Educational Robots in Primary Education

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Abstract

Today artificial intelligence (AI) is present even on devices such as smartphones that are widely used on a daily basis. One of the research areas of AI is robotics and robots are increasingly used, especially in manufacturing, warehouses, and trade where they replace humans. In addition to computer and information literacy, robotic literacy seems to be increasingly important. The simplest way to introduce robotics in primary education is by the means of educational robots. This paper presents the results of research on the application of educational robots in primary education of the Republic of Croatia.
The research hypotheses are as follows: less than a third of the respondents use educational robots in the daily teaching process with the aim of improving teaching; there is a statistically significant difference in the application of educational robots in the teaching process with regard to the respondents' age; there is a statistically significant difference in the application of educational robots in the teaching process with regard to the respondents' field of achieved education; there is a statistically significant difference in the application of educational robots in the respondents who are primary education teachers (grades 1-4) compared to the respondents who are subject teachers (grades 5-8).
The research data were collected in May 2021 on a sample of respondents consisting of 228 primary education and subject teachers employed in elementary schools in the Republic of Croatia. An anonymous online survey questionnaire constructed by the authors of this paper was used. Descriptive statistics and a chi-square test were used in the statistical analysis of the data. The research results confirm all the above hypotheses.

Key words

educational robotics; future occupationss; primary education; STEM

Introduction

Artificial intelligence (AI) is present today even on devices used daily such as smartphones. One of the research areas of AI is robotics and robots are increasingly used, especially in manufacturing, warehouses, and trade where they replace humans.
In addition to computer and information literacy, robotic literacy seems to be increasingly important (Suto, 2013; Nikolić, 2016).

Fields of research such as automation, robotics, and AI require Science, Technology, Engineering, and Mathematics (STEM) development skills. Because of that, today's elementary school students should have an early start in STEM and should be adequately educated for the future labour market. They should have appropriate education in computational thinking (CT), computer science, and robotics.

“Artificial intelligence is increasingly used in everyday life. There are many apps which use AI capabilities which are currently implemented on common devices such as smartphones. Such apps are used for image recognition, voice recognition and voice commands, converting speech to text and text to speech, solving mathematical problems, maps navigation, and so on. One of the AI’s fields of research is robotics. For the primary education students, the easiest way to enter this field is by using educational robots. To use them, the students often have to assemble them first and then write computer programs for them so that educational robots can accomplish some specific tasks by themselves.” (Oreški, 2021).

According to Hallinen (2021), the STEM acronym was introduced in 2001 at the National Science Foundation (United States). The organization previously used the acronym SMET when referring to the career fields in those disciplines or a curriculum that integrated knowledge and skills from those fields. In 2001, American biologist Judith Ramaley rearranged the words to form the STEM acronym.

The importance of STEM and its education is emphasized by many sources. For example, the Government of Western Australia and its Department of Education (2020) stress that “the global economy is changing. Current jobs are disappearing due to automation and new jobs are emerging every day as a result of technological advances. The continual advances in technology are changing the way students learn, connect and interact every day. Skills developed by students through STEM provide them with the foundation to succeed at school and beyond. Employer demand for STEM qualifications and skills is high, and will continue to increase in the future. Currently, 75 per cent of jobs in the fastest growing industries require workers with STEM skills. (…) Through STEM, students develop key skills including: problem solving, creativity, critical analysis, teamwork, independent thinking, initiative, communication, digital literacy.”
Smyrnova-Trybulska, Morze, Kommers, Zuziak, and Gladun (2016) also emphasize that the need to prepare students with twenty-first-century skills through STEM related teaching is strong, especially at the elementary level and that classes in robotics will have an impact on the development of mathematical literacy, scientific-technical information and social competences.
According to Nikolić (2016), “educational robots have an important impact on the children in the education in which the robot has the role of assistant or works independently. Educational robots should be seen as a means of encouraging children to develop important life skills and at the same time developing the potential to use their imagination. It is believed that children have a greater interest in learning with a robot because it encourages excitement as well as the ability to play with it and thus achieve more effective learning. Robots in the classroom offer great opportunities and encourage more and more students to get involved in such classes. Early introduction of robotic education in children's education systems can increase motivation and interest in technology itself. Such robots are part of new educational technologies to facilitate learning and improve education.”
Benavides, Otegui, Aguirre, and Andrade (2013) stress that the introduction of robots in classrooms is a powerful pedagogical tool as it generates environments for learning that enhance academic interdisciplinarity, exploring, and the interplay between theoretical knowledge and its practical application. “It increases students' creativity as their skills for observation, perception and sensitivity thus enforcing the development of curiosity and imagination. In turn, it allows the students to go from the abstract to the concrete (from the abstract of an idea, a design, to the realized and functional model). Every project builds on their prior knowledge and serves as a basis

for new knowledge. Every project is developed in a team and promotes working with others." (Benavides et al, 2013)

