

What digital tools teachers are ready to use in kindergarten – international comparative study with early childhood pre-service teachers

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Abstract: This paper presents study results regarding digital tools and work methods which early childhood pre-service teachers consider using in their future pedagogical activities with children. These results are part of wider international research regarding the digital competencies of the students-future early childhood teachers. The purpose of the presented results is to compare students' attitudes towards digital tools for working with kids from the perspective of 8 countries (Norway, The UK, Portugal, Slovenia, Poland, Ukraine, Turkey, and Jordan). There were 772 respondents – students of the Early childhood pedagogical specialization. The study follows the design of a survey based on the Theory of Action. The results of the study revealed that the pre-service early childhood teachers of all nations participating in the study presented positive approach towards the use of IT tools in kindergarten. The digital tools which were indicated by students as those that will be most often used in future work are the Internet as a source of knowledge, digital programs for communication with parents, video, pedagogical apps, and smart boards. Differences in answers between representatives of different nations can be explained by the specificity of the functioning of educational systems in different countries as well as differences in Early Childhood teachers' curriculums.

Keywords: Digital tools, kindergarten, international study, early childhood pre-service teachers

1. Introduction

Professional digital competence for early childhood educators (ECE) is important because digital devices for young children are evolving at a rapid rate (Arnott et al., 2018). Nevertheless, researchers and society, in general, seem to be more conflicted and critical towards the use of technology in ECE compared with other educational levels. Some researchers highlight that a 'moral panic' surrounding screen time appears to have positioned digital technology as an enemy of early childhood practice - one that could hinder

the implementation and development of digital practices in early education (Fleer, 2020). On the whole, early childhood teachers' perceptions of the benefits and disadvantages of educational technology integration have been the subject of a moderate amount of empirical research (Hatzigianni & Kalaitzidis, 2018; Magen-Nagar I & Firstater, 2019). Therefore, the current study investigates pre-service early childhood teachers' attitudes towards the use of technology in the educational setting. The goal is to gain a deeper understanding of this issue within an international educational context.

2. Materials and Methods

2.1 Study sample

This paper presents an overview of the perspectives of early childhood pre-service teachers (n=772) regarding the use of different digital tools and educational methods within their professional practices. The survey was conducted at educational institutions in eight different countries during the academic year 2021-2022. The universities which were included in the study: UiT the Arctic University and NLA University from Norway College (n=191); University of Primorska, Slovenia (n=177); ISEC Lisboa, Portugal (n=93); Pedagogical University of Krakow, Poland (n=83); Erciyes University, Turkey (n=82); H.S. Skovoroda Kharkiv National Pedagogical University, Ukraine (n=55); Birmingham City University, UK (n=46) and Al-Hussein Bin Talal University, Jordan (n=45). Data were collected from institutions providing teacher education in each country, applying the same survey structure for all the institutions. The overall average response rate was 78.38 %.

2.2 Research questions

1. What are the pre-service early childhood teachers' attitudes towards the use of IT tools in kindergarten differed in every country?
2. What kind of digital tools are ECE students in different countries more likely to be expected to use in their future practices?

2.3 Study Tools and Procedure

The results presented in this paper are a part of wider international research regarding digital competencies of the students-future early childhood teachers.

The survey includes pre-service ECE teachers' attitudes towards the future use of digital technology in kindergarten. The following items of the research tool were extracted for this variable: ECE students' self-reflection on the use of digital tools in future pedagogical work in kindergartens; availability of digital tools in early childhood education; difficulties with providing digital tools in kindergarten for economic reasons; the use of digital technology because of professional responsibility; frustration at the need to use IT tools in kindergarten. This part of the survey consists of optional questions comprising a range of 5-point Likert-scale statements ranging from 1 (Strongly disagree) to 5 (Strongly agree). The item regarding the digital tools which students will use for educational activities with children contains a list of various digital tools and closed answers to indicate the frequency of their use (1 - never, 2 - rarely, 3 - occasionally, 4 - often and 5 - extensively).

