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Pre-service Preschool Teachers' Opinions on Technology Education in Kindergarten

Darjo Zuljan
University of Primorska, Faculty of Education

Abstract

Participation in a technological society demands deep and critical understanding of technology and its impact on each individual, the environment and society. Achieving technological literacy has become an imperative of national policies; hence, the role of education and adequate teacher training has become vital. In recent years, research in technology education has begun incorporating studies of preschool, but technology education in preschool still remains less studied. The research focuses on technological literacy of pre-service preschool teachers. Most of them think that technology, technology education and knowledge are very important for preschool teachers even if they consider their aptitudes to be low. Part-time students, in comparison to full-time students, exhibit higher technological literacy and more highly assess the impact of everyday technological environment on the lives of individuals, the need for technological knowledge in the lives of modern people, the importance of technology education in kindergarten, the importance of technological knowledge for quality professional work of preschool teachers, the importance of technology education during their study at the faculty, and their own competencies in the technological field.

Key words: *full-time students; part-time students; technological literacy.*

Introduction

Knowledge of the environment has contributed significantly to human development. Technology development involves knowledge and understanding of the technological environment, which is very important for the quality of life of each individual as well as for the development of society (Aberšek, 2010; Aberšek, Borstner, & Bregant, 2014). The priority of national educational policies and schooling should be the development of critical technological literacy of each individual on the one hand, and fostering interest

in technology as a choice of profession and source of motivation for technologically gifted individuals on the other. There are several definitions of technological literacy. The International Technology and Engineering Educators Association (ITEEA) defines technological literacy as an individual's ability to use, manage, evaluate/assess, and understand technology, and this is a definition that has been widely accepted. The International Technology Education Association (ITEA, 2000 and 2006) states that all students should develop critical thinking about technology, conception, development and promotion of products, systems and environment for solving practical problems. The acquisition of technological knowledge (TK), capabilities, and critical thinking and decision making is very important.

Technology education should develop an understanding of the nature of technology, the relationship between technology and society, and technological design. The development of technological literacy along with the individual's attitude towards technology starts in the preschool/kindergarten period. The contribution of the preschool period to the development of technological literacy in children depends significantly on teachers' abilities. It is essential that preschool teachers are aware of the importance of the development of technological literacy in children, and are able to organize quality technology education (TE) (Rajšp & Fošnarič, 2014). Technology education in the preschool period should consider the specificities of learning in children; the learning process should therefore emerge from children's natural curiosity and their need to play besides the knowledge of the child's experiences and foreknowledge. The child's spontaneity and planned activity, individual and group activities, and individualized incentive and help should be connected. According to Mawson (2007, p. 265), it is important to form a "technological learning experience" and consider that "one of the important aspects of early childhood education is the length of time children are able to take to revisit and refine their ideas and outcomes" (Mawson, 2013, p. 450). Although in recent years research in technology education has begun incorporating studies of preschools (Elvstrand & Hellberg, 2015; Fleer, 2000; Hallström, Elvstrand, & Hellberg, 2015; Turja, Endepohls-Ulpe, & Chatoney, 2009), TE in kindergarten has not been studied much. Fleer (2000) reviewed some studies and stated that there is modest knowledge about how children under the age of eight work in technological learning contexts. Turja et al. (2009) presented an overview of early childhood education curricula in six countries: Austria, Estonia, Finland, France, Germany and Scotland, and concluded that the curricula do not offer much guidance for technology education in the early years.

The Role of Technology Education (TE) and Research on Technology in Kindergarten

Openness and integrity of the curriculum make it possible to organize various activities that foster technological literacy in children. TE in kindergarten can be organized in various ways: as a form of free play, or role play (Turja et al., 2009);

socio-dramatic play (Mawson, 2007, 2013); project work (Novak, Žužej, & Glogovec, 2009); drawing and modelling (Anning, 1997; Hallström et al., 2015; Mawson, 2007); research on how and why things work; storytelling about technological innovators in the past and present, etc. Children should take part in all phases of learning, from planning to evaluation. Technological activities should not be split, mechanical and an end in themselves, but rather should be directed to challenges that children have already experienced in the real environment. In this way children can understand technology more and connect it with their lives, make sense of it and place it in a broader social context.

Further on, a few possibilities for TE in kindergartens are presented. Play certainly represents a fundamental way of learning in kindergarten, but Turja et al. (2009) state that it is seldom studied in the context of technology education. Within TE, role playing of various professions like inventor, manufacturer, user, etc. can take place, as well as functional play where children acquire knowledge of objects, materials and physical phenomena, and learn to master the use of tools and techniques through explorations and rehearsals (Turja et al., 2009). Play can be individual or group, free or guided, functional, directed to the acquisition of manual skills, or creative and directed to problem solving, etc.

Preschool teachers should pay special attention to gender stereotypes in relation to technology. Hallström et al. (2015) investigated how girls and boys explore and learn technology as well as how their teachers frame this in free play. The study was based on qualitative data collected through videotaped observations and informal talk with children (primarily 3-6 years old) and teachers in two different Swedish preschool. The authors concluded that girls and boys learn to approach and handle technology differently, thereby confirming rather than dissolving gender boundaries. Teachers are not as active in supporting free play involving technology among the older children, nor in giving boys and girls equal opportunities to explore and use materials and toys which are not gender-stereotyped. In other words, when teachers support children, they encourage boys' use of technology in one way and girls' use in another.

Researchers differ in their view of preschool teachers' support in TE. Some think that free play will stimulate design capabilities (Milne, 2013 as cited in Hallström et al., 2015; Parker-Rees, 1997 as cited in Hallström et al., 2015), while others note that there is a downside when the play is too free. Hallström et al. (2015) note that the older children who use technology in free play often get little or no support from the teachers in developing this use, and likewise those who do not handle technology or do not construct at all are not encouraged to do so. It may lead to a preschool environment in which the teachers allow children to choose entirely freely and thereby those who do not choose to play with technology miss the chance of developing knowledge in and about technology. The preschool teacher's ability to offer individually adapted support with regard to the aim of the activity and the child's characteristics is very important in the process of TE.

Drawing has an important role within TE. Mawson (2010) states in his research that children had little opportunity to use drawing as part of their technological practice. Teaching of a range of drawing and modelling techniques would have given these children other tools to express their ideas.

Project work from an idea to a product has an important role in TE in kindergarten (Novak et al., 2009). A technological process begins with the identification of the aim, and ends when the outcome is developed and evaluated. Identification of the aim in early childhood settings rests on the curriculum and emerges from the child's wishes and ideas. Early childhood curriculum and pedagogy are holistic, which enables the interrelationship of various disciplines. Hence, the development of children's technological literacy can be wholly connected with mathematical and scientific literacy on the one hand, and art and language literacy on the other. The development of technological literacy should consider diverse criteria in the phase of planning as well as in evaluation. The objectives of environmental education and sustainable development should also be considered, e.g. recycling of products after use. The interests of different social groups ought to be considered as well. In TE children learn to plan and evaluate activities, they learn to reflect about interpersonal collaboration and discussion with others, which can contribute to the in-depth understanding of technology.

Although it is important to make products, learn about materials and develop different skills within TE, it should not stay on this level only. Mawson (2005 as cited in Mawson, 2010) noted that in school TE there was a strong emphasis on making the product. "The emphasis on making focused the children's attention on the materials they were manipulating and the task in hand. Wider issues of the nature of technology and the relationship of technology and society were seldom discussed" (Mawson, 2010, p. 10). Something similar can also happen in TE in preschool. It should be emphasized that in making products children learn by observing what the teacher does. The learning process can be strongly led by the preschool teacher, and is either slightly connected with the child's creative activity and their experiences, or broadly based on project work and Problem Based Learning (PBL). This allows children to place their life activities in a wider social context and start to recognize the connections between technological developments and changes in their own lives. "Students should be given opportunities to explore the wider dimensions of technology, such as issues of sustainability and stakeholder interests. If these elements are built in learning experiences in technology, it is likely that they will begin to develop a wider view of technology" (Mawson, 2010, p. 11). The main objective of TE is the development of critical technological literacy that is adapted to the child's developmental abilities; moreover, it could start in kindergarten and continue in further education.

Mawson (2013, p. 450) notes that "where the learning was led by the teachers but based on the children's interests, the children were able to come to a high level of understanding of the dairy process, from the farm to the supermarket shelves".

Children can learn the target contents in different ways. "The knowledge presented to the children through the farm visit, the DVD's of the dairy factory and the visitor showing milk-testing procedures were always followed by repeated opportunities for the children to simulate what they had seen and been told in their own dramatic play. This dramatic play, and the time given which allowed children to revisit the scenario as many times as they wished seemed to be the crucial component in the depth of understanding they were able to articulate in their conversations with the researcher", as described by Mawson (2013, p. 450).

Research on Preschool (PS) Teachers and Technology in Kindergarten

The learning process should be adapted to the child's development and characteristics if the mentioned activities within TE are to be successful. Technology involves children's home experiences and their out-of-school experiences. Mawson (2005 as cited in Mawson, 2010) notes that the major influences on children's developing an understanding of technology were their home experiences, which were certainly not considered by the teachers included in his research.

The organization of a cognitive-constructivist model of learning is essential for quality TE (Fox-Turnbull & Snape, 2011; Twyford & Järvinen, 2000; Valenčič Zuljan, 2002) because it emphasizes the importance of the didactic principle of activity and individualization. Therefore, preschool teachers should be familiar with children's concepts and experiences in addition to wrong and incomplete perceptions, and consider them within the learning process. A teacher forms situations of socio-cognitive conflict, and in the process of modelling offers children suitable support in resolving the conflict. The preschool teacher's support in cognitive conflict resolution and in the whole process of learning is very important. In order to achieve quality learning, children should be able to acquire knowledge in different ways and through various activities.

In recent years, research in technology education has begun incorporating studies of preschools, but TE in kindergarten is still not sufficiently studied, which is especially true for TE of pre-service preschool teachers and their professional development.