Prior to the new curricular reform and the new primary school curriculum in the Republic of Croatia, a private non-profit initiative was launched by Institute for Youth Development and Innovativity (in Croatian: Institut za razvoj i inovativnost mladih - IRIM) to improve the teaching of STEM in primary schools for the 21st century.

"Institute for Youth Development and Innovativity (IRIM) is a Croatia-based non-profit organization (private foundation), which has developed and implements the largest extracurricular program in EU – the Croatian Makers movement, reaching now over 200,000 children in Croatia. (...) IRIM donates a large amount of equipment, but only as a foundation for wide and deep knowledge distribution, through organised activities, teacher education (more than 3,000 teachers educated only in Croatia). (...) IRIM's core mission is to empower all children in Croatia and the region to develop STEM competencies necessary for them to be equal citizens of 21st century, by providing not only equipment, but also education and other activities. IRIM'S projects: The first was 'STEM revolution', primarily funded by the most successful crowdfunding campaign ever in Croatia and IRIM's own resources. It brought 25,000 coding devices to more than 1,000 institutions in Croatia (elementary and secondary schools, universities, libraries, orphanages ...) together with developing the complementary curriculum and teaching the teachers. The second step was ProMikro. IRIM teamed up with the Ministry of Science and Education which funded 45,000 micro:bits for all the Grade 6 children in Croatian schools, thus effectively introducing coding to elementary schools. The schools opted in voluntarily, and 85% of them chose to join the project. In such a manner, coding was effectively introduced to Croatian elementary schools. (...) Teaching the teachers was the key element of the projects. Following a large-scale education effort in STEM Revolution, in ProMikro IRIM delivered more than 500 workshops in 3 waves for 2,000 teachers, out of whom the majority never, or rarely, coded before. (...) The next important IRIM's project is Croatian Makers Robotics League is IRIM's flagship project in robotics, the largest competition of such kind in the EU with more than 12,000 children included per school year in more than 600 schools and non-profits, whereas IRIM has donated more than 3,000 robots. The educational institutions participate regularly, in 4-5 rounds during the schools' year, and locally, so that the subject can be integrated into the curriculum, and not be (as is usual with robotics competition) a one-off." (Croatian Makers, 2022)

Curricular reform (Ministry of Science and Education, 2018) has brought a number of changes that are presented in the new curricula of subjects for primary and secondary school. The most important changes in the new curriculum related to subject of ICT (Information and Communication Technology or Informatics) in primary school are the following: for the first time ICT has become an elective subject in grades 1 to 4 (ages 7-10), for the first time it has become a compulsory subject in grades 5 and 6 (ages 11-12) and continues to be elective in grades 7 and 8 (ages 13-14).

For the first time the creation of a computer program using a visual environment programs for the youngest students, such as Scratch, Hour of Code, Code Week and Run Marco, is mentioned and advised. There is a guideline to use, where it is possible, "hardware solutions for programming visualization (robots, etc.)." (Ministry of Science and Education, 2018). Other devices such as educational robots or microcomputers are mentioned. All the necessary equipment (desktops, tablets) was procured for the needs of primary and secondary schools.

The simplest way to introduce robotics in primary education is by the means of educational robots.

Methodology

Aims and hypotheses

The aim of this research is to explore the extent of the application of educational robots in primary education in the Republic of Croatia, and this paper presents the results of that research. The research hypotheses are as follows:
- H1 - less than a third of the respondents use educational robots in their daily teaching process with the aim of improving teaching
- H2 - there is a statistically significant difference in the application of educational robots in the teaching process with regard to the respondents' age
- H3 - there is a statistically significant difference in the application of educational robots in the teaching process with regard to the respondents' field of achieved education
- H4 - there is a statistically significant difference in the application of educational robots in the respondents who are primary school teachers of core subjects in grades 1-4 compared to the respondents who are subject teachers in grades 5-8

Participants, Methods and Instruments

The research data were collected in May 2021 on a sample of respondents consisting of 228 primary schools teachers of core subjects and subject teachers employed in elementary schools in the Republic of Croatia (Benčak, 2021).