An English version of the survey was used as a template for translating the survey into the different languages needed. Translations were done by researchers from each nation, thus ensuring a high level of accuracy. Data were collected through the use of online survey tools, mainly through Nettskjema, a Norwegian tool for the design and implementation of surveys and secure online data collection, made for the university and college sector.

Considering the ordinal character of the measurement of variables, the between-group comparisons were conducted using the Mann-Whitney U and Wilcoxon W nonparametric tests.

4. Results

4.1 Pre-service ECE teachers' attitudes towards future use of digital technology in kindergarten

The results of the single items regarding the pre-service ECE teachers' attitudes towards future use of digital technology in kindergarten revealed differences among the different nations. These differences are presented in Table 1, using mean scores and standard deviations.

Table 1. Mean Scores for Single items regarding the pre-service ECE teachers' attitudes towards future use of digital technology in kindergarten

	Mean Score (SD)				
	self-reflection on the use of digital tools in future pedagogical work in kindergartens	availability of digital tools in early childhood education	difficulties with providing digital tools in kindergarten for economic reasons	use of digital technology as professional responsibility	frustration at the need to use IT tools in kindergarten
Norway	4.12 (0.99)	3.96 (1.02)	4.16 (0.91)	2.16 (1.02)	2.30 (1.11)
UK	4.26 (0.58)	3.76 (0.85)	4.04 (0.76)	2.48 (0.84)	2.63 (0.74)
Portugal	4.27 (0.51)	4.12 (0.69)	4.31 (0.59)	2.21 (1.30)	2.45 (1.23)
Slovenia	3.56 (0.82)	3.33 (1.05)	3.69 (0.83)	2.42 (0.95)	2.84 (0.96)
Poland	4.13 (1.11)	3.65 (1.08)	3.77 (1.03)	2.83 (1.24)	2.34 (1.11)
Ukraine	4.00 (0.64)	3.67 (1.07)	4.04 (0.86)	2.42 (0.98)	2.75 (1.02)
Turkey	4.32 (0.58)	3.95 (0.87)	4.05 (0.72)	2.00 (0.96)	2.52 (0.92)
Jordan	3.69 (0.85)	3.53 (1.14)	4.07 (0.99)	3.58 (0.72)	3.20 (1.10)
average	4.04 (0.76)	3.74 (0.97)	4.02 (0.84)	2.51 (1.00)	2.63 (1.02)
Mann-Whitney U	4204.50	4680.00	4792.50	430.00	2485.50
Wilcoxon W	19957.50	20433.00	20545.50	3833.00	20821.50
Z statistic	-6.09	-6.12	-6.11	-7.45	-4.54
Asym. sig. (2-tailed)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
r_g	0.42	0.43	0.42	0.77	0.42

Note: r_g - Effect size between the mean ranks in the two compared groups;
The bolded values concern the groups in which the lowest and highest scores relate to a specific attitude component

When looking at nations' mean scores independently, the results tend to vary. The effect sizes between the lowest and highest scoring nations are significant for all the items. The biggest difference between the highest and lowest score relates to the use of digital technology due to professional responsibility ($r_g=0.77$). Teachers from most countries disagree

and are neutral regarding the statement of the need to use IT as part of professional duties. Teachers from Jordan, however, are generally in favor of such a justification for the use of IT. For the other components of the attitude the effect sizes were similar (about $r_g=0.40$). The highest level of self-reflection on the use of digital tools in future pedagogical work in kindergartens were recorded among students from Turkey (4.32), whereas the lowest one were observed among students from Slovenia (3.56). The results for the other attitude components should be interpreted similarly (see Table 1).

4.2 Students' future Early Childhood teachers' opinions about the digital tools for use during ECE from the perspective of different countries

This variable is a good indicator of the respondents' reported future use. Obtained results are based on the mean scores for 17 different tools and work methods (see Table 2).