Systematic review of articles with Social Science Citation Index and Science Citation Index in the Elsevier, Science Direct and Scopus databases shows that the topic of preschool teachers' education is rarely the subject of research. Where research does take place, most of the articles focus on ICT (Baf, Radetić-Paić, & Zarevski, 2013; Kabadayı, 2012). TE of pre-service preschool teachers can be successful if we know students' technological literacy and their opinions about TE in kindergartens and technology and quality TE teaching in kindergartens. As regards the few studies in technology education (Fleer, 2000; Hallström et al., 2015; Stables, 1997), it seems that technology is not widely present in preschool activities. Some countries do not have a technology curriculum for the very early years which, according to Hallström et al. (2015), also contributes to a lack of teaching due to unsatisfactory teacher education and teaching materials.

Methodology

In Slovenia, technological activities are included in the kindergarten curriculum. Pre-service preschool teachers gain some TE knowledge at the faculties of education as a compulsory curriculum subject, but they can also choose extracurricular technological content. In this empirical research the survey research method was used.

Research Questions

The aim of the research was to determine students' opinions about the role and significance of technology for individuals and society, as well as their experiences with TE in primary school. Students' opinions on the significance of TE in kindergarten and in their studies at university in addition to their evaluation of their TE abilities were explored.

Five research questions were formulated:

1. What level of technological literacy do pre-service preschool teachers have?
2. What school experiences do they have regarding TE?
3. What are their opinions about the role and importance of technology in the individual's life and in society?
4. How do pre-service preschool teachers evaluate the importance of TE in kindergarten and school?
5. How do pre-service preschool teachers evaluate the importance of TE in the process of study, and how do they evaluate their abilities in this field?

We were also interested if there were differences between full-time and part-time students with regards to the defined research questions, and if students' evaluations pertaining to the above questions are connected with the degree of their technological literacy.

Sample

Research encompassed 118 full-time (FT) and 58 part-time (PT) students of preschool education at the Faculty of Education, University of Primorska. The questionnaire was filled out by third year students (98 % of full-time students and 60 % of part-time students) of Preschool Education programme at the beginning of 2014 and 2015 academic year. There were 94.9 % female students and 5.1 % male students in the sample. The obtained previous level of education was as follows: full-time students obtained high school education; in the group of part-time students, 83 % obtained high school education, 12 % obtained higher education, 2 % obtained university education and 3 % of students did not answer the question. The age range of full-time students was 21-23 years, and part-time students were 23-52 years old.

Instrument and Procedures

Data were collected via a questionnaire of technological literacy and a written questionnaire about students' opinions on technology. Both instruments were created for the purpose of the research.

The questionnaire of technological literacy (TL) was formed on the basis of objectives of technological subjects for primary school in Slovenia. It contains 29 questions of different levels of Bloom's taxonomy and different content areas: technical devices and inventions, transport, technical drawing, materials, tools, machines and basic technologies. To ensure validity of the "Questionnaire of TL for preschool teachers" it was based on the content of the curriculum for the primary school subject Engineering and Technology. Methodological adequacy is based on the consideration of relevant methodological guidelines (Fraenkel & Wallen, 2003). Objectivity of the instrument was met by providing specific instructions and close-ended tasks. The Cronbach's alpha reliability coefficient (α=.771) confirms the reliability of the test.

The questionnaire also covered 17 questions about students' opinions on their primary school experiences in TE, students' opinions of the importance of TE in the kindergarten and primary school setting, the importance of TK for quality professional work of preschool teachers, own competencies in the technology field, and the importance of TE during university studies. Cronbach's alpha reliability coefficient was .781, which confirms good reliability of the questionnaire. In order to test psychometric properties we also used factor analysis, which is justifiable if Kaiser-Meyer-Olkin is higher than .60 and if Bartlett's test shows statistical significance. Kaiser-Meyer-Olkin measure of sampling adequacy was .782 and Bartlett's test of sphericity was $\chi 2 = 878.741$; $df = 120$; $p < .001$. Factor analysis (Extraction method: Principal Component Analysis and Rotation method: Varimax with Kaiser Normalization) extracted four factors that together explain 66.190 % of variance, thus reliability is .781. Validity is shown by the first factor with 24.344 % of variance.

The completed questionnaire was returned by all of the students. Participation in the research was anonymous and optional for students.

Data Analysis

The statistical procedures employed were: frequency distribution (f, f %) of the nominal and ordinal variables, basic descriptive statistics of the numerical variables (mean - *M*, standard deviation - *SD*, coefficient of variability - CV, skewness - SKEW, kurtosis - KURT, the χ^2 test of hypothesis of independence, Mann-Whitney *U* test, Eta coefficient). The assumption of linearity can be verified by computing the differences between the coefficient of the correlation ratio η (Eta) and the Pearson coefficient of correlation (r) using the Blackman test. According to the Blackman rule, $(\eta^2 - r^2) * n > 11.37$ is a nonlinear relationship (n - number of cases).

Statistical data processing was carried out using the IBM SPSS Statistics 22 program.

Results and Interpretation

Technological Literacy (TL) of Pre-service Preschool Teachers

The "Questionnaire of TL for preschool teachers", i.e. TL test score showed, on the basis of 80 available scores, that participants' average estimation of technological literacy was 42.86.

Table 1

Basic descriptive statistics of students' TL test score

Variable	Minimum	Maximum	*M*	*SD*	CV (%)	SKEW	KURT
TL	11	69	42.86	11.53	26.70	.053	-.184

Table 1 shows that the distribution is skewed to the right (SKEW=.053) and slightly flattened (KURT=-.184), which means that there are more students with technological literacy lower than average. The average dispersion rate was confirmed by the coefficient of variation (CV=26.70 %).

Table 2

Mann-Whitney U test results comparing full-time (FT) and part-time (PT) students on total TL test score

Variable	Type of study	*n*	Mean Rank	Mann-Whitney *U*	*2p*
TL	FT	118	73.47	1649.000	< .001
	PT	58	119.07		

Mann-Whitney U test results showed the existence of statistically significant differences between mean ranks of the technological literacy of full-time and part-time students. Part-time students displayed a 119.07 mean rank of technological literacy, and full-time students' mean rank was 73.47 (Table 2).

Students' Opinions of Their Primary School Experiences in Technology Education

Students' experiences in TE in primary and secondary schools affect students' interests and knowledge. These dimensions are especially important for future preschool teachers and teachers whose practices will create the school experiences of the next generations. The research therefore investigated pre-service preschool teachers' school experiences in TE, how interesting technological content was for them, what achievements they gained in TE in comparison with other achievements, and how they estimated the quality and amount of TE in kindergarten as well as in primary school. We were interested to learn if they were so enthusiastic about any content or teaching method that they wanted to choose a profession related to engineering (e.g. engineering teacher, etc.).

The results show that 40.7 % of pre-service preschool teachers assessed the quality of their TE in primary school with a total TL test score of 3 on a 5-point scale. Furthermore, 26 % of students think that the quality of their TE was low (total TL test score was 2), while for 22.6 % of students the total TE test score was 4. When assessing the amount of TE in primary school, 50 % of students thought that they did not have enough TE, 47.1 % believed that they had enough TE, while 2.9 % of students responded that there was too much TE in primary school. Despite the fact that the greatest number of students thought there was not enough technology education, 49.7 % of students estimated that technological content in primary school was less interesting than that of other subjects (for 17 % of students it was more interesting).

Most of the students had similar grades in TE as in other subjects. It was also found that 92.1 % of pre-service preschool teachers were not so enthusiastic about TE in school and they never thought about technological profession. Statistical significance of the relationship between different experiences of students with technology education and technological literacy was also tested. A high statistically significant estimation of the quality of TE experienced in primary school (p = .007) was found in students with higher technological literacy, who also had better grades in technological subjects in a larger proportion (p = .016) (Table 3).

Table 3

Students' opinions on their primary school experiences in TE and correlations with TL

	Students' opinions					Correlations with TL *test score*
	Very bad	Bad	Medium	Good	Very good	*F*
	f	f	f	f	f	*p*
Variables	f(%)	f(%)	f(%)	f(%)	f(%)	Eta
						Blackman test
Quality of TE in primary school	9 6.0	39 26.0	61 40.7	34 22.7	7 4.7	1.802 .007 .662 65.70>11.37
	Not enough		Just right		Too much	
Amount of technological content/subjects in primary school	f f(%)		f f(%)		f f(%)	1.245 .187 .605 42.28>11.37
	70 50.0		66 47.1		4 2.9	
	More		Equally		Less	
Interestingness of technological content/subjects in primary school in comparison with other subjects	f f(%)		f f(%)		f f(%)	1.170 .253 .580 41.31>11.37
	26 17.0		51 33.3		76 49.7	
	Better		Equal		Lower	
Grades in technological contents/subjects in primary school in comparison with grades in other subjects	f f(%)		f f(%)		f f(%)	1.674 .016 .650 60.80>11.37
	42 27.6		96 63.2		14 9.2	
	Yes		No			
Enthusiasm about engineering, considerations about the choice of technological profession	f f(%)		f f(%)			1.308 .132 .605 53.00>11.37
	12 7.9		139 92.1			

Note. TL - Technological Literacy

Pre-service Preschool Teachers' Opinions on the Role and Impact of Technology on the Lives of Individuals and Society

Opinions about the importance of technology and its impact on an individual, society and the environment were measured with 6 items.

Table 4

Students' opinions on the role and impact of technology on the lives of individuals and society and correlations with TL

Variables	Students' opinions					Correlations with TL *test score*
	1	2	3	4	5	*F*
						p
	F	f	f	f	f	Eta
	f(%)	f(%)	f(%)	f(%)	f(%)	*Blackman test*
Impact of technology development on society	0 0	0 0	7 4.1	47 27.3	118 68.6	0.931 .599 .507 43.94>11.37
Impact of technology development on the quality of life	0 0	1 0.6	10 5.9	61 35.9	98 57.6	1.534 .033 .605 61.34>11.37
Impact of everyday technological environment on individual's life	0 0	2 1.2	16 9.4	58 33.9	95 55.6	1.259 .161 .566 53.89>11.37
Impact of everyday technological environment on the development of society	0 0	33 1.9	9 5.6	54 33.5	95 59.0	1.654 .017 .634 64.32>11.37
Impact of everyday technological environment on natural environment	1 0.6	2 1.2	6 3.7	44 27.3	108 67.1	0.812 .786 .498 39.68>11.37
Necessity of TK in the modern life	1 0.6	5 2.9	39 22.5	82 47.4	46 26.6	1.169 .247 .548 51.26>11.37

Notes. 1- unimportant, 2 – quite unimportant, 3 – neither unimportant nor important, 4 – quite important, 5 – very important (this scale applies to all of the following tables).