An anonymous online survey questionnaire constructed by the authors of this paper was used. In the first part of the questionnaire there were questions regarding respondents' gender, age, education, teaching subject, and in the second part there were 5-point Likert scale (1-totally disagree to 5-totally agree) items questions concerning the application of educational robots in teaching. GNU PSPP 1.4 statistical software was used in data processing.
Descriptive statistics and a chi-square test were used in the statistical analysis of the data.
There were 196 (85.96%) female and 32 (14.04%) male respondents.

Table 1. Number of respondents by age

Respondents' age in years	Number of respondents	Percentage of respondents
23 – 29	57	25.00
30 – 39	76	33.33
40 – 49	55	24.12
50 – 59	37	16.23
60 and above	3	1.32
Total:	228	100.00

Regarding five age groups (see Table 1), the largest number of respondents (76) were in the age group between 30 - 39 years, followed by 57 respondents in the 23 – 29 age group, and 55 respondents in 40 – 49 age group. There were 37 respondents in the 50 - 59 age group and three respondents in the age group of 60 and above.

Table 2. Number of respondents by graduated faculty

Faculty	Number of respondents	Percentage of respondents
Faculty of Teacher Education	107	46.93
Faculty of Science	32	14.04
Faculty of Humanities and Social Sciences	28	12.28
Faculty of Organization and Informatics	14	6.14
Faculty of Mechanical Engineering and Naval Architecture	6	2.63
Faculty of Electrical Engineering and Computing	5	2.19
Faculty of Transport and Traffic Sciences	5	2.19
Department of Physics (University of Rijeka, University of Osijek)	4	1.75
Faculty of Graphic Arts	3	1.32
Department of Mathematics (University of Rijeka)	2	0.88
Faculty of Maritime Studies	2	0.88
Faculty of Pedagogy	2	0.88
Faculty of Textile Technology	2	0.88
Other faculties	16	7.01
Total:	228	100.00

It can be clearly seen from the data illustrated in Table 2 that the most represented were respondents who graduated from the Faculty of Teacher Education (107), followed by respondents from Faculty of Science (32), Faculty of Humanities and Social Sciences (28), Faculty of Organization and Informatics (14), Faculty of Mechanical Engineering and Naval Architecture (6), Faculty of Electrical Engineering and Computing (5), Faculty of Transport and Traffic Sciences (5), Department of Physics (University of Rijeka, University of Osijek) (4), Faculty of Graphic Arts (3), Department of Mathematics (University of Rijeka) (2), Faculty of Maritime Studies (2), Faculty of Pedagogy (2), Faculty of Textile Technology (2), and other faculties (16).

Table 3.
Number of respondents by teaching subject

Teaching Subject	Number of respondents	Percentage of respondents
ICT	79	34.65
Primary School Teachers of Core Subjects in Grades 1-4	68	29.82
Technical Education	32	14.04
Mathematics	12	5.25
Croatian	8	3.50
Chemistry and Biology	3	1.32
History and Geography	3	1.32
German	3	1.32
Physics	3	1.32
English	2	0.88
Foreign Language	2	0.88
Other subjects or combinations of subjects	13	5.70
Total:	228	100.00

It can be seen from Table 3 that the most represented is ICT (79 respondents), followed by Primary School Teachers of Core Subjects in Grades 1-4 (68), Technical Education (32), Mathematics (12), Croatian (8), Chemistry and Biology (3), History and Geography (3), German (3), Physics (3), English (2), Foreign Language (2), and other subjects or combinations of subjects (13).

Results and Discussion

The number of respondents that have available educational robots in their schools is 106 (46.5%), and 165 respondents (72.4%) are interested to learn more about educational robotics.
The number of respondents that think that the use of educational robots in teaching encourages greater interest of students in teaching content is 173 (75.88%).
The number of respondents that think that there should be more educational robotics education available in schools is 177 (77.63%).

Table 4. Number of respondents according to the fact whether or not they use robots in teaching

Using educational robots in teaching	Number of respondents	Percentage of respondents
Yes	61	26.75
No	167	73.25
Total:	228	100.00

The number of respondents that use educational robots in teaching was 61 (26.75%) and the number of respondents that do not use educational robots in teaching was 167 (73.25%) (see Table 4).

Hypothesis H1 stating that less than a third of the respondents use educational robots in their daily teaching process with the aim of improving teaching was confirmed.

The conclusion is that 3 in 4 respondents (about 75%):

- are interested to learn more about educational robotics
- think that the use of educational robots in teaching is useful for students' motivation
- think that there should be more educational robotics education available in schools.

