



PARENTS' ATTITUDES TOWARD STEM TEACHING SUBJECTS IN THE FIRST CYCLE OF PRIMARY EDUCATION

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Abstract: The aim of the research concerns the attitudes of parents towards teaching subjects from the STEM field (mathematics, the world around us/nature and society and the digital world) in the first cycle of primary education. A total of 129 parents participated in the research. Parents are mostly familiar with the teaching and learning program of the subject mathematics, the world around us/nature and society and the digital world, while mothers are more often familiar with the teaching and learning programs of the mentioned subjects from the STEM field. Parents' responses range from undecided to agreement with the items that describe that the contents of the subjects are mathematics, the world around us/nature and society and the digital world are fun, while the parents' responses are slightly more positive that the subjects are mathematics, the world around us/nature and society and the digital world applicable in everyday life. The results show that it is necessary to inform parents more about the possibilities and importance of STEM teaching subjects. Future research can be directed towards ways of involving parents in the school system in order to be informed about STEM subjects and the possibilities for their implementation.

Key words: parents, STEM, subjects, teaching, primary school.

1. Introduction

The Council of the European Union, as one of the eight key competencies for lifelong learning, states and "mathematical competence and competence in science, technology and engineering" (The Council of European Union 2018, p. 7). The mentioned competence is an integral part of STEM (Science, Technology, Engineering, Mathematics) discipline and represents "one cornerstone of current educational research and practice" (Schiefer, et al., 2017, p. 447). It is the subject of numerous researches that highlight the benefits for both individuals and society. The authors state that the STEM concept encourages problem-solving skills, critical thinking, and analytical thinking (Brown, et al., 2011; İdin & Dönmez, 2020; Ceylan & Akçay Malçok, 2020; Hacıoğlu & Gülhan, 2021; Minarti et al., 2022), and "innovation and literacy depend on a solid knowledge base in the STEM areas, and most jobs of the future will require a basic understanding of the sciences, technology, engineering and math" (Barcelona, 2014, p. 865). Also, "continued prosperity and progress in the global marketplace depended on the education community's ability to prepare the future generation of STEM professionals" (Roehrig, et al., 2021, p. 2).

Although the STEM concept is the subject of numerous researches "in the domain of science, technology, engineering, and mathematics (STEM) education, the family still presents an untapped resource for promoting students' motivation and achievement" (Šimunović & Babarović, 2020, p. 701). The research he conducted Gülhan (2023) came to the result that "the subject of family participation in the STEM program (parent-child activities) is frequently studied" (p. 1), and a particularly noticeable increase in 2021 in the USA. The importance and role of parents is also said to be "since the TIMSS 2015 cycle, parents' data on the family context, resources and activities of students in the early periods of development and learning have also been collected" (Đerić, 2021, p. 14). Key competences for lifelong learning are the starting point Education development strategy in the Republic of Serbia (2021) on the basis of which the subject competencies will be developed, and the educational standards will be formulated so that "students and parents are clear about the

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fundamental knowledge of a certain subject and what skills and abilities are developed through a certain subject“ (p. 39). In order to successfully implement the aforementioned, teachers must have the necessary information, as well as the ability to communicate with parents (Majeed & Khawaja, 2024). When it comes to competencies, by the Law on Basic Education and Upbringing it is stated that “the aim of orientation towards general cross-curricular competences and key competences is a more dynamic and engaging combination of knowledge, skills and attitudes relevant to different real contexts that require their functional application“ (*Zakon o osnovnom obrazovanju i vaspitanju*, 2023, p. 5), and teachers have the task of planning the use of different methods, approaches and learning techniques with an integrated approach to teaching and learning (*Pravilnik o programu nastave i učenja za prvi razred osnovnog obrazovanja i vaspitanja*, 2018).

Anderson and Tully (2024) state that “more teachers are keen to investigate how integrated STEM curriculum can prepare students with twenty-first century skills and capabilities“ (p. 265) which contribute to the overall development of students. “The most crucial instrument for accomplishing educational objectives is the curriculum in schools“ (Majeed & Khawaja, 2024, p. 659), and the teacher is the most important factor in its implementation in order to achieve the expected learning outcomes. In the Strategic Documents of the Republic of Serbia, the methods of cooperation between schools and parents are precisely defined, and in the framework of the document Guidelines for the organization and implementation of educational work in primary schools (2023) it is stated that it is necessary to involve parents in all segments and areas of school work. Based on the above, in order for teachers and professional services (pedagogues and psychologists) to involve parents in teaching activities, in the field of STEM teaching subjects, they need to know whether parents have enough information about the teaching and learning programs of teaching subjects in the STEM field, which is and the subject of our research. Since in the Republic of Serbia, the subjects in the first cycle of basic education and upbringing, in the STEM field, are studied individually within the mandatory subjects - mathematics, the world around us/nature and society and the digital world, we will use the names of the mentioned subjects in the paper.

2. Method

2. 1. The goal and tasks of the research

The aim of the research concerns the attitudes of parents towards teaching subjects from the STEM field (mathematics, the world around us/nature and society and the digital world) in the first cycle of primary education.

