education frustrate me	3.74	3.32	3.46	3.63	3.24	3.21	3.496
In professional debates at my university, the expectations of the impact of digital tools are exaggerated	3.24	3.47	3.23	3.40	3.11	3.05	3.255
The use of digital tools is disruptive to the relationship between student and teacher	3.53	3.53	3.83	4.21	3.69	3.16	3.646
Digital tools can make the students more interested in the subject I am teaching	4,28	4.14	4.04	4.57	3.76	3.29	4.082
I like testing new digital tools in my teaching	3.97	3.65	4.14	4.15	3.68	4.02	3.941

'The use of digital tools is essential for good teaching' is agreed to only by Turkey, with other nations remaining neutral. Implicitly, this reflects the observation that even if pre-service teachers gain experience in the design of technology-enhanced lessons, they continue to lack experience in enacting technology-based lessons. This may support the idea that pre-service teachers would learn from their own teaching and learning practice as being actively involved in these processes [8,54]. The teacher's reflection is an important element here.

The variable 'Society's expectations of the impact of digital tools are exaggerated' revealed that only Turkey and Slovenia are neutral towards society's expectations of the

impact of digital tools and are above the nations' average. All other nations are in relative disagreement with the claim and are below the average. This could point to their positive attitude towards the pedagogical use of DT and awareness of the importance of knowledge and developed skills for work and life in a digital society.

The results of the following three variables point to relatively neutral opinions of pre-service teachers about the statements and show a positive attitude toward the pedagogical use of DT. Only Turkey agreed that the use of digital tools is disruptive to the relationship between student and teacher.

Most nations agreed with the statement: 'Digital tools can make the students more interested in the subject I am teaching'. The results also reflect their positive attitude toward the pedagogical use of DT, which is above the nations' average. Jordan and Ukraine are more oriented towards neutrality.

Pre-service teachers expressed their positive attitude toward the pedagogical use of DT by agreeing with the statement 'I like testing new digital tools in my teaching', where Turkey, Portugal, and Jordan agreed, but Norway remained slightly under; nevertheless, all four were above the nations' average. This could follow those digital pedagogies that support student active learning more than teacher-centred approaches [54,59].

Professional attitude (ATT) towards using digital tools in education is a factor that influences pre-service teachers' (early childhood education and pre-service teachers') use of digital technologies in their classrooms. Findings indicate that pre-service teachers' attitudes toward technology are important determinants of the success of future technology integration [40–42]. Therefore, in general, research has shown that pre-service teachers express positive attitudes towards DT use in education [18]. We can summarise that presenting a more positive attitude toward digital tools and technology will position the pre-service and in-service teacher, regardless of age, in a place to develop professional digital competence more solidly [76,85].

Results can be tied to several studies suggesting that teachers' attitudes towards DT and knowledge and skills about DT are crucial factors influencing both in-service and pre-service teachers' digital practices [86–88]. Teachers' attitudes about DT are significantly and positively related to teachers' knowledge and skills about DT, so a causal relationship is probable. More specifically, positive attitudes promote improvements in teachers' digital competence [41,87–90]. The authors also point out that openness and positive attitudes towards DT use in education appear to be important dimensions of teachers' digital competence [7,56,65,76,85,91]. Palak and Walls [92] argued that teachers' beliefs, attitudes, and efficacy are fundamental to the successful integration of DT in education [93].

4.5. Other Constructs and Factors

Although the AT, DKS, and ATT constructs or factors are explored in the literature, there are several other constructs and factors researched by many authors. Tømte et al.'s [54] research of two higher education institutions' (HEIs) case studies revealed that even if online teacher education programmes represent good avenues for stimulating teachers and student teachers to develop digital competence for pedagogical purposes, this aspect is poorly integrated within the actual programmes, although some interesting examples were demonstrated. By looking at the origins of the discourses on online education and digital competence, at both HEIs, the authors found that they derive from different stakeholders. The discourse on online education originated from the management side, and the discourse on digital competence was derived from certain teaching staff. The authors' study indicated that there is still some room for improvement toward innovative solutions and the development of professional digital competence's potential in online teacher education programmes.

