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Self-assessment of digital competencies of early and preschool education teachers

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Abstract: Digital technology permeates all spheres of human activity today, including the education system. Following the development of today's children, the school educational system has accepted and integrated digital technology into the educational process. In contrast, in early and preschool education, the use of digital technologies is rare. The analysis of previous and recent research leads to the conclusion that teachers in the early and preschool education system, mostly avoid using digital technology in their professional educational work. To adapt the teaching process to modern digital changes, the teacher's readiness for continuous self-assessment and developing digital competencies is necessary. This quantitative research aims to obtain insight into the results of the self-assessment of digital competencies of teachers of early and preschool education in Croatia by statistical processing and analysis of data from the survey questionnaire *Digital Literac* (Bayrakci & Narmanlioğlu, 2021), using inferential statistics methods. The results of the work indicate no statistically significant age difference between the respondents in the attitude toward the usefulness of digital technology in the work of early and preschool education institutions. Also, it was determined that the most respondents show a medium level of digital competence according to the questionnaire. The results showed that preschool teachers in Croatia are not completely satisfied with the level of development of their digital competencies, so the scientific contribution of this work is manifested in the determination of possibilities for developing of digital competencies in their further educational work.

Keywords: digital competencies, digital technology, early and preschool educational system, early and preschool teachers

I. Introduction

The world affected by the COVID-19 pandemic favored the fact that the educational system faced the express integration of digital technology, which suddenly became the main instrument of education at that moment. Problems with access to digital technology, the material equipment of educational institutions, the low level of digital competence of educational staff, and the lack of self-confidence and experience in using digital technology, have set barriers to the development of the educational process (Schleicher, 2020).

Although the educational system experienced a sudden digital transformation, it was not possible to develop and improve the digital competencies of the educational staff in a short time. While employees in schools had various forms of professional development in the form of digital competencies and work with digital technology tools, employees in educational institutions did not have as many opportunities because the educational process itself does not rely on digital technology to such an extent that it was necessary. The need for professional digital competence of educators is growing following the development and increased use of digital technology in society as a whole, including in the field of education (Medsen et al., 2023). Therefore, digital competence is considered one of the main skills of the 21st century.

In the literature, there are studies whose aim was to examine the level of digital competencies specifically of preschool teachers with different variables. This study aimed to determine the self-assessment of preschool teachers' digital competencies and their attitude toward the usefulness of digital technology in the work of early and preschool education institutions using some variables. Croatian preschool teachers were examined with the self-assessment questionnaire named Digital Literac, created by authors Bayrakci & Narmanlioğlu (2021).

II. Digital competencies

There is no universal definition of digital competence, and different authors define it differently. Digital competence is one of the eight key competencies of lifelong learning, and according to the Framework

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for the Development and Understanding of Digital Competence, it includes five areas: information, communication, content creation, security, and problem-solving (Punie et al., 2014). It is an ability related to creativity and openness to innovation, responsibility, productivity, communication, collaboration, critical thinking, problem-solving, and metacognition (Ilomäki et al., 2016).

Foreign authors also give different definitions. The competencies understood from the educational sphere, as manifested by Marza & Cruz (2018), are assumed as very useful instruments that allow the mobilization of attitudes, knowledge, and processes, by which students acquire s to facilitate the transfer of knowledge and create innovation. For their part, Iordache et. al. (2017) propose that digital competencies be assumed as the most practical and measurable results of the training processes concerning the new digital literacy. For Rangel & Peñalosa (2013), the meaning of digital literacy, understood as a construct, is limited evidently to cognitive processes that allow the acquisition of certain abilities to use ICTs and handle information, although to be precise they assume that these processes are the product of training in the management of resources based on technologies of the computer world. In conclusion, digital competencies must be understood under a holistic perspective that encompasses technological knowledge and abilities which must be supported by a network of high complexity in technological but functional literacy. This aspect has already been pointed out by Rangel & Peñalosa (2013) who already strongly affirm that new competencies, competencies, and attitudes are required in the current context, and its consistency with this approach is linked to the implementation of a new process of digital literacy. Educators working in kindergartens must not only have digital competencies but also be able to apply their digital knowledge and skills in their daily work.