However, only 46.5% of respondents have available educational robots in their schools, and only 26.75% (about 1 in 4) use educational robots in teaching.

Table 5.
Crosstab of Respondents' age and Using robots

CROSSTABS

/TABLES= Respondents' Age BY Using robots (Yes/No)

/FORMAT=AVALUE TABLES PIVOT

/STATISTICS=CHISQ

/CELLS=COUNT ROW COLUMN TOTAL.

			Using robots		Total
			Yes	**No**	
Age in years	**23 - 29**	Count	10	47	57
		Row %	17.5%	82.5%	100.0%
		Column %	16.4%	28.1%	25.0%
		Total %	4.4%	20.6%	25.0%
	30 - 39	Count	28	48	76
		Row %	36.8%	63.2%	100.0%
		Column %	45.9%	28.7%	33.3%
		Total %	12.3%	21.1%	33.%
	40 and over	Count	23	72	95
		Row %	24.2%	75.8%	100.0%
		Column %	37.7%	43.1%	41.7%
		Total %	10.1%	31.6%	41.7%
Total		Count	61	167	228

Row %	26.8%	73.2%	100.0%
Column %	100.0%	100.0%	100.0%
Total %	26.8%	73.2%	100.0%

	Value	df	Asymptotic Sig. (2-tailed)
Pearson Chi-Square	**6.73**	**2**	**.035**
Likelihood Ratio	6.71	2	.035
Linear-by-Linear Association	.28	1	.597
N of Valid Cases	228		

Hypothesis H2, which states that there is a statistically significant difference in the application of educational robots in the teaching process with regard to the respondents' age, was confirmed (χ^2 = 6.73, p=0.035).

Regardless of the age group to which respondents belong, the majority of respondents do not use robots in teaching process. However, the respondents in the age group 30 to 39 years use educational robots in education more often (36.8%) than other age groups (23-29 years of age 17.5% and 40 years of age and above 24.2%) (see Table 5).

The statistically significant difference exists only in the division of the sample of respondents into these three age groups (23-29, 30-39, 40 and over). In different divisions into age groups there is no statistically significant difference (e.g. in the division into two, four or five age groups).

Table 6. Crosstab of Respondents' acquired education type and Using robots

CROSSTABS

/TABLES= Respondents' Education type BY Using robots (Yes/No)

/FORMAT=AVALUE TABLES PIVOT

/STATISTICS=CHISQ

/CELLS=COUNT ROW COLUMN TOTAL.

			Using robots		Total
			Yes	**No**	
Respondents according to their type of education	**STEM**	Count	33	58	91
		Row %	36.3%	63.7%	100.0%

Column %	54.1%	34.7%	39.9%		
Total %	14.5%	25.4%	39.9%		
Other	Count	28	109	137	
	Row %	20.4%	79.6%	100.0%	
	Column %	45.9%	65.3%	60.1%	
	Total %	12.3%	47.8%	60.1%	
Total		Count	61	167	228
		Row %	26.8%	73.2%	100.0%
		Column %	100.0%	100.0%	100.0%
		Total %	26.8%	73.2%	100.0%

	Value	df	Asymptotic Sig. (2-tailed)	Exact Sig. (2-tailed)	Exact Sig. (1-tailed)
Pearson Chi-Square	6.99	1	.008		
Likelihood Ratio	6.89	1	.009		
Fisher's Exact Test				.010	.007
Continuity Correction	**6.20**	**1**	**.013**		
Linear-by-Linear Association	6.96	1	.008		
N of Valid Cases	228				

Hypothesis H3 stating that there is a statistically significant difference in the application of educational robots in the teaching process according to respondents‘ type of education, is confirmed (χ^2=6.20, p=0.013).

Regardless of the respondents‘ type of education, the majority of respondents do not use robots in teaching process. However, the respondents with acquired education in the field of STEM use educational robots in teaching more often (36.3%) than respondents in other fields (20.4%) (See Table 6).

Respondents are classified in these two groups according to their acquired type of education. If they graduated on STEM studies on the faculties such as Faculty of Science, Faculty of Humanities and Social Sciences, Faculty of Organization and Informatics, Faculty of Mechanical Engineering and Naval Architecture, Faculty of Electrical Engineering and Computing, Faculty of Transport and Traffic Sciences, Department of Physics (University of Rijeka, University of Osijek), Faculty of Graphic Arts, Department of Mathematics (University of Rijeka), Faculty of Maritime Studies, then

they belong to STEM group.