Chesnut [94] used a sample of 287 pre-service teachers from a large Midwestern university in the United States of America and examined the predictive relationships between four unique measures of commitment (commitment to the profession; commitment to career choice scale; single-item teaching scenario; single-item commitment question) and

a commonly used measure of teacher self-efficacy. For example, commitment is a complex, multifaceted construct, and the most utilised predictor of commitment is self-efficacy [94].

Güneş and Bahçivan's [95] study constructs a science teaching belief system to examine 979 pre-service science teachers' scientific epistemological beliefs (SEBs) and conceptions of teaching and learning (COTLs). The findings of the study show that pre-service science teachers' SEBs positively affected their constructivist conceptions. On the other hand, their SEBs were negatively related to their traditional conceptions. In addition, pre-service teachers' COTL contributes more positively to their digital literacy skills if they hold constructivist conceptions. The previous experiences of pre-service science teachers were also found to affect their beliefs and digital literacy skills.

Spiteri and Rundgren [17] performed a literature review that aimed to discover what factors affect primary teachers' use of DT in their teaching practices. Based on that, the authors suggested better training, which would lead to a more guided and relevant use of technology in education. Based on the concept map to the data from the selected studies, four influencing factors were identified: teachers' knowledge, attitudes and skills, and the school culture.

Based on findings of several researchers, it can be summarised that commitment, in-service teacher education, self-perception and self-confidence, and collaboration with expert DT support positive and constructivist attitudes (i.e., confidence, beliefs, and self-efficacy) [17,41,54,94,95]. According to Cuhadar [96], it is a necessity for the success of teacher education for the teacher educators to be role models for pre-service teachers. This considers DT-supported classes in every stage of the teaching and learning process. Although pre-service teachers may acquire theoretical knowledge, to some extent, about the use of DT in a class context, if teacher educators do not support their classes with successful DT applications, it would be difficult for pre-service teachers to put their theoretical knowledge into practice and turn it into a skill.

Identifying gaps between what is evaluated and what should be evaluated could result in valuable recommendations about the focus of future educational technology studies and the methods used to conduct evaluations [83]. According to Lai et al. [83], the eight dimensions identified from the previous review of what had been evaluated [97], namely learning outcomes, affective elements, behaviour, design, technology, teaching/pedagogy, presence, and institutional environment, were all generally found to be valuable by the researchers and specialists.

Studies by several authors, e.g., Tondeur et al. [98] and Tezci [99], indicated that the school culture was considered an important factor in technology integration, especially when the school management offered encouragement and technical help to the teachers [17].

4.6. Construct Correlations of all Nations

The Spearman correlation analysis (Table 8) shows that, for most nations, the professional application of digital tools in future practice (AT) correlates from low to moderate with DKS—0.333 to 0.609, respectively—and somehow less with professional attitude (ATT)—0.269 to 0.537, respectively. Norway and Jordan have slightly higher dependencies between AT and ATT. Construct dependencies are relatively low-to-moderately correlated and positive, and statistically significant at the level of 0.01. Similar results were found in the study of pre-service teachers' use of technology, attitudes, and digital competence in the years 2020 and 2021 by Madsen and Thorvaldsen [56]. The results stand in contrast to prior data collections with the same survey tool [66,67]. Pre-service teachers, who have mostly knowledge-based learning from a university, could not transform or utilise their experiences in advanced learning strategies. Learning is a continuous experience, and so pre-service teachers' learning beliefs and strategies will change over time with their real-work situations' learning experience [57,100]. Based on these and Mou and Kao's studies [57], we can summarise that there is a probable correlation between teachers' DT experiences and their beliefs about the integration of DT.

Table 8. Pre-service teachers' professional application of digital tools correlated with knowledge and skills about DT and professional attitude towards DT.