Valuable insights regarding the assessment of digital competencies of educational staff employed in early and preschool education institutions were made possible by the results of various research on the use of digital technology in education.

III. Overview of previous research

Some scholars are concentrating on studying how digital abilities are developed at the beginning of their education. The findings of Sillat et al. (2017)'s research demonstrate that the original learning objectives and curriculum design do not assist the development of digital competences in educator preparation. Thus, the authors stress that the integration of digital competencies into the curriculum's learning outcomes, the integration of courses, and collaboration among academic staff members in curriculum design are the most crucial modifications for the development of digital competencies. The authors draw the conclusion that digital technology can be utilized in education, information-gathering, the production of instructional materials, and dealing with kids by using various software and technological solutions, but they emphasize that digital competence alone is not sufficient for the same, it is necessary to work on improving leadership and self-management skills.

The study conducted by Çebi & Reisoğlu (2020) yielded the following conclusions: respondents, or educational workers, view their level of digital competence to be moderate, with substantial variations based on gender, branch, and perceived level of digital competence. The study was carried out by the writers. Because they highlight the needs of pre-service teachers and provide guidance on what kind of training or activities to organize to address these needs, it is thought that the study's findings will be helpful to researchers. The findings demonstrated that nearly daily usage of digital technology and its tools is made by staff members of elementary schools and early childhood education facilities. The instructors in both groups stress that while utilizing digital technology for their work, they require extra assistance and support. While primary school teachers primarily use digital technology for communication and general information searches (i.e., not information specific to their profession), early childhood education institution employees primarily use it for communication, information searching, and news reading. The study's findings also demonstrated that, in comparison to staff members at early and preschool education facilities, primary school instructors believe they have attained a greater degree of digital competency.

Sánchez-Cruzado et al.'s research from 2021. presents the findings of a quantitative study. 4883 Spanish teachers from different educational levels participated in the study, which assessed their digital competencies. The findings demonstrate how little they believe they know about their own digital competencies in the workplace. Additionally, the research shows that the teaching and learning process has not benefited from digital literacy, and that teachers urgently require a training program to attain optimal levels of digital skills, undergo a true paradigm shift, and ultimately combine methodology and instructional strategies (Sánchez-Cruzado et al., 2021). The authors suggest creating a plan for training teachers in digital skills, taking the INTEF (Spanish acronym for the National Institute for Educational Technologies and Teacher Training) common digital skills framework as a point of reference.

In eight different countries (Norway, Slovenia, Portugal, Poland, Turkey, Ukraine, England, and Jordan), a group of authors conducted research (Sollied Madsen et al., 2023) that produced 772 responses from early childhood and preschool education educational staff in the final year of their initial university education.

The findings show that there are significant national differences in the use of digital technology in teaching across both single- and multi-item scales. Simultaneously, the dynamics of digital technology use across nations show that digital knowledge, skills, and attitudes are statistically significant indicators of how educational professionals in early and preschool education institutions will use technology in the future. The findings show both cross-national parallels and divergences and can be used to inform the creation of training programs for early childhood education institution staff members, as well as the significance of incorporating all relevant elements in the process of enhancing their digital competency.

Author Alnasib (2023) conducted a study that looks at digital competence (DigComp) as an essential skill for teachers in the twenty-first century. It looks into the degree of DigComp that pre-service teachers felt their preparation program had prepared them for, as well as whether they thought they were qualified for digital education. The findings revealed that 22.9% of pre-service teachers gave their DigComp a middling rating and 77.1% gave it an excellent rating. The results also showed that, in terms of preparing pre-service teachers to incorporate technology into their future teaching practices, the pre-service teacher program performed mediocrely (65.04%). The findings of this study demonstrate how important it is to assess pre-service teacher programs to make sure they are suitable for producing teachers with the digital, cognitive, and teaching competences needed in the age of technology.