Table 7. Crosstab of Respondents' teaching subject type and using robots

CROSSTABS

/TABLES= Respondents' Teaching subject type BY Using robots (Yes/No)

/FORMAT=AVALUE TABLES PIVOT

/STATISTICS=CHISQ

/CELLS=COUNT ROW COLUMN TOTAL.

			Using robots		Total
			Yes	**No**	
Respondents' teaching subject type	**Primary school teaching of core subjects**	Count	7	61	68
		Row %	10.3%	89.7%	100.0%
		Column %	11.5%	36.5%	29.8%
		Total %	3.1%	26.8%	29.8%
	Subject teaching	Count	54	106	160
		Row %	33.8%	66.3%	100.0%
		Column %	88.5%	63.5%	70.2%
		Total %	23.7%	46.5%	70.2%
Total		Count	61	167	228
		Row %	26.8%	73.2%	100.0%
		Column %	100.0%	100.0%	100.0%
		Total %	26.8%	73.2%	100.0%

	Value	df	Asymptotic Sig. (2-tailed)	Exact Sig. (2-tailed)	Exact Sig. (1-tailed)
Pearson Chi-Square	13.40	1	.000		
Likelihood Ratio	15.17	1	.000		
Fisher's Exact Test				.000	.000

Continuity Correction	**12.23**	**1**	**.000**		
Linear-by-Linear Association	13.34	1	.000		
N of Valid Cases	228				

Hypothesis H4 stating that there is a statistically significant difference in the application of educational robots of the respondents who are primary school teachers of core subjects in grades 1-4 compared to the respondents who are subject teachers in grades 5-8 was confirmed (χ^2=12.23, p<0.001).

Regardless of the respondents' teaching subject type, the majority of respondents do not use robots in teaching process. However, the respondents who are subject teachers in grades 5-8 use educational robots in teaching more often (33.8%) than primary education teachers of core subjects (10.3%) (see Table 7).

The summary of three Chi-squared results is presented in Table 8.

Table 8. Summary of chi-squared results

No	Contingency table variables	Contingency table size	n	χ^2	df	p
1.	Respondents' age: 23-29, 30-39, 40 and over Using educational robots in education: yes, no	3 x 2	228	6.73	2	0.035*
2.	Respondents' acquired education type: STEM, other Using educational robots in education: yes, no	2 x 2	228	6.20[x]	1	0.013*

3.	Respondents' teaching subject type: primary teaching of core subjects, subject teaching Using educational robots in education: yes, no	2 x 2	228	12.23[x]	1	<0.001***

Notes: n = sample test size; χ^2 = chi-squared value; df = degrees of freedom; p = probability;

* statistical significance 5%; ** statistical significance 1%; *** statistical significance 0.1%

[x] = Yates correction for continuity was used in the calculation of the chi-square value

The research results confirm all the above hypotheses.

Conclusion

The technology has influenced the development of educational robotics and its application in education. Educational robotics is a relatively new field in education with the purpose of serving as a teaching aid which enables students to better acquire knowledge and better prepare for future occupations which will include AI, automation and robotics.

Educational robotics, as something new and different, helps teachers to stimulate children's interest in teaching content. It aims to motivate and encourage students to better participate in the teaching process, which is why it is given great attention.

The application of educational robotics in Croatian education is carried out mainly through extracurricular activities. With their knowledge, skills and their own example of using educational robotics in teaching, teachers of STEM subjects such as ICT and technical culture can influence the orientation of students towards this field.

Teachers of other subjects do not use or insufficiently use educational robots in their teaching process due to lack of necessary knowledge, skills and opportunities. Nevertheless, in the conducted research, they expressed significant interest in education in the field of educational robotics, which would make it easier to implement educational robotics in these other subjects.

References

Benavides, F., Otegui, X., Aguirre, A., & Andrade, F. (2013). Robótica educativa en Uruguay: de la mano del Robot Butiá. XV Congreso Internacional de Informática en la Educación. /online/.

Retrieved on 21st February 2022 From https://redi.anii.org.uy/jspui/handle/20.500.12381/379

Benčak, N. (2021). Robotika u obrazovanju. (Diplomski rad). [Robotics in Education]. (Master's Thesis). Zagreb: University of Zagreb - Faculty of Teacher Education.