Spearman Corr.	DKS	ATT
AT	0.333 ** Portugal	0.269 ** Portugal
	0.352 ** Norway	0.360 ** Norway
	0.400 ** Jordan	0.397 ** All
	0.440 ** Slovenia	0.431 ** Slovenia
	0.494 ** All	0.436 ** Ukraine
	0.499 ** Ukraine	0.530 ** Jordan
	0.609 ** Turkey	0.537 ** Turkey

Note: ** Significant at the 0.01 level (2-tailed); AT—application of digital tools in future practice; DKS—knowledge and skills about DT; ATT—professional attitudes towards DT in education.

Correlation coefficients whose magnitude is between 0.7 and 0.9 indicate variables that can be considered highly correlated. Correlation coefficients whose magnitude is between 0.5 and 0.7 indicate variables that can be considered moderately correlated. Correlation coefficients whose magnitude is between 0.3 and 0.5 indicate variables that have a low correlation [101].

Correlations between the DKS and ATT of six nations are significant, positive, and mostly moderately to strongly correlated. The highest correlation holds Ukraine (0.695) and Slovenia (0.646) (Table 9). It can be assumed that the cultural context plays a big role in this case. For example, in Ukraine, digital competence as a formal national policy for education has been considered one of the priority areas in recent years. In order to accurately determine the cause of the difference, a deeper study is needed. The development of digital skills is integrated into primary school education.

Table 9. Pre-service teachers' digital competence and professional attitudes correlation.

Spearman Corr.	ATT
DKS	0.245 * (Portugal)
	0.475 ** (Jordan)
	0.514 ** (Norway)
	0.516 ** All
	0.574 ** (Turkey)
	0.646 ** (Slovenia)
	0.695 ** (Ukraine)

Note: ** significant at the 0.01 level (2-tailed); * correlation is significant at the 0.05 level (2-tailed); DKS—knowledge and skills about DT; ATT—professional attitudes towards DT in education.

In Slovenia, the development of digital competencies is part of every basic and secondary curriculum. For example, the National Institute of Education has prepared guidelines for applying digital technologies for every subject area in basic education [102]. There is no obligatory DT training in initial teacher education (ITE), but teachers' digital competencies are assessed before entering the profession. At some faculties regarding ITE, there is a mandatory subject named 'Educational technology', aiming to develop the digital competencies of student-teachers [62]. Slovenia has recently initiated a process of curricular reform that encompasses the entire educational vertical. One of the key elements of the reform is digitalisation, which will play a crucial role in providing a more interactive and adaptable learning environment for students and also foresees the (further) development of educators' and learners' digital competencies.

Portugal has the lowest correlation (0.245; Table 9), perhaps because there is no obligation for digital technologies to be included in the curricula in teacher training; however, most higher education institutions have a curricular unit related to the pedagogical use of technologies. Jordan, Norway, and Turkey have moderate correlations. In Jordan, the National Center for Curriculum Development [103] published the curriculum framework, where (16) standards referred to technology usage in schools and how students and teachers make use of it.

In Norway, requirements state that when graduated, teachers must be able to evaluate and use relevant teaching materials, digital tools, and resources in their teaching and teach their pupils digital skills [60,61]. Turkey's teacher training programmes include courses that focus on digital technologies and their applications in education, as well as the development of digital competencies such as digital literacy, digital citizenship, and digital pedagogy [104].

This suggests that if teacher education institutions provide the pre-service teachers with extensive and positive experiences of DT, their professional attitudes may improve as long as their belief in their knowledge and skills about DT remains strong. In addition to the above, the implementation of experiential learning for pre-service students depends on the mindset of educational institutions and the attitude of higher education teachers towards DT. Also, very few studies have examined pre-service teachers' ideas or attitudes about incorporating DT into their teaching practice [9,57].