The relationship between several aspects of digital literacy (DL) competency and digital literacy practices in teaching as well as teacher identity was examined in a study by Shuting Zhang et al. (2023). There were 910 Chinese preschool teachers included in the study. According to Shuting Zhang et al. (2023), the results indicated that digital practices in education were significantly positively correlated with information and information literacy, communication and collaboration, and security. Additionally, the effect of digital competence on teacher identity was mediated by digital literacy practices, which significantly and favorably predicted teacher identity. This suggests that preschool teachers' digital competencies had a favorable impact on teachers' identities generally. According to the report, it's critical for preschool teachers to increase their digital competency and use digital technology as a teaching tool.

The goal of the study by Akyar et al. (2024) is to investigate how preschool teachers feel about information and communication technology (ICT), as well as the factors that influence it and how they use ICT tools in their instruction. A mixed-method study technique was used to collect data utilizing field observation and surveys, combining quantitative and qualitative information in order to accomplish this goal. This study comprised 58 preschool teachers from the northern region of Portugal. According to the survey, preschool instructors, regardless of age, experience level, or professional course completion, enjoy utilizing ICT in the classroom. Teachers engage students, conduct research with them, and improve classroom activities by using ICT tools as materials. Finally, the study's findings show that preschool teachers actively use ICT in their lessons and have positive attitudes about it, which suggests that they will be inspired to further their digital abilities in the future.

Research conducted in different countries also shows different results of the self-assessment of preschool teachers' digital competencies. Although the studies were done according to different variables and different methods, the aims were the same. As a follow-up to all the aforementioned studies, this research tried to determine the level of digital competencies of educators in Croatia. By the recommendations of the conducted studies, implications for future research on digital competencies in Croatia are given.

IV. Research Methodology

Aim and hypotheses of the research

The research aims to determine the self-assessment of preschool teacher's digital competencies and their attitude toward the usefulness of digital technology in the work of early and preschool education institutions.

By the given aim, the following hypotheses were set:

H0: There is no statistically significant age difference among the respondents in the opinion about the usefulness of digital technology in the work of early and preschool education institutions.

H1: Most respondents show a medium level of digital competence according to the self-assessment questionnaire (Bayrakci & Narmanlioğlu, 2021).

H2: The attitude about the usefulness of digital technology in the work of early and preschool education institutions is related to the respondents' self-assessment of digital competence.

Respondents

The total number of respondents was N = 99, and Table 1 shows there is one missing value, and all respondents answered every question from the survey questionnaire. Table 1., and Table 2 show the frequencies of independent nominal variables – age (younger, middle-aged, older educators), and workgroup. It can be seen that the majority of respondents by age are younger educators and that most of them work with children under

the age of 5 and/or a mixed group, by gender 100% of the respondents are female, and the data of the Croatian State Statistics Institute (2022) agree with this.

Table 1. Distribution of respondents by age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	younger educators	52	52.0	52.5	52.5
	middle-aged educators	22	22.0	22.2	74.7
	educators of mature age	25	25.0	25.3	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

Table 2. Distribution of respondents according to the group within which they work (children aged up to 5 years or older than 5 years)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	children up to 5 years old	81	81.0	81.8	81.8
	children older than 5 years	18	18.0	18.2	100.0
	Total	99	99.0	100.0	
Missing	System	1	1.0		
Total		100	100.0		

Instrument

Data collection was carried out using a questionnaire that consisted of two parts:

a) sociodemographic characteristics of the respondents;

b) valid and reliable digital literacy scale - DLS.