Table 2. Mean Scores and standard deviation (SD) for Single Variable regarding digital tools and work methods which will be used by pre-service early childhood teachers in their future pedagogical activities with children

Digital tools and methods	Mean Score (SD)								
	Norway	UK	Portugal	Slovenia	Poland	Ukraine	Turkey	Jordan	average
Quiz	2,66 (1,01)	3,04 (0,89)	3,27 (0,63)	2,91 (0,90)	3,05 (1,23)	3,64 (0,80)	2,79 (1,23)	3,64 (0,88)	3,00 (1,02)
Digital tools for presentation	3,06 (1,02)	3,78 (0,89)	3,01 (1,06)	3,38 (0,96)	3,94 (1,06)	3,60 (0,89)	3,37 (0,85)	3,38 (1,05)	3,35 (1,02)
Programs to create texts	3,56 (1,21)	3,70 (0,99)	3,15 (0,94)	3,84 (1,19)	4,00 (1,20)	4,07 (0,81)	2,82 (1,22)	2,98 (1,03)	3,55 (1,19)
Video use	3,49 (1,07)	4,07 (0,65)	4,04 (0,55)	3,69 (0,82)	2,20 (1,12)	3,76 (0,84)	4,02 (0,74)	3,69 (1,10)	3,59 (1,04)
Production of film/video/animation	3,05 (1,10)	3,72 (0,94)	3,67 (0,86)	3,27 (0,99)	2,22 (1,21)	3,24 (1,02)	3,89 (0,80)	3,53 (1,18)	3,26 (1,12)
The Internet as a source of knowledge	4,17 (0,91)	4,24 (0,79)	3,95 (0,80)	3,81 (1,07)	4,69 (0,66)	4,31 (0,81)	4,16 (0,78)	3,98 (0,92)	4,12 (0,92)
iPad	3,78 (1,03)	3,70 (0,73)	2,92 (1,05)	2,10 (1,03)	2,07 (1,30)	2,35 (1,24)	3,20 (1,16)	2,58 (0,89)	2,87 (1,27)
Pedagogical apps	3,79 (0,96)	3,70 (0,73)	3,68 (0,77)	3,30 (0,99)	3,53 (1,17)	3,93 (0,86)	4,33 (0,77)	4,00 (0,93)	3,71 (0,98)
Toys and technology for coding	2,73 (1,17)	3,37 (0,88)	3,05 (0,95)	2,45 (0,99)	1,60 (1,01)	2,89 (1,05)	3,70 (1,05)	2,62 (1,05)	2,73 (1,17)
Digital camera	3,64 (1,07)	3,46 (0,94)	3,41 (0,78)	3,58 (1,00)	2,71 (1,43)	3,15 (0,93)	3,39 (1,02)	2,56 (1,06)	3,36 (1,10)
Digital microscope	2,49 (1,18)	2,89 (1,04)	2,77 (0,98)	2,44 (0,94)	1,39 (0,93)	2,27 (0,99)	3,24 (1,02)	2,51 (1,01)	2,48 (1,13)
Digital storytelling	3,33 (1,07)	3,48 (0,98)	2,84 (0,80)	3,10 (1,05)	1,99 (1,21)	3,00 (1,02)	3,49 (0,91)	3,07 (1,29)	3,06 (1,12)
Digital music and sounds (as a producer)	3,30 (1,3)	3,20 (1,00)	3,29 (1,02)	3,22 (1,11)	1,55 (0,91)	3,25 (1,14)	3,66 (0,84)	3,00 (1,23)	3,10 (1,22)
Digital music and sounds (as a consumer)	3,79 (1,14)	3,63 (0,77)	3,65 (0,80)	3,87 (0,98)	2,72 (1,49)	3,58 (0,99)	3,83 (0,81)	3,36 (1,28)	3,63 (1,11)

Art or drawing using digital technology	3,00 (1,12)	3,61 (0,95)	3,03 (0,98)	2,79 (1,05)	1,92 (1,21)	3,00 (0,82)	3,43 (0,85)	2,82 (1,17)	2,91 (1,12)
Smart board	2,91 (1,21)	4,30 (0,87)	3,31 (0,80)	2,60 (1,07)	2,65 (1,44)	3,05 (1,10)	3,70 (0,91)	3,31 (1,35)	3,06 (1,20)
Digital programs for communication with parents	4,15 (1,06)	4,11 (0,92)	3,85 (1,00)	3,98 (0,96)	1,46 (1,56)	3,69 (0,90)	4,13 (0,77)	4,02 (1,08)	3,85 (1,16)

The obtained results show that the Internet as a source of knowledge was indicated by early childhood education students from all the nations. Students from Norway reported that they intend to use digital programs for communication with parents most often, similarly indicated by students from Turkey and Jordan. Video, as a tool for frequent uses in kindergarten, was picked up by students from the UK, Portugal and Turkey. Students from Turkey and Jordan also indicated their intention to use Pedagogical apps frequently in their future professional work. Students from the UK were the only ones who indicated that they intended to use the Smartboard often in their work with children in kindergarten.