The correlation analysis of Norway, Slovenia, Portugal, Turkey, Ukraine, and Jordan showed results similar to those correlations of singular nations (Tables 8 and 9). The correlation analysis between the constructs' application of tools (AT), DKS, ATT, and the use of digital tools in the expected future pedagogical work of pre-service teachers (USE), showed a relatively low to moderate positive correlation, from 0.218 to 0.516. The highest correlation of 0.516 is between constructs of DKS and ATT. Correlation majorities are statistically significant at the level of 0.01 (Table 10). Low correlation, in general, is related to quite a strong national invasive top-down governing of education, regarding the implementation of DT. This results in a situation where external factors are governing educators' application of tools, and when the use is driven by both external and internal forces, the correlation is low as there are other factors explaining some of the practitioners' use of technology. Johanson et al. [9] reported that several researchers in Norway highlighted a lack of connection between what is stated about knowledge and skills concerning DT in international and national plans for teacher education, what is occurring in school practice, and the pre-service teachers' experiences of their learning knowledge and skills about DT in their teacher education.

Table 10. Construct correlation—all nations (Spearman).

Construct	AT	DKS	ATT	USE (16 Var.)
AT	1	0.494 **	0.397 **	0.218 **
DKS	0.497 **	1	0.516 **	0.273 **
ATT	0.397 **	0.516 **	1	0.297 **

Note: ** significant at the 0.01 level (2-tailed). AT—application of tools in future; DKS—knowledge and skills about DT; ATT—professional attitudes towards DT in education; USE—use of digital tools in the expected future pedagogical work of pre-service teachers (16var.).

4.7. Linear Regression Results by Nation

Analysis (Table 11) showed that the regression model explains from 10.5% to 34.7% of the construct of the future use of digital tools in pedagogical work—AT, with predictors of DKS and ATT. This fact supports the conclusion that there must be external factors at play, not covered by the used model. External factors could, for instance, be policy, requirements, and external expectations. It has been argued that the governing of education must to some degree put the use of DT above pedagogical considerations. Therefore, 65.3% to 89.5% of the unexplained variance depends on other factors that are not included in the model.

Table 11. Linear regression results by nation-explanatory power of the predictors.

Nation	Adjusted R^2	S.C.B. ATT	Sig.	S.C.B. DKS	Sig.	Method
Norway	0.105	0.197	0.016	0.194	0.017	Stepwise
Slovenia	0.121	0.363	<0.001	-	-	Stepwise
Portugal	0.141	0.200	0.046	0.298	0.003	Stepwise
Ukraine	0.239	-	-	0.500	<0.001	Stepwise
All	0.245	0.199	<0.001	0.358	<0.001	Stepwise
Turkey	0.335	0.587	<0.001	-	-	Stepwise
Jordan	0.347	0.394	0.004	0.276	0.042	Stepwise

Note: S.C.B. ATT is the standardised coefficient of variable ATT. S.C.B. DKS is the standardised coefficient of variable DKS—knowledge and skills about DT. Dependent variable: AT—application of digital tools in future (Var23 'I will often use digital tools in my future teaching'); predictors: DKS—knowledge and skills about DT; ATT—professional attitudes towards DT in education.

Regarding the explanatory power of the regression coefficients, we can summarise that in the case of Norway, Slovenia, Turkey, and Jordan, the ATT regression coefficient is higher. In Portugal and Ukraine, however, DKS's regression coefficient has greater explanatory power (Table 11).

4.8. Linear Regression of All Nations

To better interpret the results, we performed the linear regression. As shown in Table 12, Model 2 is somewhat better and explains 24.5% (Adjusted R^2) of the construct of the future use of digital tools in pedagogical work—AT, with the predictors DKS and ATT. There is still 75.5% remaining of the unexplained variance, which depends on other factors that are not included in Model 2. A Durbin–Watson test for autocorrelation in the residuals from a regression analysis is in the range of 1.5 to 2.5, which is a relatively normal and acceptable range without autocorrelation [105].

Table 12. Model summary—all nations.

Model	R	R^2	Adjusted R^2	Std. Error of the Estimate	Durbin-Watson
1	0.470 [a]	0.221	0.219	0.712	
2	0.498 [b]	0.248	0.245	0.700	1.565

[a]. predictors: (constant), DKS (knowledge and skills about DT); [b]. predictors: (constant), DKS (knowledge and skills about DT), ATT—professional attitudes towards DT in education.