It was noticed that pre-service preschool teachers mostly had a very positive opinion regarding the impact of technology: in 5 items the total TL test score was 5 and was placed in the first position (between 55.6 % and 68.6 %). Only in the item that measured students' opinion and view about TK in modern life the total TL test score was 4 (47.4 %) and was placed in the first position. This is the only item in which the total TL test score 3 (22.5 %) represents a larger proportion. Further, it would be interesting to know if there existed a statistically significant relation between pre-service preschool

teachers' opinions about the role and impact of technology in the lives of individuals and society and the technological literacy of students. It was found that the results of the students with high technological literacy showed a high statistically significant correlation in the evaluation of two items: the impact of technological development on the quality of life (p = .033) and the impact of technological environment on the development of society (p = .017). A certain degree of discrepancy exists between the students' assessment of the importance and effectiveness of technology on the one hand, and the need of technological knowledge in the lives of people on the other. In fact, this is a stimulus for the development of critical technological literacy of preschool teachers, who will be aware of the importance of knowledge when decisions about technologies and consequences will have to be taken (Table 4).

Table 5

Chi-Square test results of the effect of type of study (part-time (PT), full-time (FT)) on student's opinions of the role and impact of technology on the lives of individuals and society

Variables	Type of study	Students' opinions 1	2	3	4	5	χ2 or K *p*
		f f(%)	f f(%)	f f(%)	f f(%)	f f(%)	
Impact of technology development on society	FT	0 0	0 0	4 3.4	34 28.8	80 67.8	0.752 .687
	PT	0 0	0 0	3 5.6	13 24.1	38 70.4	
Impact of technology development on the quality of life	FT	0 0	1 0.9	8 6.9	43 37.1	64 55.2	1.986 .575
	PT	0 0	0 0	2 3.7	18 33.3	34 63.0	
Impact of everyday technological environment on the individual's life	FT	2 1.7	15 12.6	40 33.6	62 52.1	2 1.7	8.057 .045
	PT	0 0	1 1.9	18 34.6	33 63.5	0 0.0	
Impact of everyday technological environment on the development of society	FT	0 0	3 2.5	8 6.7	41 34.5	67 56.3	3.725 .293
	PT	0 0	0 0	1 2.4	13 31.0	28 66.7	
Impact of everyday technological environment on the natural environment	FT	1 0.8	2 1.7	6 5.0	32 26.9	78 65.5	5.631 .228
	PT	0 0	0 0	0 0	12 28.6	30 71.4	
Necessity of TK in modern life	FT	1 0.8	4 3.4	34 28.6	54 45.4	26 21.8	11.649 .020
	PT	0 0.0	1 1.9	5 9.3	28 51.9	20 37.0	

Note. K-Kullback (it applies to all of the following tables).

Statistically significant differences in the opinions of part-time and full-time students about the role and impact of technology in the life of individuals and society were tested. The assessment of the impact of technology differs statistically significantly between part-time and full-time students in two out of six items, namely in the estimation of the effect of everyday technology on the life of each individual (p = .045), and in the estimation of the necessity of TE knowledge in modern life (p = .020). Part-time students showed a high statistically significant estimation of both items (Table 5).

Students' Opinions of the Importance of Technology Education in the Kindergarten Setting and in Primary School

The importance of technological content in the kindergarten setting and in school was measured by three items. Pre-service preschool teachers assessed that TE is important for children in kindergarten as well as for children in the first and second cycles of primary school.

All cycles are given the total TL test score 4 (quite important), while its share increases with the age of children (27.3 % for kindergarten, 43 % for the first cycle and 51.4 % for the second cycle). It is worrying that 31.4 % of students (test score 1 and 2) think that TE is not important for children in kindergarten. Statistically significant correlation was not noticed between students' assessment of the importance of TE in kindergarten and technological literacy, but it was noticed between the technological literacy of students and their assessment of TE in the first (p = .043) and second cycle of primary school (p = .006) (Table 6).

Table 6

Students' opinions on the importance of TE in kindergarten and primary school, and correlations with TL

Variables	Students' opinions					Correlations with TL *test score*
	1	2	3	4	5	*F*
						p
	f	f	f	f	f	Eta
	f(%)	f(%)	f (%)	f(%)	f(%)	*Blackman test*
Importance of TE in kindergarten	13	34	39	41	23	1.276
	8.7	22.7	26.0	27.3	15.3	.156
						.596
						33.45>11.37
Importance of TE in the first cycle of primary school (age 6-8 years)	2	10	49	64	24	1.517
	1.3	6.7	32.9	43.0	16.1	.043
						.631
						51>11.37
Importance of TE in the second cycle of primary school (age 9-11 years)	1	5	28	76	38	1.845
	0.7	3.4	18.9	51.4	25.7	.006
						.670
						63.15>11.37

Table 7

Chi-Square test results of the effect of type of study (part-time (PT), full-time (FT)) on students' opinions of the importance of TE in kindergarten and in primary school

Variables	Type of study	Students' opinions					χ2 or K
		1	2	3	4	5	
		f	f	f	f	f	*p*
		f(%)	f(%)	f(%)	f(%)	f(%)	
Importance of TE in kindergarten	FT	13	32	26	22	6	37.79
		13.1	32.3	26.3	22.2	6.1	< .001
	PT	0	2	13	19	17	
		0	3.9	25.5	37.3	33.3	
Importance of TE in the first cycle of primary school (age 5-8 years)	FT	2	10	42	38	7	34.51
		2.0	10.1	42.4	38.4	7.1	< .001
	PT	0	0	7	26	17	
		0	0	14.0	52.0	34.0	
Importance of TE in the second cycle of primary school (age 9-12 years)	FT	1	5	22	53	18	13.08
		1.0	5.1	22.2	53.5	18.2	.011
	PT	0	0	6	23	20	
		0	0	12.2	46.9	40.8	

The assessment of the importance of TE showed a statistically significant difference between part-time and full-time students in all three items, namely in the assessment of TE in kindergarten ($p < .001$), in the first ($p < .001$) and in the second cycle of primary school ($p = .011$). Part-time students showed statistically significant higher estimation of the importance of TE in all three cycles. Full-time students assessed the importance of TE in kindergarten by the total TL test score of 2. It was also found that 32.3 % of students think that TE in kindergarten is less important (only 3.9 % of part-time students think so). Most part-time students assess the importance of TE in kindergarten by the total TL test score of 4, while 37.3 % of students think that TE in kindergarten is quite important (only 22.2 % of full-time students think so). No part-time students think that TE in kindergarten is not important (but 13.1 % of full-time students do think that TE is not important in kindergarten) (Table 7).

Students' Opinions on the Importance of Technology Education during Their Studies and Estimation of Their Technology Education Competencies

Students' opinions on the importance of TE for preschool profession were measured with three items (Table 8).

The results indicate that 55.2 % of students think that TK and TE are very important for the professional work of preschool teachers, while 33.1 % think that they are quite important. Most students assess their TE competencies as low, or they see themselves

as modestly qualified (45.9 %, total TL test scores 1 and 2). The item indicating the importance of TE for pre-service preschool teachers during their studies was assessed by total TL test score 4 – quite important and placed in the first position (40.5 %), followed by total TL test score 3 – medium importance (28.1 %). Total TL test score 5 (very important) and 2 (less important) have the same percentage – 13.1 %. Finally, 5.2 % of students think that TE is not important for pre-service preschool teachers (total TL test score 1). A statistically significant correlation was noticed only between technological literacy of students and their opinion of the importance of TE during their university study (p = .010) (Table 8).

Table 8

Students' opinions on the importance of TE in the study process and correlations with TL

Variables	Students' opinions					Correlations with TL test score
	1	2	3	4	5	F p Eta Blackman test
	f f(%)	f f(%)	f f(%)	f f(%)	f f(%)	
Importance of TK for the quality professional work of preschool teachers	0 0	3 1.7	17 9.9	57 33.1	95 55.2	1.217 .205 .580 42.50>11.37
Own competencies in the technology field	15 8.8	63 37.1	54 31.8	36 21.2	2 1.2	0.949 .571 .513 28.22>11.37
Importance of TE during university studies	8 5.2	20 13.1	43 28.1	62 40.5	20 13.1	1.756 .010 .652 51.25>11.37

Nevertheless, a statistically significant difference exists between part-time and full-time students in the assessment of three items. Part-time students demonstrated a high statistically significant difference in the evaluation of three items. Furthermore, 27.8 % of part-time and only 8 % of full-time students think that TK and TE are very important for the professional work of preschool teachers, while 24 % (test score 1 and 2) of full-time and only 1.9 % of part-time students think that such knowledge is less important. TE during their studies is important or very important (total TL test score 5 and 4) for 75.5 % of part-time students and for 42 % of full-time students. Full-time students assess their own competencies by the total TL test score 2 (47.1 %) and part-time students by 3 (45.1 %) (Table 9).

Table 9

Chi-Square test results of the effect of type of study (part-time (PT), full-time (FT)) on students' opinions of the importance of TE in the study process

Variables	Type of study	1 f f(%)	2 f f(%)	3 f f(%)	4 f f(%)	5 f f(%)	χ2 or K *p*
Importance of TK for the quality professional work of preschool teachers	FT	2 2	22 22	32 32	36 36	8 8	23.17 < .001
	PT	0 0	1 1.9	11 20.4	27 50.0	15 27.8	
Own competencies in the technology field	FT	14 11.8	56 47.1	31 26.1	17 14.3	1 0.8	27.94 < .001
	PT	1 2.0	7 13.7	23 45.1	19 37.3	1 2.0	
Importance of TE during university studies	FT	8 8	19 19	31 31	33 33	9 9	20.55 < .001
	PT	0 0	1 1.9	12 22.6	29 54.7	11 20.8	

Discussion

In the modern technological world the development of technological literacy is very important for people's active participation in the society and for the individual's well-being. Consequently, technological literacy has become the subject of numerous studies in different countries in recent decades. The technological literacy of preschool teachers and their perceptions of technology and technology education represent a less developed area in this context. Preschool teachers' perceptions of technology, their views about TE and their qualifications for TE represent an important factor in the development of technological literacy in preschool children. Quality TE of preschool teachers requires research on the learning of technology in the kindergarten setting, which should be followed by the presentation of research results to preschool teachers. Preschool teachers should implement a reflective approach and conduct an independent investigation of their own teaching practices. The formation of a quality model of professional development requires research on professional education, opinions, experiences and perceptions of preschool teachers and pre-service preschool teachers. Students' perceptions of technology and the role of TE in kindergarten enable the educators of preschool teachers to adequately alter students' attitudes during their studies and prepare them professionally to carry out TE in kindergartens. These views are the main focus of the research.