Summarizing, there were a few kinds of digital tools indicated by students as those that will be most often used in future work, including the Internet as a source of knowledge, digital programs for communication with parents, video, pedagogical apps and smart boards. Differences in answers between representatives of different nations can be explained by the specificity of the functioning of educational systems in different countries as well as differences in Early Childhood teachers' curriculums.

5. Discussion

The obtained results indicate a tendency towards positive attitudes regarding the use of IT tools in kindergarten demonstrated by pre-service early childhood teachers of all the countries participating in the study. This result indicates the high credibility of the implementation of innovative technologies in the educational process of kindergarten students after starting their professional career in kindergarten. Our results are in line with some previous ones regarding mobile learning as a kind of education in kindergarten (Kalogiannakis and Papadakis, 2019). The authors stated that the pre-service teachers' attitudes towards the usefulness of mobile learning in the teaching process has the strongest influence on their intention to adopt mobile learning followed equally by perceived ease of use. According to the recent studies (Zilka, 2021) the attitudes of preservice teachers toward integrating computers into kindergartens are mainly positive, but their perception of the situation as stressful and threatening is higher than among in-service teachers.

Our results regarding the kinds of digital tools which the pre-service early childhood teachers are going to use in their future teacher activities in kindergarten are quite diverse across nations. All the respondents pointed to the Internet as a source of knowledge. Digital programs for communication with parents, video, pedagogical apps and smart boards were also mentioned as students' intentions to use during future teaching with kids. This result shows ECE students' readiness for the integration of some digital tools into the educational process in kindergarten. Similar results were reported by Chinese authors, who highlighted that, preservice teachers conceptualize ICT as screen-based technologies such as interactive whiteboards, desktop and laptop computers, e-projectors and smartphones, as well as educational software and applications that can be used on these devices (Dong & Mertala, 2021).

6. Conclusion

Overall, the dynamics of digital practices across the countries reveal that pre-service early childhood teachers of all the nations participating in the study presented positive

intentions towards the use of IT tools in kindergarten. Respondents from all the countries are aware of different digital tools, hardware, and software for use in ECE. The digital tools which were indicated by the students as those that will be most often used in future work are the Internet as a source of knowledge, digital programs for communication with parents, video, pedagogical apps and smart boards. This outcome calls for a closer examination to determine whether certain factors can explain the different nations' strong explanatory power and statistical significance in terms of attitudes and skills as predictors. Related to this, qualitative studies of different educational contexts are needed to understand the complexity of our results. Finally, further research into the emerging digital pedagogies in ECE is needed so that there can be more discussions and development of education built on knowledge and research.

The scope of this study was to present how pre-service early childhood teachers of different countries consider using digital tools and work methods in their future pedagogical activities with children. The findings of the previous studies we examined, showed that kindergarten teachers can benefit from the use of new technology and can gain many advantages and profits using the appropriate educational tools that offer the use of ICT.

However, the teachers' intentions for using different digital tools are thought to be significant and demand elaboration and clarification, especially from the perspective of comparative international studies. There are a lot of learnings that come with the execution of a multi-institutional and multi-national study like addressing cultural differences, ethical review constraints, technology policy differences etc. Addressing these challenges will offer valuable insights to researchers in the Asia-Pacific region.

7. Limitations

First of all, there was a small number of respondents and the study was conducted only once and it was cross-sectional. Thus, more research is needed, carried out in more advanced designs. Finally, a significant challenge was the investigators' cultural differences and the need to adapt the research tools to the participants' national languages with maintaining satisfactory psychometric characteristics.

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