Model 1 showed that the regression coefficient for DKS, with Beta = 0.470, is the highest predictor among the models (Table 13). In Model 2, the best predictor is also DKS, with Beta = 0.358.

Table 13. Regression coefficients—all nations.

Model		Unstandardised Coefficients B	Std. Error	Standardised Coefficients Beta	t	Sig.
1	(Constant)	1.505	0.217		6.949	<0.001
	DKS	0.725	0.057	0.470	12.710	<0.001
2	(Constant)	1.075	0.233		4.615	<0.001
	DKS	0.553	0.068	0.358	8.167	<0.001
	ATT	0.298	0.066	0.199	4.529	<0.001

Dependent variable: application of digital tools in future (AT)—Var23 I will often use digital tools in my future teaching.

A linear regression analysis of all nations together showed a greater explanatory power of the DKS construct in both models. In certain cases of the analysis of individual nations, however, attitude's (ATT) regression coefficient has greater explanatory power for Norway, Slovenia, Turkey, and Jordan (Table 11). The results seem to point to the cultural background and imposed national education policy regarding knowledge and skills about DT. For all nations together, the DKS's regression coefficient has greater explanatory power

(0.358) (Table 13). It is evident that DKS has the greatest impact on pre-service students' application of digital tools in the future (AT), and all nations have demands to support the development of DKS. Therefore, this could be caused by the imposed national education policy regarding digital competencies, which is a common factor in all nations. Only Norway's formal policy and practice for student-teacher programmes requirements state that, when graduated, one should possess digital skills appropriate to the profession.

Several authors found that pre-service teachers' beliefs regarding the usefulness of technology and their computer self-efficacy had a direct impact on their intention to utilise technology in the classroom. In general, although pre-service teachers at present are familiar with DT, they seem to have a limited experience in taking advantage of DT in teaching and learning compared with in-service teachers [57,106,107]. Also, teachers' internet experiences influence their intention to use DT. Their attitudes toward DT are affected by their knowledge/experience of DT as well [49]. Teachers who feel confident in their digital ability also tend to have positive views on the use of DT in the classroom and vice versa [50–52]. Based on these studies, we can summarise that there is a probable correlation and even causality between teachers' DT experiences and their beliefs about its integration [41,57].

5. Conclusions

The purpose of the research was to determine the self-assessment of pre-service teachers about their knowledge and skills concerning DT and their professional attitudes towards the use of DT in education, as well as these factors' role in the pre-service teachers' use of digital technologies in future pedagogical work.

To answer the research question 'How are knowledge, skills, and attitudes towards the use of DT related to pre-service teachers' future professional use of DT?', the following findings can be emphasised.

The present research shows the significant importance of DKS and ATT factors for pre-service teachers' future professional use of DT. Correlation analysis showed significant and relatively weak to strong correlations between constructs of a singular nation and all nations together. The regression analysis of six nations was in the range from 0.105 to 0.347 of adjusted R^2 and 65.3% of the unexplained percentage of non-included factors. A regression analysis of all nations together explained only 0.245 of adjusted R^2. So, in the case of all nations, about 75.2% of the unexplained percentage of factors is not included in the regression models.

Likewise, the demonstrated intention of the future use of DT shows the readiness of pre-service teachers regarding the inclusion of DT in pedagogical work. In addition to the integration of DT in study processes, pre-service teachers also need their own experience for the effective use of DT in pedagogical processes with primary school students. Extensive and positive experiences with digital technology (DT) during teacher education can enhance pre-service teachers' perceptions of their knowledge and skills about DT, thereby influencing their professional attitudes positively.

It makes sense to find and include the remaining related factors in the regression model. The present research shows the significant importance of DKS and ATT factors for pre-service teachers' future professional use of DT. As Lindfors et al. [108] pointed out, there is an extensive need for future research on teacher educators, DKS, and the use of DT in teacher education. Research must always be conducted in a reflective and sequential way, carefully considering the apparent risk of serving, or reproducing, the policy makers' intentions and thereby ending up blaming DT for not providing good enough conditions for the pre-service teachers' DKS development.