Results indicate a medium level of students' TL, especially that of full-time students. A statistically significant difference exists in technological literacy between part-time and full-time students as part-time students showed a statistically significant higher level of technological literacy. Students' school experiences in technology

education influence individuals' perceptions of technology, pupils' interests and knowledge, as has been shown by several studies (Burns, 1992 as cited in Mawson, 2010; Jones et al., 1994 as cited in Mawson, 2010; Moreland, 2004 as cited in Mawson, 2010). These dimensions are especially important for future preschool teachers and teachers whose own practices will create school experiences of the next generations. The survey showed that 50 % of students believed, based on their school experiences in TE, that technological content/subjects were insufficient in primary school. Even though 40.7 % of students assessed their TE in primary school as mediocre, 49.7 % of students criticized TE for not being interesting. Only 7.9 % of students were so enthusiastic about TE in school that they envisioned a technological profession. Thus, some questions appeared regarding TE teaching that students had experienced in school, i.e. pertaining to how their former teachers actualized the subject matter and placed technological content in the context of everyday life. One might ask how teachers organized the process of learning, if PBL prevailed and whether the project work and other student-focused approaches in which students actively created the learning process were used, or if the transmission model of teaching, in which pupils just received scientific truths, predominated. In the background of the above questions, there is the question regarding the perception of technology and TE among former teachers of these students, because teachers' perceptions are closely connected with teachers' educational decisions and policies (Valenčič Zuljan, 2007; Wittrock & American Educational Research Association, 1986).

The research also shows that most students (55.2 %) think that TK and TE are very important for the professional work of preschool teachers. The item related to the importance of TE for pre-service preschool teachers during university studies was assessed by a total TL test score of 4 – quite important by 40.5 % of students. Even though students are aware of the importance of TE in kindergarten, 31.4 % (test score 1 and 2) of students think that TE in kindergarten is not important. Special attention should be paid to the fact that most students evaluated their competencies for TE as low. On the basis of the above findings, the background of students' perceptions that TE is not important in kindergarten should be investigated in the light of how TE is presented at faculties, so that students can develop positive opinions towards TE in kindergarten, and gain awareness of the importance of TE and adequate competencies to lead TE. Researchers have confirmed the importance of teachers' opinions towards technology and confidence in their competencies for teaching technology as an important factor in pupils' opinions towards technology (McRobbie, Ginns, & Stein, 2000; Rohaan, Taconis, & Jochems, 2010; Verloop, Van Driel, & Meijer, 2001).

For quality TE during university studies, which is knowledge-oriented and individualized regarding the differences in technical literacy and other discovered differences among students, the constructivist approach seems to be the most suitable. In this model of training, the lecturer of technology at the faculty at the beginning of the course elicits students' perceptions and experiences and on this basis forms situations of cognitive conflict. In the process of individualized support and modelling,

students are encouraged to form proper perceptions of TE in kindergarten. The development of skills necessary to lead various activities within TE in kindergarten involves educational practice of students. Students prepare and carry out deep and sensible technological activities with children under the support of lecturers at the faculty and mentors in the kindergarten. Having in mind the research results and the findings of other researchers (Hallström et al., 2015; Mawson, 2007), it is particularly important to encourage students to implement complex goals of developing technological literacy, that are already presented within TE in the wider social context in addition to resolving gender stereotypes related to technology, etc. Along with the development of certain complex skills required to manage technology activities in the kindergarten, it is important to accustom students to the reflective and exploratory approach, which requires careful preparation of educational practice and in-depth analysis of the experiences gained during such practice (M. Zuljan, D. Zuljan, & Pavlin, 2011). This further requires competent mentoring in terms of both TE and in terms of mentoring and quality cooperation between the mentor and professor (Valenčič Zuljan & Marentič Požarnik, 2014; Valenčič Zuljan & Vogrinc, 2007) on the one hand, and building partnerships between kindergartens and universities on the other.

Conclusions

The quality of technology education in kindergarten depends on the study programmes in which students should gain specific skills and a sense of confidence in the implementation of technology education. The development of technological literacy in pre-service preschool teachers represents an important area with a poor research background, which gives this research the added value from the international perspective.

The research shows that the results of the students with higher technological literacy indicated a high statistically significant correlation with the evaluation of the quality of their school experiences in technology education, and they had better grades in technological subjects in a larger proportion. They evaluated more highly the impact of technological development on the quality of people's lives and the influence of the everyday technological environment on the development of society as well as the importance of technology education during schooling. They also evaluated more highly the importance of technology education during their studies at the faculty. The highlighting of opinions represents an important aspect of promoting the professional development of students during their studies. Part-time students in comparison to full-time students showed a statistically significant higher technological literacy. The survey also pointed to the necessity of a personalized approach to technology education at the faculty, which should depend on the degree of students' technological literacy and on the mode of study.

The research showed that students evaluated highly the importance of technology and its impact on the individual, society and environment. A certain degree of

discrepancy exists between students' perceptions of the importance of technology in people's lives and the need for technology education and literacy. This recognition represents an interesting motivation for preschool teachers' educators, who should turn to the development of critical technological literacy in preschool teachers. It is important that preschool teachers are aware of a real connection between technology and society and of the importance of everyone's technological literacy for responsible decisions related to technologies, and even more, they should be capable of teaching others about it.

This research has therefore highlighted the pivotal role of pre-service preschool teachers' knowledge of technological literacy and their opinions on technology knowledge as a basis for quality implementation of technology education in kindergartens. In further research, it would be interesting to find out to what extent and in what way students with different levels of technological literacy implement technology education in kindergartens during their teaching practice. It would also be useful to find out how students gain the necessary competency for quality implementation of technology education in kindergartens during their study at the faculty.

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Darjo Zuljan
University of Primorska, Faculty of Education
Cankarjeva 5, 6000 Koper, Slovenia
darjo.zuljan@pef.upr.si

Mišljenja studenata predškolskog odgoja o tehnološkom obrazovanju u predškolskim ustanovama

Sažetak

Život u društvu u kojemu tehnologija zauzima važno mjesto zahtijeva duboko i kritičko razumijevanje tehnologije i njezina utjecaja na svakog pojedinca, okolinu i društvo. Postizanje tehnološke pismenosti postao je imperativ nacionalnih politika; stoga je uloga obrazovanja, uz adekvatno osposobljavanje učitelja, iznomno važna. Posljednjih godina istraživanja u području tehnološkog obrazovanja uključuju i istraživanja vezana uz predškolski odgoj i obrazovanje, ali poučavanje tehnologije u predškolskim ustanovama još se uvijek nedovoljno istražuje. Istraživanje je usmjereno na tehnološku pismenost studenata programa predškolskog odgoja. Većina studenata smatra da su tehnologija, tehnološko obrazovanje i znanje iznimno važni za odgojitelje, iako svoje sposobnosti u navedenom području ocjenjuju niskima. Izvanredni studenti, za razliku od redovnih, pokazuju veću tehnološku pismenost i daju veću važnost utjecaju svakodnevnog tehnološkog okruženja na živote pojedinaca, potrebi za tehnološkim znanjem u životu modernog čovjeka, važnosti tehnološkog obrazovanja u predškolskim ustanovama, važnosti tehnološkog znanja za kvalitetan profesionalni rad odgojitelja, važnosti tehnološkog obrazovanja tijekom studija i svojim kompetencijama u području tehnologije.

Ključne riječi*: izvanredni studenti; redovni studenti; tehnološka pismenost.*

Uvod

Poznavanje okoline znatno je doprinijelo ljudskom razvoju. Tehnološki napredak podrazumijeva poznavanje i razumijevanje tehnološkog okruženja koje je iznimno važno za kvalitetu života svakog pojedinca, kao i za razvoj društva (Aberšek, 2010; Aberšek, Borstner i Bregant, 2014). Prioritet nacionalnih obrazovnih politika i školstva trebao bi biti razvoj kritičke tehnološke pismenost svakog pojedinca s jedne strane, i njegovanje interesa za tehnologiju kao profesiju i izvor motivacije za tehnološki nadarene pojedince s druge strane. Postoji niz definicija tehnološke pismenosti, a općeprihvaćena je ona koju su predložili članovi Međunarodne udruge edukatora u

području tehnologije i inženjerstva (The International Technology and Engineering Educators Association - ITEEA), prema kojoj je tehnološka pismenost definirana kao sposobnost pojedinca da upotrebljava tehnologiju, njom upravlja, procjenjuje ju i razumije. Prema Međunarodnoj udruzi za tehnološko obrazovanje (International Technology Education Association – ITEA; 2000 i 2006), svi bi učenici trebali razviti kritičko mišljenje o tehnologiji, koncepciji, razvoju i promoviranju proizvoda, sustavu i okolini za rješavanje praktičnih problema. Stjecanje tehnološkog znanja (TZ), sposobnosti, razvoj kritičkog mišljenja i sposobnosti odlučivanja iznimno je važno.