Brlek, V., & Oreški, P. (2020). Edukativni roboti i njihova primjena u obrazovanju. [Educational Robots and Their Application in Education]. Hrvatski sjever, 115. /online/. Retrieved on 7th February 2022 from https://maticack.com.hr/wp-content/uploads/2021/02/6-Brlek-Oreski-Edukativni-roboti.pdf

Croatian Makers (2022). /online/. Retrieved on 7th February 2022 from https://croatianmakers.hr/en/home/

Hallinen, J. (2021). STEM. Encyclopaedia Britannica. /online/. Retrieved od 24th August 2021. From https://www.britannica.com/topic/STEM-education

Government of Western Australia - Department of Education (2020). What is STEM?. /online/. Retrieved on 24th August 2020. from https://www.education.wa.edu.au/what-is-stem

Ministarstvo znanosti i obrazovanja Republike Hrvatske (MZO) (2018). Kurikulum nastavnog predmeta informatika za osnovne škole i gimnazije. [Ministry of Science and Education of the Republic of Croatia. Curriculum of the subject Informatics for primary schools and gymnasiums]. /online/. Retrieved on 7th February 2022 from https://mzo.gov.hr/UserDocsImages/dokumenti/Publikacije/Predmetni/Kurikulum%20nastavnog%20predmeta%20Informatika%20za%20osnovne%20skole%20i%20gimnazije.pdf

Nikolić, G. (2016). Robotska edukacija: "Robotska pismenost" ante portas?. *Andragoški glasnik: Glasilo Hrvatskog andragoškog društva, 20*(No. 1-28(35)), pp. 25–57.

Oreški, P. (2021) Prospective Teachers' Attitudes towards Educational Robots in Primary Education. In L. Gómez Chova, A. López Martínez, & I. Candel Torres (Eds.) ICERI2021 Proceedings. Španjolska (Online), IATED Academy, pp. 2322–2331.

Smyrnova-Trybulska, E., Morze, N., Kommers, P., Zuziak, E., & Gladun, M. (2016). "Educational Robots in Primary School Teachers' and Students' Opinion About STEM Education for Young Learners". International Conferences ITS, ICEduTech and STE 2016, pp. 197–204.

Suto, H. (2013). Robot Literacy and Approach for Sharing Society with Intelligent Robots. International Journal of Cyber Society and Education. *6*(2), pp. 139–144

2. međunarodna znanstvena i umjetnička konferencija Učiteljskoga fakulteta Sveučilišta u Zagrebu Suvremene teme u odgoju i obrazovanju – STOO2 - in memoriam prof. emer. dr. sc. Milanu Matijeviću, Zagreb, Hrvatska

Edukativni roboti u osnovnom obrazovanju

Sažetak

Umjetna inteligencija prisutna je danas čak i u uređajima poput pametnih telefona koji se svakodnevno koriste. Jedno od područja istraživanja umjetne inteligencije je robotika i roboti se sve više koriste, posebice u proizvodnji, skladištima i trgovini gdje zamjenjuju ljude. Pored računalne i informacijske pismenosti, čini se da i robotička pismenost postaje sve važnija. Najjednostavniji način uvođenja robotike u osnovno obrazovanje je uz pomoć edukativnih robota. U ovom radu prikazani su rezultati istraživanja primjene edukativnih robota u osnovnom obrazovanju Republike Hrvatske.
Hipoteze istraživanja su sljedeće: manje od trećine ispitanika koristi edukativne robote u svakodnevnom nastavnom procesu s ciljem poboljšanja nastave; postoji statistički značajna razlika u primjeni edukativnih robota u nastavnom procesu s obzirom na dob ispitanika; postoji statistički značajna razlika u primjeni edukativnih robota u nastavnom procesu s obzirom na područje obrazovanja ispitanika; postoji statistički značajna razlika u primjeni edukativnih robota kod ispitanika koji su učiteljice i učitelji razredne nastave (1. - 4. razred osnovne škole) u odnosu na ispitanike koji su nastavnice i nastavnici predmetne nastave (5. - 8. razred osnovne škole).
Istraživački podaci prikupljeni su u svibnju 2021. godine na uzorku ispitanika od 228 učiteljica i učitelja razredne nastave te nastavnica i nastavnika predmetne nastave koji su zaposleni u osnovnim školama u Republici Hrvatskoj. Za prikupljanje podataka korišten je anonimni online anketni upitnik koji su izradili autori ovog rada. U statističkoj analizi podataka korišteni su deskriptivna statistika i hi-kvadrat test. Rezultati istraživanja potvrđuju sve navedene hipoteze.

Ključne riječi

edukativna robotika; buduća zanimanja; osnovno obrazovanje; STEM

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