The limitations of the research are due to a single measurement and the limited number of respondents and participating nations. Opportunities for further research are in the implementation of focus groups after surveying pre-service teachers, as well as regular measurements and the inclusion of other important constructs in the regression model.

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Institutional Review Board Statement: Not applicable as no identifying data were gathered. Our study has not collected personal data, and according to Norwegian (accessed on 30 May 2023. https://sikt.no/en/about-sikt) and Slovenian (accessed on 30 May 2023. https://www.upr.si/en/about-university/integrity-and-ethics/) ethical guidelines, external approval is not needed. The survey has been conducted anonymously and with informed voluntary consent, which does not include the need to gain ethical approval according to SIKT (Norwegian Agency for Shared Services in Education and Research). We are working in line with NESH (Guidelines for Research Ethics in the Social Sciences and the Humanities). In our research work, the employees and students also follow the European Code of Conduct for Research Integrity issued in 2018 by ALLEA—association of European Academies. Ethics issues at the University of Primorska are addressed by the Ethical Issues Commission (KEV UP), which discusses and takes views on ethically questionable actions and practices and the Commission of the University of Primorska for Ethics in Human Subjects Research (KER UP) whose main task is to evaluate and perform ethics assessments of research involving human subjects or secondary data, which do not fall under the competence of the state ethics commissions.

Informed Consent Statement: We obtained informed consent from all participants involved in the study.

Data Availability Statement: The data presented in this study can be made available on request from corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

Appendix A. Variables

Construct variables

USE—Which digital tools and work methods do you think you will be using in your future pedagogical activities with elementary school students? (5—Extensively, 4—Often, 3—Occasionally, 2—Rarely, and 1—Never).

- Digital tools for testing with multiple choice questions.
- Platforms like Moodle or Fronter (Learning management systems).
- Digital tools for presentations (like Powerpoint or Prezi).
- Word processor.
- Spreadsheets (like Excel).
- Use of video.
- Production of film/video/animation.
- Online discussions.
- Online meetings (like Lync, Adobe Connect or Skype).
- Production of Wiki (website which allows collaborative modification).
- Screen capture (like Camtasia or Mediasite).
- Programs for scientific analyses (like SPSS).
- Student response systems, Online questions answered by phone or computers (like Kahoot og Socrative.
- Tools for collaborative writing (like Google docs).
- Social media (like Facebook or Twitter).
- The internet as a source of knowledge.

DKS—knowledge and skills about DT

Response options for the following items: 5—Strongly Agree, 4—Agree, 3—Neutral, 2—Disagree, and 1— Strongly disagree.

- I am familiar with digital tools that can help diversify teaching.
- I am, in general, confident when using digital tools.
- I find it easy to become familiar with new digital tools.
- I can use digital tools which are appropriate for the subjects I am teaching.
- It is difficult to use digital tools as an educational resource within my subject.
- When I am using digital tools it is difficult to adjust the content to the individual students' needs.
- I have no clear idea of the learning outcome when using digital tools in my teaching.
- I use digital tools when giving feedback to students.

ATT—Professional attitude towards DT in education

- When I use digital tools in my teaching, I find it adds value.
- The use of digital tools is essential for good teaching.
- Society's expectations of the impact of digital tools are exaggerated.
- Expectations related to the use of digital tools in education frustrate me.
- In professional debates at my university, the expectations of the impact of digital tools are exaggerated.
- The use of digital tools is disruptive to the relationship between student and teacher.
- Digital tools can make the students more interested in the subject I am teaching.
- I like testing new digital tools in my teaching.

Single variables

- I will often use digital tools in my future teaching (AT—Application of digital tools in future work).
- I mainly use digital tools in my teaching because it is expected by others.
- I wish there were more digital tools available in schools.
- The economic situation in schools makes it difficult to provide digital tools.

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