Tehnološko obrazovanje trebalo bi razviti razumijevanje prirode tehnologije, povezanosti tehnologije i društva i tehnološkog dizajna. Razvijanje tehnološke pismenosti kao i stava pojedinaca prema tehnologiji započinje u ranoj i predškolskoj dobi. Doprinos tog razdoblja u životu razvoju tehnološke pismenosti u djece uvelike ovisi o sposobnostima odgojitelja. Posebno je važno da odgojitelji budu svjesni važnosti razvoja tehnološke pismenosti u djece i da znaju organizirati kvalitetno tehnološko obrazovanje (TO) (Rajšp i Fošnarič, 2014). Tehnološko obrazovanje u predškolskoj dobi treba uzeti u obzir specifičnosti učenja djece; proces učenja trebao bi stoga proizaći iz prirodne dječje radoznalosti i potrebe za igrom, uz odgojiteljevo poznavanje iskustava i predznanja djece. Potrebno je spojiti dječju spontanost i planirane aktivnosti, individualne i grupne aktivnosti i individualizirane poticaje. Prema Mawsonu (2007, str. 265), važno je stvoriti „doživljaj tehnološkog učenja" i imati na umu da je „jedan od važnih aspekata učenja u ranom djetinjstvu vrijeme koje djeca imaju na raspolaganju kako bi ponovno razmotrila svoje ideje i ishode" (Mawson, 2013, str. 450). Iako posljednjih godina istraživanja u području tehnološkog obrazovanja postupno uključuju i istraživanja o ranom i predškolskom odgoju i obrazovanju (Elvstrand i Hellberg, 2015; Fleer, 2000; Hallström, Elvstrand i Hellberg, 2015; Turja, Endepohls-Ulpe i Chatoney, 2009), TO u predškolskim ustanovama nije se istraživalo u većoj mjeri. Fleer (2000) je analizirao neka istraživanja i navodi da je poznavanje načina na koji djeca mlađa od osam godina funkcioniraju u kontekstu tehnološkog učenja uistinu skromno. Turja i sur. (2009) predstavili su pregled kurikula predškolskog obrazovanja u šest zemalja: Austriji, Estoniji, Finskoj, Francuskoj, Njemačkoj i Škotskoj, te su zaključili kako kurikuli ne daju dovoljno smjernica vezanih uz tehnološko obrazovanje u ranoj dobi.

Uloga tehnološkog obrazovanja (TO) i istraživanja tehnologije u predškolskim ustanovama

Otvorenost i cjelovitost kurikula omogućava organiziranje raznih aktivnosti koje potiču tehnološku pismenost u djece. TO se u ustanovama ranog i predškolskog odgoja i obrazovanja može organizirati na razne načine: kao slobodna igra ili igra uloga (Turja i sur., 2009); sociodramska igra (Mawson, 2007, 2013); kao projekt (Novak, Žužej, i Glogovec, 2009); crtanje i oblikovanje (Anning, 1997; Hallström i sur., 2015; Mawson, 2007); kao istraživanje kako i zašto nešto radi; pričanje priča o tehnološkim inovatorima u prošlosti, ali i u sadašnjosti itd. Djeca bi trebala sudjelovati

u svim fazama učenja, od planiranja do evaluacije. Tehnološke aktivnosti ne bi trebale biti podijeljene, mehaničke niti same sebi svrhom, već bi trebale biti usmjerene na izazove s kojima su se djeca već suočila u stvarnosti. Na taj način djeca mogu bolje razumjeti tehnologiju i povezati je sa svojim životima, shvatiti je i postaviti je u širi društveni kontekst.

Nadalje se daje pregled nekih mogućnosti za TO u predškolskim ustanovama. Igra svakako predstavlja osnovni način učenja u ustanovama za rani i predškolski odgoj i obrazovanje (RPOO), ali Turja i sur. (2009) navode da se rijetko proučavala u kontekstu tehnološkog obrazovanja. U sklopu tehnološkog obrazovanja može se osmisliti i provesti igra uloga s različitim profesijama, kao npr. izumitelj, proizvođač, korisnik itd., kao i funkcionalna igra u kojoj djeca uče o predmetima, materijalima i fizičkim pojavama te o tome kako se koristiti alatima i tehnikama u istraživanju i isprobavanju (Turja i sur., 2009). Igra može biti individualna ili grupna, slobodna ili vođena, funkcionalna, usmjerena prema svladavanju vještina ručne izrade predmeta, ili kreativna i usmjerena na rješavanje problema itd.

Odgojitelji u ustanovama RPOO trebali bi posebnu pažnju posvetiti spolnim i rodnim stereotipima. Hallström i sur. (2015) istraživali su kako djevojčice i dječaci istražuju i uče o tehnologiji i kako njihove odgojiteljice i odgojitelji oblikuju ove aktivnosti putem slobodne igre. Istraživanje se temeljilo na kvalitativnim podatcima prikupljenim s pomoću videozapisa opažanja i u neformalnim razgovorima s djecom (od 3 do 6 godina života) i odgojiteljima u dvjema švedskim ustanovama RPOO. Autori su zaključili da djevojčice i dječaci uče različito pristupati i koristiti se tehnologijom, što umjesto da umanjuje, zapravo potvrđuje spolne i rodne razlike. Odgojitelji nisu dovoljno aktivni u podupiranju slobodne igre koja uključuje tehnologiju među starijom djecom, niti daju dječacima i djevojčicama jednake prilike da istražuju i koriste se materijalima i igračkama koji nisu spolno stereotipizirani. Drugim riječima, kada odgojitelji podupiru djecu, način na koji potiču upotrebu tehnologije različit je za djevojčice i dječake.

Istraživači se razilaze u stajalištima o podršci koju odgojitelji daju u tehnološkom obrazovanju. Neki misle da slobodna igra stimulira sposobnosti za dizajniranje (Milne, 2013 u Hallström i sur., 2015; Parker-Rees, 1997 u Hallström i sur., 2015), a drugi napominju da pretjerano slobodna igra ima i loših strana. Hallström i sur. (2015) naglašavaju da starija djeca koja se koriste tehnologijom u slobodnoj igri često dobivaju malo ili nimalo podrške od odgojitelja u razvijanju vještina za upotrebu tehnologije, a slično tome oni koji se ne koriste tehnologijom ne dobivaju poticaj da se njome nauče koristiti. To može dovesti do predškolskog okruženja u kojemu odgojitelji dopuštaju djeci potpuno slobodan izbor, što znači da oni koji ne odaberu igru s tehnologijom propuštaju priliku za razvijanje znanja o tehnologiji i znanja potrebnih za upotrebu tehnologije. Odgojiteljeva sposobnost da pojedincima pruži individualiziranu podršku u skladu s ciljem aktivnosti i djetetovim osobinama jako je važna u procesu tehnološkog obrazovanja.

Crtanje također ima važnu ulogu u tehnološkom obrazovanju. Mawson (2010) u svom istraživanju navodi da djeca tijekom uporabe tehnologije nisu imala dovoljno prilika koristiti se crtanjem. Poučavanje raznih tehnika crtanja i oblikovanja pružilo bi djeci dodatnu mogućnost za izražavanje vlastitih ideja.

Projektni rad od ideje do proizvoda ima važnu ulogu u tehnološkom obrazovanju u predškolskim ustanovama (Novak i sur., 2009). Tehnološki proces započinje prepoznavanjem cilja i završava kada je rezultat postignut i vrednovan. Prepoznavanje cilja u okruženju ranog djetinjstva počiva na kurikulu i proizlazi iz djetetovih želja i ideja. Kurikuli pedagogija ranoga djetinjstva su holistički, što omogućuje povezivanje različitih disciplina. U skladu s tim razvoj tehnološke pismenosti u djece može u potpunosti biti povezan s matematičkom i znanstvenom pismenošću s jedne strane, i pismenošću u području umjetnosti i jezika s druge strane. Razvijanje tehnološke pismenosti treba uzeti u obzir različite kriterije u fazi planiranja i evaluacije. U obzir trebaju biti uzeti i ciljevi učenja o prirodi i održivu razvoju, kao npr. recikliranje proizvoda nakon uporabe. Treba voditi računa i o interesima različitih društvenih grupa. Putem tehnološkog obrazovanja djeca uče planirati i evaluirati aktivnosti, uče razmišljati o međusobnoj suradnji i raspravi s ostalima, što može doprinijeti dubljem razumijevanju tehnologije.

Iako je unutar tehnološkog obrazovanja važno stvarati proizvode, učiti o materijalima i razvijati različite vještine, ne treba ostati samo na toj razini. Mawson (2005 u Mawson, 2010) je zaključio da je u tehnološkom obrazovanju u školama stavljen prevelik naglasak na izradu proizvoda. „Naglasak na izradu usmjerava dječju pažnju na materijale koje su oblikovali i na trenutni zadatak. O širim pitanjima vezanim uz prirodu tehnologije i odnosu tehnologije i društva rijetko se raspravljalo" (Mawson, 2010, str. 10). Slično se može dogoditi i kod tehnološkog obrazovanja u predškolskim ustanovama. Potrebno je naglasiti da izrada proizvoda podrazumijeva da djeca uče promatrajući ono što učitelj radi. Odgojitelj može čvrsto voditi proces učenja koji može tek u neznatnoj mjeri biti povezan s dječjom kreativnošću i iskustvima, ili je uglavnom utemeljen na projektnom radu i projektnoj nastavi. Takav način rada omogućuje djeci da smjeste aktivnosti koje provode u vlastitom životu u širi društveni kontekst i počnu prepoznavati odnose između tehnološkog napretka i promjena u vlastitim životima. „Učenicima bi trebalo dati priliku da istraže šire dimenzije tehnologije, kao što su pitanja održivosti i interesa dionika. Ako su ti interesi ugrađeni u iskustvo učenja o tehnologiji, veće su mogućnosti da će početi razvijati širi pogled na tehnologiju" (Mawson, 2010, str. 10). Glavni je cilj tehnološkog obrazovanja razvoj kritičke tehnološke pismenosti koja je prilagođena dječjim razvojnim sposobnostima. Nadalje, TO može započeti u vrtiću i nastaviti se u daljnjem obrazovanju.