The authors of this questionnaire are scientists from Turkey Bayrakci & Narmanlioglu (2021). The reliability and validity of the digital literacy scale have been tested and approved, and it has been developed as a 25-item scale that includes six factors. The ranges of the respondents' scores represent the levels of digital literacy (low, below average, medium, above medium, and high) by converting them into a standard Z score, and the competencies that can be achieved for each are shown in Table 3. In addition to the independent variables of socio-demographic characteristics, an interval scale was added that measures the teacher's attitude about the usefulness of teaching.

Table 3. Scale of digital literacy (Bayrakci & Narmanlioglu, 2021)

Digital Literacy Scale Score Ranges	Level	Competence
1,62-3,07	Low/Poor	S/he can perform simple and routine digital operations at the most basic level; It is the entrance level. He/She often needs the guidance of others.
3,08-3,62	Below Average/Weak	He/she is capable of solving uncomplicated routine tasks and clearly understand problems on his/her own.
3,63-4,17	Average	S/he is able to solve non-routine but not complicated problems on his own. S/he is intermediate in keeping up with the digital age and continues to learn.
4,18-4,72	Above Average/Good	S/he is a digital literate who can solve complex situations on his own and guide others in routine tasks. S/he can both apply and interpret digital technologies in his/her own life.
4,73-5,00	High/Perfect	S/he is at the level of expertise to be able to guide others in solving problems encountered in professional life and to propose or produce new ideas and processes related to work.

Results

H0: There is no statistically significant age difference among the respondents in the opinion about the usefulness of digital technology in the work of early and preschool education institutions.

To determine the difference between the age of the respondents and the attitude about the usefulness of ICT in the work of early and preschool education institutions, parametric techniques were used. Table 4. and Table 5. show the results of the age difference of the respondents.

Table 4. Results of one-way analysis of variance

		Levene Statistic	df1	df2	Sig.
I consider technology useful in my work	Based on Mean	1,742	2	96	.181
	Based on Median	1.137	2	96	.325
	Based on Median and with adjusted df	1.137	2	90.490	.325
	Based on trimmed mean	1.545	2	96	.219

The results of Levene's test on equality of variances indicate that the assumption of homogeneity of variances is not violated, as it can be seen from Table 5 (p =0.505).

Table 5. Results of one-way analysis of variance

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.610	2	1.305	.689	.505
Within Groups	181.935	96	1.895		
Total	184.545	98			

Table 6. ANOVA - I consider technology in work useful.

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	2.610	2	1.305	.689	.505
Within Groups	181.935	96	1.895		
Total	184.545	98			

Table 6. shows there are no differences between respondents in their attitude toward the usefulness of technology in their work and the age of the respondents (p=0.505, F=0.689).

H1: Most respondents show a medium level of digital competence according to the Self-Assessment Questionnaire (Bayrakci & Narmanlioğlu, 2021).

To determine the hypothesis, a composite variable of 25 particles was created, as in the aforementioned standardized questionnaire. Frequencies of self-assessment values of the composite variable can be seen in Table 7.

Table 7. Composite variable - Self-assessment of ICT in total

N	Valid	99
	Missing	1
Mean		95.8687
Median		98.0000
Std.	Deviation	16.33492
Minimum		31.00
Maximum		123.00

In the average of the total population of respondents (N=99), regardless of the differences between the groups, the Mean is 95,867, that is, M=3.82, while the Median is 3.92. Whereby it can be concluded that it is a question of the average level of the overall self-assessed digital competence of the respondents. Visible in Table 3 (Bayrakci, Narmanlioglu, 2021). This also confirms hypothesis H1: Most respondents show a medium level of digital competence according to the Self-Assessment Questionnaire (Bayrakci & Narmanlioğlu, 2021).

H2: The attitude about the usefulness of digital technology in the work of early and preschool education institutions is related to the respondents' self-assessment of digital competence.

Before just the correlation, the scatter diagram shown in Figure 1. was made, where the assumption of linearity of variances and homogeneity of variances is visible.

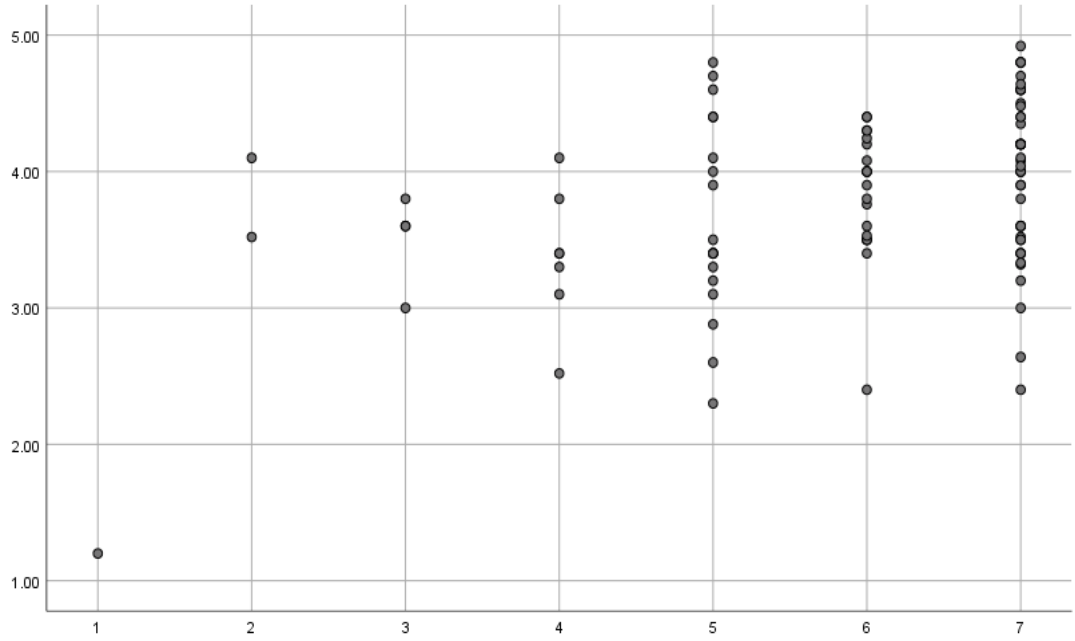

Figure 1. Assumption of linearity of variances and homogeneity of variances

Figure 1. shows data on the connection between the two variables, where r=0.39, N=99, p<0.05, and the correlation is of medium strength and in a positive direction, which indicates that a more positive attitude towards the usefulness of technology in work in institutions of early and preschool upbringing and education means greater digital competence of the respondents.

Table 8. Presentation of the correlations between the workplace and the attitude toward the usefulness of technology

		I consider technology useful in working in educational groups	ukupno
I consider technology useful in working in educational groups.	Pearson Correlation	1	.391
	Sig. (2-tailed)		.000
	N	99	99
ukupno	Pearson Correlation	.391	1
	Sig. (2-tailed)	.000	
	N	99	99

Also, the regression analysis established that the attitude about the usefulness of ICT in the work of educators is a significant predictor of self-assessment of digital competence (p<0.05, B=0.186), as can be seen from Table 9., and the same is shown in the results in Figure 2. it also shows that the residuals are normally distributed.

Table 9. Results of regression analysis

	Unstand	Coeffic ients	Standardi zed Coefficien ts			95,0% Confid ence	Interva l for 8		Co rrel ati ons		Colli neari ty	Statisti cs

Model	B	Std Error	Beta	1	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolleranace	VIF
1 (Constant)	2.708	268		10.089	000	2.176	3.241					
I consider technology useful in work in educational groups.	.186	044	391	4,185	000	098	274	391	391	391	1,000	1,000