Mawson (2013, str. 450) navodi: „Kad su proces učenja vodili odgojitelji, a na temelju interesa djece djeca su uspijevala postići višu razinu razumijevanja sadržaja", npr. informacija o procesu prerade mliječnih proizvoda od farme do polica u prodavaonicama. Djeca mogu učiti na različite načine. „Informacije prezentirane djeci tijekom posjeta farmi, gledanje DVD-a o tvornici u kojoj se prerađuju mliječni proizvodi i prezentacije procedura za testiranje mlijeka, uvijek su bili

popraćeni opetovanim prilikama zahvaljujući kojima su djeca mogla ono što su vidjela i čula simulirati u svojoj dramskoj predstavi. Ta dramska igra i vrijeme koje je omogućavalo djeci da pogledaju scenarij onoliko puta koliko su željeli, čine se ključnim komponentama za dubinsko razumijevanje, a što su uspijevali artikulirati i u razgovoru s istraživačem, kako to navodi Mawson (2013, str. 450).

Istraživanja o odgojiteljima i tehnologiji u predškolskim ustanovama

Kako bi spomenute aktivnosti u sklopu tehnološkog obrazovanja bile uspješne, proces učenja treba biti prilagođen djetetovu razvoju i osobinama. Tehnologija obuhvaća djetetova iskustva kod kuće i izvan škole. Mawson (2005 u Mawson, 2010) napominje da glavni utjecaj na razvoj i razumijevanje tehnologije u djece imaju njihova iskustva kod kuće, koja odgojitelji koji su sudjelovali u njihovu istraživanju nisu uzeli u obzir.

Za kvalitetno tehnološko obrazovanje iznimno je važna organizacija kognitivno-konstruktivističkog modela učenja (Fox-Turnbull i Snape, 2011; Twyford i Järvinen, 2000; Valenčič Zuljan, 2002) jer naglašava važnost didaktičnog principa aktivnosti i personalizacije. U skladu s tim, odgojitelji bi trebali poznavati koncepte i iskustva djece, uključujući i pogrešne i nepotpune percepcije, i uzeti ih u obzir u procesu učenja. Odgojitelj oblikuje situacije socio-kognitivnih konflikata i u procesu oblikovanja nudi djeci odgovarajuću podršku u rješavanju konflikata. Odgojiteljeva podrška u rješavanju kognitivnih konflikata i u cjelokupnom procesu učenja vrlo je važna. Da bi učenje bilo kvalitetno, djeci treba omogućiti usvajanje znanja na različite načine i putem različitih aktivnosti.

Posljednjih su godina istraživanja u području tehnološkog obrazovanja počela obuhvaćati i predškolski odgoj, ali tehnološko obrazovanje u ustanovama ranog i predškolskog odgoja i obrazovanja ostaje nedovoljno istraženo, pogotovo kada je riječ o tehnološkom obrazovanju studenata ranog i predškolskog odgoja i obrazovanja i njihovu profesionalnom razvoju.

Sustavan pregled članaka u citatnim bazama podataka (Social Science Citation Index (SSCI) i Science Citation Index (SCI)), Elsevier, Science Direct i Scopus pokazao je da je tema obrazovanja odgojitelja vrlo rijetko istraživana. U provedenim istraživanjima većina članaka usredotočena je na informacijsko-komunikacijsku tehnologiju (Baf, Radetić-Paić i Zarevski, 2013; Kabadayı, 2012). TO studenata RPOO može biti uspješno ako smo upoznati s tehnološkom pismenošću studenata i njihovim mišljenjem o TO u predškolskim ustanovama, tehnologiji i kvalitetnom poučavanju o tehnologiji u predškolskim ustanovama. Što se tiče nekolicine istraživanja u području tehnološkog obrazovanja (Fleer, 2000; Hallström i sur., 2015; Stables, 1997), čini se da tehnologija nije dovoljno zastupljena u predškolskim aktivnostima. Neke zemlje nemaju kurikul za poučavanje tehnologije u ranoj dobi što, prema Hallströmu i sur. (2015), također doprinosi nedostatku poučavanja zbog nezadovoljavajuće razine osposobljenosti odgojitelja i nedostatka materijala za poučavanje.

Metodologija

U Sloveniji su tehnološke aktivnosti uključene u kurikul za RPOO. Studenti ranog i predškolskog odgoja i obrazovanja usvajaju određena tehnološka znanja na učiteljskim fakultetima putem obveznih kurikulskih predmeta, ali mogu izabrati i izvannastavne tehnološke sadržaje. U ovom je empirijskom istraživanju primijenjena anketa kao istraživačka metoda.

Istraživačka pitanja

Cilj je istraživanja bio utvrditi mišljenja studenata o ulozi i važnosti tehnologije za pojedince i društvo, kao i njihova iskustva s tehnološkim obrazovanjem u osnovnoj školi. Istražena su i mišljenja studenata o važnosti tehnološkog obrazovanja u ustanovama RPOO i u njihovoj nastavi na fakultetu, kao i njihova procjena vlastitih sposobnosti u području tehnološkog obrazovanja.

Formulirano je pet istraživačkih pitanja:

1. Kakvu razinu tehnološke pismenosti imaju studenti RPOO?
2. Kakvo iskustvo iz škole imaju studenti s obzirom na tehnološko obrazovanje?
3. Koja su njihova mišljenja o ulozi i važnosti tehnologije u životu pojedinca i društva?
4. Kako studenti (budući odgojitelji) procjenjuju važnost tehnološkog obrazovanja u predškolskim ustanovama i u školi?
5. Kako studenti (budući odgojitelji) procjenjuju važnost tehnološkog obrazovanja tijekom studija i kako procjenjuju svoje sposobnosti u ovom području?

Željeli smo utvrditi postoje li razlike između redovitih i izvanrednih studenta u odgovorima na istraživačka pitanja te jesu li njihove procjene i odgovori povezani sa stupnjem njihove tehnološke pismenosti.

Uzorak ispitanika

Istraživanjem je obuhvaćeno 118 redovnih i 58 izvanrednih studenata RPOO na Učiteljskom fakultetu Primorskog sveučilišta. Upitnik su ispunili studenti treće godine (98 % redovnih i 60 % izvanrednih studenata) programa predškolskog odgoja početkom 2014. i 2015. akademske godine. Od ukupnog broja 94,9 % ispitanika bilo je ženskog, a 5,1 % muškog spola. Posljednja postignuta razina obrazovanja ispitanika bila je sljedeća: svi redovni studenti završili su srednjoškolsko obrazovanje; u grupi izvanrednih studenata 83 % studenata završili su srednjoškolsko obrazovanje, 12 % studenata imali su više obrazovanje, 2 % su bili fakultetski obrazovani, a 3 % nisu odgovorili na to pitanje. Dob redovnih studenata bila je 21 – 23 godine, a izvanredni studenti imali su 23 – 52 godine.

Instrument i postupak

Podatci su prikupljeni s pomoću upitnika o tehnološkoj pismenosti i upitnika o mišljenju studenata o tehnologiji. Oba su upitnika kreirana za potrebe ovog istraživanja.

Upitnik o tehnološkoj pismenosti (TP) utemeljen je na ciljevima tehnoloških predmeta u osnovnim školama u Sloveniji. Sastoji se od 29 pitanja različitih razina prema Bloomovoj taksonomiji i s različitim sadržajima: tehnički uređaji i izumi, transport, tehničko crtanje, materijali, alati, strojevi i osnovne tehnologije. Kako bi se osigurala valjanost, „Upitnik o TP odgojitelja" utemeljen je na sadržaju kurikula za osnovnoškolski predmet Inženjerstvo i tehnologija. Metodološka primjerenost utemeljena je na razmatranju relevantnih metodoloških smjernica (Fraenkel i Wallen, 2003). Objektivnost instrumenta osigurana je preciznim uputama i zadatcima zatvorenog tipa. Koeficijent pouzdanosti Cronbachova alpha (α=,771) potvrđuje pouzdanost testa.

Upitnik sadrži i 17 pitanja o mišljenjima studenata o njihovim osnovnoškolskim iskustvima vezanima uz TO, njihovom mišljenju o važnosti TO u RPOO i osnovnoj školi, važnosti tehnološkog znanja za kvalitetan profesionalan rad odgojitelja, o vlastitim kompetencijama u području tehnologije i važnosti TO na sveučilišnoj razini. Koeficijent pouzdanosti Cronbachova alpha iznosio je ,781, što potvrđuje dobru pouzdanost upitnika. S ciljem testiranja psihometrijskih karakteristika napravljena je faktorska analiza. Primjena te analize opravdana je ako je Kaiser-Meyer-Olkin veći od 0,60 i ako Bartlettov test pokazuje statističku značajnost. Kaiser-Meyer-Olkinova mjera primjerenosti uzorka bila je ,782, a Bartlettov test sferičnosti bio je ($\chi 2 = 878{,}741$; $df = 120$; $p<,001$). Faktorskom analizom (Metoda ekstrakcije: Analiza osnovnih komponenti i metoda rotacije: Varimax s Kaiserovom normalizacijom) izdvojena su četiri faktora koja zajedno objašnjavaju 66,190 % odstupanja, uz pouzdanost ,781. Valjanost je potvrđena prvim faktorom s 24,344 % odstupanja.

Svi su studenti predali popunjen upitnik. Sudjelovanje u istraživanju bilo je anonimno i neobvezno za sve studente.

Analiza podataka

Primijenjene statističke procedure su: frekvencijska distribucija (f, f %) nominalnih i ordinalnih varijabli, osnovna deskriptivna statistika s numeričkim varijablama (aritmetička sredina – *M*, standardna devijacija – *SD*, koeficijent varijabilnosti – CV, asimetrija – SKEW, zaobljenost – KURT, χ^2 test hipoteze o neovisnosti, Mann-Whitneyev U test, Eta koeficijent). Pretpostavka linearnosti može se verificirati računanjem razlike između koeficijenta korelacijskog omjera η (Eta) i Pearsonova koeficijenta korelacije (r), upotrebljavajući Blackmanov test. Prema Blackmanovu pravilu ($\eta^2 - r^2$) * n> 11,37 je nelinearna veza (n – broj slučajeva).

Statistički su podatci obrađeni s pomoću IBM SPSS Statistics 22 programa.

Rezultati i interpretacija

Tehnološka pismenost (TP) studenata predškolskog odgoja

„Upitnik o TP odgojitelja", tj. rezultati testa TP pokazali su da je prosječna samoprocjena tehnološke pismenosti ispitanika 42,86 od ukupno 80 bodova.