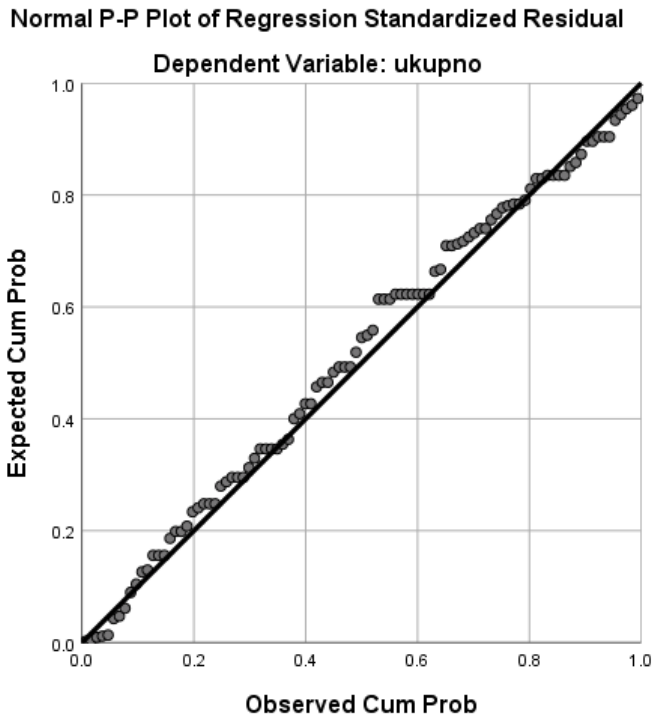

Figure 2. Presentation of the residuals of the regression analysis

V. Conclusion and discussion

Digital competence is one of the eight key competencies of lifelong learning. Digital competencies are assumed as very useful instruments that allow the mobilization of attitudes, knowledge, and processes, by which students acquire skills to facilitate the transfer of knowledge and create innovation (Marza & Cruz, 2018). In the research conducted for this work, an effort was made to determine the self-assessment of preschool teachers' digital competencies and their attitude toward the usefulness of digital technology in the work of early and preschool education institutions. The total number of respondents was N = 99, of which all were women.

The research found there were no differences between the respondents in their attitude toward the usefulness of technology in their work and the age of the respondents. This means there are no differences between younger and older preschool teachers with the attitude of using new digital technology tools in their educational work. The study in Portugal (Akyar et. al. 2024) also shows that preschool teachers are using ICT in education, no matter how old they are.

According to the results, the average level of assessment of the digital competencies of employees of early and preschool education institutions in Croatia was determined, which opens up possibilities for rethinking procedures for improving their digital competencies. Results of research in Saudi Arabia show that 77.1% of pre-service teachers rated their digital competencies as excellent (Alnasib, 2023). Still, the results of Spanish preschool teachers show the low self-perception of digital competencies in their work environment (Sánchez-Cruzado et. al. 2021). According to Sollied Madsen et al. (2023) the results indicate large differences between

nations for both single-item and multi-item scales on the use of digital technology in educational work, as we can see in early mentioned results.

This research determined that a more positive attitude towards digital technology is a significant predictor of the digital competence of employees of early and preschool education institutions. It means that preschool teachers are open to learning and developing their digital competencies as a way of their professional development in their work area. Shuting Zhang et. al. (2023) also claim that digital literacy practices significantly and positively predicted teacher identity and mediated the effect of digital competence on teacher identity. And, according to Çebi & Reisoğlu (2020), employees of early and preschool education institutions in Turkey use digital technology and its tools almost every day so it can be concluded that there is a positive attitude toward using digital technology in educational work.

This study which aimed to determine preschool teachers' self-assessment of their digital competencies, was limited to an insignificant number of respondents. The study was limited only to preschool teachers who had access to online questionnaires and were included in social media groups where the questionnaire was shared.

The results, in general, showed that preschool teachers in Croatia are not completely satisfied with the level of development of their digital competencies, so the scientific contribution of this work is manifested in the determination of possibilities for the development of digital competencies in their further educational work. The research indicated the need to develop and strengthen the digital competencies of employees of early and preschool education institutions, to be in line with the development of digital technology and the needs of children of today's generation.

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