Tablica 1

Tablica 1 pokazuje da je distribucija desno asimetrična (SKEW=,053) i blago spljoštena (KURT=-,184), što znači da ima više studenata s tehnološkom pismenošću nižom od prosjeka. Prosječna mjera disperzije potvrđena je koeficijentom varijabilnosti (CV=26,70 %).

Tablica 2

Rezultati Mann-Whitneyeva U testa pokazuju postojanje statistički značajnih razlika između srednjih rangova tehnološke pismenosti redovnih i izvanrednih studenata. Srednji rang tehnološke pismenosti izvanrednih studenata bio je 119,07, a redovnih studenata 73,47 (Tablica 2).

Mišljenja studenata o iskustvima u osnovnoj školi koja su vezana uz tehnološko obrazovanje

Studentska iskustva vezana uz TO u osnovnoj i srednjoj školi utječu na njihove interese i znanja. Te su dimenzije posebno važne za buduće odgojitelje i učitelje čiji će rad u praksi utjecati na školska iskustva generacija koje dolaze. Istraživanjem se stoga nastojao steći uvid u školska iskustva studenata predškolskog odgoja vezana uz TO, utvrditi koliko su im bili zanimljivi tehnološki sadržaji, koja su njihova postignuća vezana uz TO u odnosu na ostala postignuća i kako procjenjuju kvalitetu i opseg TO u RPOO, kao i u osnovnoj školi. Zanimalo nas je jesu li oko nekog sadržaja ili metode poučavanja bili toliko entuzijastični da su poželjeli odabrati profesiju povezanu s inženjerstvom (npr. učitelj inženjerstva).

Tablica 3

Dobiveni rezultati pokazuju da je 40,7 % studenata predškolskog odgoja ocijenilo kvalitetu svog TO u osnovnoj školi s ukupnim rezultatom TP 3 na petostupanjskoj skali. Nadalje, 26 % studenata misli da je kvaliteta njihova TO bila niska (ukupan rezultat TP 2), a za 22,6 % studenata ukupan rezultat testa TO 4. Procjena količine TO u osnovnoj školi pokazuje da 50 % studenata smatra da nisu imalo dovoljno TO, 47,1 % misli da su imali dovoljno TO, a njih 2,9 % smatra da su imali previše TO u osnovnoj školi. Unatoč činjenici da najveći broj studenata smatra da nisu imali dovoljno tehnološkog obrazovanja, 49,7 % studenata smatra da je tehnološki sadržaj u osnovnoj školi bio manje zanimljiv od sadržaja ostalih predmeta (za 17 % studenata bio je zanimljiviji). Većina je studenata imala slične ocjene iz TO i ostalih predmeta. Također je utvrđeno da 92,1 % studenata predškolskog odgoja nisu pokazivali velik entuzijazam za TO u školi da bi razmišljali o tehnološkoj profesiji. Također je testirana statistička značajnost povezanosti između različitih iskustava studenata s tehnološkim obrazovanjem i tehnološkom pismenošću. Utvrđena je statistički vrlo velika procjena kvalitete TO u osnovnoj školi (p = ,007) kod studenata s višom tehnološkom pismenošću, koji su uglavnom imali i bolje ocjene iz tehnoloških

predmeta (p = ,016) (Tablica 3).

Mišljenja studenata predškolskog odgoja o ulozi i utjecaju tehnologije na život pojedinaca i društva

Mišljenja studenata o važnosti tehnologije i njezinu utjecaju na život pojedinaca, društva i okoliš mjerena su preko 6 čestica.

Tablica 4

Može se primijetiti da su studenti predškolskog odgoja uglavnom imali vrlo pozitivno mišljenje o utjecaju tehnologije: na 5 čestica ukupan je rezultat TP bio 5 i stavljen je na prvo mjesto (između 55,6 % i 68,6 %). Samo je na čestici koja mjeri mišljenje i stav studenata o tehnološkom znanju u modernom životu ukupan rezultat testa TP bio 4 (47,4 %) i bio je stavljen na prvo mjesto. To je jedina čestica na kojoj ukupan rezultat testa TP 3 (22,5 %) predstavlja najveći udio. Nadalje, bilo bi zanimljivo vidjeti postoji li statistički značajna povezanost između mišljenja studenata predškolskog odgoja o ulozi i utjecaju tehnologije na živote pojedinaca i društva i njihove tehnološke pismenosti. Utvrđeno je da rezultati studenata s visokom tehnološkom pismenošću pokazuju statistički visoko značajnu korelaciju u procjeni dviju čestica, utjecaju tehnološkog napretka na kvalitetu života (p = ,033) i utjecaju tehnološkog okruženja na razvoj društva (p = ,017). Određeni stupanj nepodudarnosti postoji između procjene studenata o važnosti i učinkovitosti tehnologije s jedne strane i potrebe za tehnološkim znanjem u životima ljudi s druge strane. Zapravo, ovo je poticaj za razvoj kritičke tehnološke pismenosti odgojitelja koji će biti svjesni važnosti znanja kada će o tehnologiji i njezinim posljedicama trebati donijeti odluke (Tablica 4).

Tablica 5

Ispitana je statistički značajna razlika u mišljenjima redovnih i izvanrednih studenata o ulozi i utjecaju tehnologije na život pojedinaca i društva. Procjena utjecaja tehnologije statistički se značajno razlikuje između redovnih i izvanrednih studenata u dvije od šest čestica, uglavnom u procjeni utjecaja svakodnevne tehnologije na život svakog pojedinca (p = ,045) i u procjeni neophodnosti tehnološkog znanja u suvremenom životu (p =,020). Izvanredni studenti pokazuju visoku statistički značajnu procjenu za obje čestice (Tablica 5).

Mišljenja studenata o važnosti tehnološkog obrazovanja u RPOO i osnovnoj školi

Važnost tehnoloških sadržaja u ranom i predškolskom okruženju i u školi mjerena je preko tri čestice. Studenti predškolskog odgoja procijenili su da je TO važno za djecu u predškolskim ustanovama, kao i za djecu u prvom i drugom ciklusu osnovne škole.

Tablica 6

Za sva je tri ciklusa postignut rezultat TP 4 (prilično važno), a udio se povećava s

dobi djece (27,3 % u vrtiću, 43 % u prvom i 51,4 % u drugom ciklusu). Zabrinjavajuće je da 31,4 % studenata (rezultat 1 i 2) misli da TO nije važno za djecu u ranom i predškolskom odgoju i obrazovanju. Nije uočena statistički značajna korelacija između studentske procjene važnosti TO u RPOO i tehnološke pismenosti, ali je statistički značajna korelacija uočena između tehnološke pismenosti studenata i njihove procjene TO u prvom (p = ,043) i drugom ciklusu osnovne škole (p = ,006) (Tablica 6).

Tablica 7

Na temelju procjene važnosti TO utvrđena je statistički značajna razlika između redovnih i izvanrednih studenata na sve tri čestice, pogotovo u procjeni TO u RPOO (p<,001) te u prvom (p<,001) i drugom ciklusu osnovne škole (p = ,011). Izvanredni studenti pokazali su višu statistički značajnu procjenu važnosti TO u sva tri ciklusa. Redovni studenti procijenili su važnost TO u predškolskim ustanovama s ukupnim rezultatom TP 2. Također je utvrđeno da 32,3 % studenata misli da je TO u predškolskim ustanovama manje važno (samo 3,9 % izvanrednih studenata dijeli isto mišljenje). Većina izvanrednih studenata ocjenjuje važnost TO u RPOO s ukupnim rezultatom TP 4, a 37,3 % studenata misli da je TO u predškolskim ustanovama poprilično važno (samo 22,2 % redovnih studenata misli isto). Nijedan izvanredni student ne misli da TO u RPOO nije važno (ali 13,1 % redovnih studenata misli da TO u ranom i predškolskom odgoju i obrazovanju nije važno) (Tablica 7).

Mišljenje studenata o važnosti tehnološkog obrazovanja tijekom studija i njihova procjena vlastitih kompetencija za tehnološko obrazovanje

Mišljenje studenata o važnost TO za profesiju odgojitelja mjerena je s tri čestice (Tablica 8).

Tablica 8

Rezultati pokazuju da 55,2 % studenata misli kako su tehnološko znanje i TO vrlo važni za profesionalni rad odgojitelja, a da ih 33,1 % smatra prilično važnima. Većina studenata ocjenjuje svoje kompetencije vezane uz TO kao slabe ili se smatraju samo umjereno kvalificiranima (45,9 %, ukupan rezultat TP 1 ili 2). Čestica koja pokazuje važnost TO za buduće odgojitelje djece rane i predškolske dobi tijekom studija ocijenjena je s ukupnim rezultatom TP 4 – prilično važno i zauzima prvo mjesto (40,5 %), a odmah nakon je rezultat 3 – srednja važnost (28,1 %). Ukupan rezultat TP 5 (vrlo važno) i 2 (manje važno) imaju isti postotak – 13,1 %. Na kraju, 5,2 % studenata smatra da TO nije važno za buduće odgojitelje (ukupan rezultat TP 1). Statistički značajna korelacija uočena je samo između tehnološke pismenosti studenata i njihova mišljenja o važnosti TO tijekom sveučilišnog studija (p = ,010) (Tablica 8).

Tablica 9

Ipak, statistički značajna razlika postoji između redovnih i izvanrednih studenata

u procjeni triju čestica. Izvanredni studenti pokazali su visoku statistički značajnu razliku u procjeni triju čestica. Nadalje, 27,8 % izvanrednih studenata i samo 8 % redovnih studenata misle da su tehnološko znanje i TO vrlo važni za profesionalni rad odgojitelja, a 24 % (rezultat 1 i 2) redovnih i samo 1,9 % izvanrednih studenata misli da je navedeno znanje manje važno. TO tijekom studija važno je ili vrlo važno (ukupan rezultat TP 5 i 4) za 75,5 % izvanrednih studenata i 42 % redovnih studenata. Redovni studenti procjenjuju svoje kompetencije s ukupnim rezultatom TP 2 (47,1 %), a izvanredni s rezultatom 3 (45,1 %) (Tablica 9).

Rasprava

U suvremenom tehnološkom svijetu razvoj tehnološke pismenosti vrlo je važan za aktivno sudjelovanje svakog pojedinca u društvu i njihovu dobrobit. Posljedica je toga da je tehnološka pismenost postala temom brojnih istraživanja u raznim zemljama tijekom posljednjih desetljeća. Tehnološka pismenost odgojitelja i njihova percepcija tehnologije i tehnološkog obrazovanja u ovom kontekstu predstavlja manje razvijeno područje. Percepcija odgojitelja o tehnologiji, njihovi stavovi o TO i njihove kvalifikacije za TO predstavljaju važan čimbenik u razvoju tehnološke pismenosti djece rane i predškolske dobi. Kvalitetno TO odgojitelja zahtijeva istraživanje o učenju o tehnologiji u predškolskim ustanovama, a iza čega bi trebalo slijediti upoznavanje odgojitelja s rezultatima istraživanja. Odgojitelji bi trebali primjenjivati refleksivni pristup i provoditi neovisna istraživanja svoje nastavne prakse. Kreiranje kvalitetnog modela profesionalnog razvoja zahtijeva istraživanje o profesionalnom obrazovanju, mišljenjima, iskustvima i percepcijama odgojitelja i studenata predškolskog odgoja. Percepcija studenata o tehnologiji i ulozi TO u ustanovama ranoga i predškolskoga odgoja i obrazovanja omogućava profesorima da utječu na stavove studenta i educiraju ih u profesionalnom smislu za provedbu TO u predškolskim ustanovama. Navedeni su stavovi u središtu pozornosti ovoga istraživanja.

Rezultati upućuju na srednju razinu TP kod studenata, pogotovo redovnih. Statistički je značajna razlika u tehnološkoj pismenosti utvrđena između redovnih i izvanrednih studenata. Izvanredni studenti pokazali su statistički značajno višu razinu tehnološke pismenosti. Školska iskustva studenata u tehnološkom obrazovanju utječu na percepcije pojedinaca o tehnologiji, interese i znanja učenika, što je bilo i potvrđeno u različitim studijama (Burns, 1992 u Mawson, 2010; Jones i sur., 1994 u Mawson, 2010; Moreland, 2004 u Mawson, 2010). Te su dimenzije posebno važne za buduće odgojitelje i učitelje čija će vlastita praksa stvoriti školsko iskustvo za generacije koje dolaze. Anketa je pokazala da 50 % studenata na osnovi svojih školskih iskustava s TO procjenjuju da nema dovoljno tehnološkog sadržaja/predmeta u osnovnoj školi. Iako je 40,7 % studenata procijenilo svoje TO kao osrednje, 49,7 % studenata izrazili su kritiku TO jer nije zanimljivo. Samo je 7,9 % studenata bilo entuzijastično u vezi s TO u školi pa su predvidjeli odabir tehnološke profesije. Pojavila su se neka pitanja koja se tiču poučavanja TO u školi, a vezana su uz njihova iskustva u školi, odnosno način na

koji su njihovi bivši nastavnici poučavali nastavne sadržaje i stavili tehnološki sadržaj u kontekst svakodnevnog života. Mogli bi se zapitati kako su učitelji organizirali proces učenja, je li prevladavala problemska nastava i jesu li se koristili projektni rad i drugi pristupi usmjereni prema učenicima u kojima oni sami aktivno kreiraju proces učenja, ili je dominirao transmisijski model učenja u kojemu učenici samo primaju znanstvene istine. U pozadini navedenih pitanja javlja se i pitanje vezano uz percepciju tehnologije i TO kod bivših nastavnika ispitanih studenata, jer je percepcija nastavnika tijesno povezana s njihovim obrazovnim odlukama i politikama (Valenčič Zuljan, 2007; Wittrock i American Educational Research Association, 1986).

Istraživanje je također pokazalo da većina studenata (55,2 %) smatra da su tehnološko znanje i TO vrlo važni za profesionalni rad odgojitelja. Česticu povezanu uz važnost TO za studente predškolskog odgoja tijekom sveučilišnog studija ukupnom ocjenom 4 – poprilično važno ocijenilo je 40,5 % studenata. Iako su studenti svjesni važnosti TO u RPOO, 31,4 % (ocjena 1 i 2) studenata smatra da TO u predškolskim ustanovama nije važno. Posebnu pažnju treba posvetiti činjenici da je većina studenata procijenila svoje kompetencije za TO slabima. Na temelju navedenih rezultata, razloge studentske percepcije da TO u ustanovama RPOO nije važno trebalo bi istražiti s obzirom na način na koji je TO prezentirano na fakultetima, kako bi studenti mogli razviti pozitivno mišljenje prema TO u predškolskim ustanovama, i steći svijest o važnosti TO i pripadajućih kompetencija za vođenje TO. Istraživači su potvrdili važnost mišljenja učitelja o tehnologiji i njihova samopouzdanja vezanoga uz poučavanje tehnologije kao važnog čimbenika u formiranju učeničkih stavova prema tehnologiji (McRobbie, Ginns i Stein, 2000; Rohaan, Taconis i Jochems, 2010; Verloop, Van Driel i Meijer, 2001).

Za kvalitetno TO tijekom sveučilišnog studija, koje je orijentirano prema znanju i individualizirano s obzirom na razlike u tehnološkoj pismenosti i druge uočene razlike među studentima, konstruktivistički se pristup čini najprikladnijim. U tom modelu izobrazbe profesor tehnologije na sveučilišnom studiju već na samom početku potiče percepcije i prethodna iskustva studenata te na taj način stvara situacije kognitivnog konflikta. U procesu individualizirane podrške i modeliranja studente se ohrabruje na to da stvore ispravne percepcije o TO u predškolskim ustanovama. Razvoj vještina potrebnih za vođenje različitih aktivnosti u sklopu TO u predškolskim ustanovama obuhvaća pedagošku praksu studenata. Studenti se pripremaju i izvode detaljne i primjerene tehnološke aktivnosti s djecom uz podršku predavača na fakultetu i mentora u predškolskim ustanovama. Imajući u vidu rezultate istraživanja i rezultate do kojih su došli i drugi istraživači (Hallström i sur., 2015; Mawson, 2007), posebno je važno poticati studente da provode složene ciljeve razvoja tehnološke pismenosti koji su već predstavljeni unutar TO u širem socijalnom kontekstu uz rješavanje spolnih i rodnih stereotipa vezanih uz tehnologiju itd. Uz razvoj određenih složenih vještina neophodnih za upravljanje tehnološkim aktivnostima u predškolskim ustanovama, važno je upoznati studente s refleksivnim i istraživačkim pristupom koji zahtijeva

pažljivu pripremu pedagoške prakse i detaljnu analizu iskustava stečenih takvom praksom (M. Zuljan, D. Zuljan, Pavlin, 2011). Nadalje, neophodno je i kompetentno mentorstvo s obzirom na TO, ali i mentorstvo u praksi i kvalitetna suradnja mentora i profesora (Valenčič Zuljan i Marentič Požarnik, 2014; Valenčič Zuljan i Vogrinc, 2007) s jedne strane i izgradnja partnerstva između predškolskih ustanova i sveučilišta s druge.

Zaključak

Kvaliteta tehnološkog obrazovanja u predškolskim ustanovama ovisi o studijskim programima na kojima bi studenti trebali steći specifične vještine i osjećaj samopouzdanja pri provedbi tehnološkog obrazovanja. Razvoj tehnološke pismenosti kod budućih odgojitelja predstavlja važno područje koje je nedovoljno istraženo, što ovom istraživanju daje dodatnu vrijednosti iz međunarodne perspektive.

Istraživanje pokazuje da je bolja tehnološka pismenost studenta više, statistički značajno povezana s procjenom kvalitete školskog iskustva s tehnološkim obrazovanjem te da ih je većina imala bolje ocjene iz tehnoloških predmeta. Spomenuti su studenti višom ocjenom vrednovali utjecaj tehnološkog napretka na kvalitetu života ljudi i utjecaj svakodnevne tehnološke okoline na razvoj društva, kao i važnost tehnološkog obrazovanja tijekom školovanja. Također su dali veću ocjenu važnosti tehnološkog obrazovanja tijekom studija. Naglašavanje mišljenja predstavlja važan aspekt promicanja profesionalnog razvoja studenata tijekom studija. Izvanredni su studenti u usporedbi s redovnim studentima pokazali statistički značajno veću tehnološku pismenost. Istraživanje je također ukazalo na potrebu personaliziranog pristupa tehnološkom obrazovanju na fakultetu, koje bi trebalo ovisiti o stupnju tehnološke pismenosti studenata i načinu studiranja.

Istraživanje je pokazalo da studenti visokom ocjenom vrednuju važnost tehnologije i njezin utjecaj na pojedinca, društvo i okoliš. Postoji određeni stupanj nepodudarnosti između percepcije studenata o važnosti tehnologije u životu ljudi i potrebe za tehnološkim obrazovanjem i pismenošću. Takva procjena predstavlja zanimljivu motivaciju za profesore koji poučavaju buduće odgojitelje, a koji bi se trebali usmjeriti na razvoj kritičke tehnološke pismenosti kod odgojitelja. Važno je da odgojitelji budu svjesni stvarne veze između tehnologije i društva i važnosti tehnološke pismenosti svakog pojedinca za donošenje odgovornih odluka vezanih uz tehnologiju i, što je još važnije, trebali bi moći tomu poučavati druge.

Ovo je istraživanje stoga naglasilo ključnu ulogu znanja budućih odgojitelja o tehnološkoj pismenosti i njihova mišljenja o tehnološkom znanju kao osnovi za kvalitetnu provedbu tehnološkoga obrazovanja u predškolskim ustanovama. U daljnjim istraživanjima bilo bi zanimljivo saznati u kojoj mjeri i na koji način studenti s različitim razinama tehnološke pismenosti primjenjuju tehnološko obrazovanje u predškolskim ustanovama tijekom svoje nastavne prakse. Također bi bilo korisno saznati kako učenici stječu kompetencije potrebne za kvalitetnu primjenu tehnološkoga obrazovanja u predškolskim ustanovama tijekom studija.