Based on the research objective, we defined the following research tasks:

- to examine whether parents heard about the characteristics, purpose and application of the STEM concept from teachers at school;
- determine if there are statistically significant differences between the sociodemographic variables and parents' responses as to whether they heard about the characteristics, purpose and application of the STEM concept of learning from teachers at school;
- ask parents if they are familiar with the teaching and learning program of the subject mathematics, the world around us/nature and society and the digital world;
- determine if there are statistically significant differences between the socio-demographic variables and the answers of the parents, whether they are familiar with the teaching and learning program of the subject mathematics, the world around us/nature and society and the digital world;
- examine whether, according to parents, the subjects of mathematics, the world around us/nature and society and the digital world are fun;
- to determine whether there are statistically significant differences between sociodemographic variables and parents' answers whether the subjects of mathematics, the world around us/nature and society and the digital world are fun;
- examine whether, according to parents' opinion, the subjects of mathematics, the world around us/nature and society and the digital world are applicable in everyday life;
- to determine whether there are statistically significant differences between sociodemographic variables and parents' responses, whether the subjects of mathematics, the world around us/nature and

society and the digital world are applicable in everyday life;

- to determine whether there is a correlation between parents' opinions about whether the subjects of mathematics, the world around us/nature and society and the digital world are fun and parents' opinions about whether the subjects of mathematics, the world around us/nature and society and the digital world are applicable in everyday life.

2. 2. Participants

The sample included 129 parents of primary school students from the Republic of Serbia.

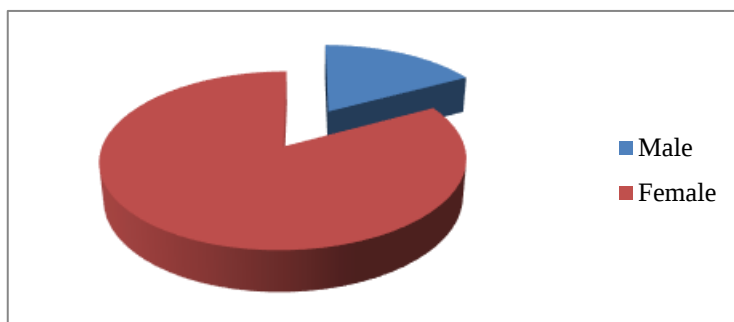


Chart 1. Structure of the sample according to gender of parents

A total of 22 (17.1%) fathers and 107 (82.9%) mothers participated. Chart 2 shows the structure of the sample by age.

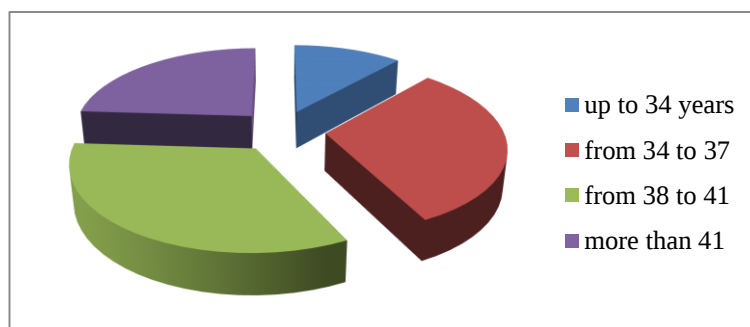


Chart 2. Structure of the sample according to parents' age

From Chart 2, we can see that 15 (11.6%) parents belong to the age category up to 34 years, 40 (31%) parents belong to the 34 to 37 year age category, 43 (33.4%) parents belong to the 38 to 41 year age category and 31 (24%) of parents are over 41 years old. Chart 3 shows the structure of the sample according to the level of education of the parents.

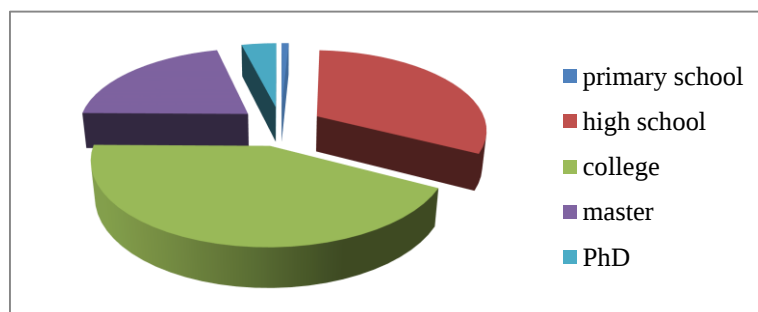


Chart 3. Structure of the sample according to parents' level of education

The parents' data presented in Chart 3 show that 1 (0.8%) parent who participated in the research completed primary school, 41 (31.8%) parents completed secondary school, 55 (42.6%) have university education, 27 (20.9%) have completed master's studies and 5 (3.9%) parents have a doctorate degree.

2. 3. Methods, techniques and instruments

This paper utilizes a quantitative research approach, combining a survey and scale for data collection and with the descriptive method for summarizing and interpreting findings. The used instrument was created by a combination of adopted and modified certain questions from the instrument developed by Marotto and Milner-Bolotin (2018) and questions that we formulated based on tangential literature from the STEM field. This research is part of a wider research that dealt with modern parenting and the STEM concept of learning. The instrument consisted of four parts. The first part consisted of sociodemographic questions (parental gender, parental age and parental education level). The second part of the instrument consisted of questions about whether teachers at school informed them about the characteristics, purpose and application of the STEM learning concept, with parents responding on a five-point Likert-type assessment scale. The third part consisted of multiple-choice questions (yes, I am familiar; I am partly familiar; I am not familiar) regarding parents' familiarity with the teaching and learning program of mathematics, the world around us/nature and society and the digital world. The fourth part consisted of questions about mathematics, the world around us/nature and society and the digital world are fun and other groups of questions about mathematics, the world around us/nature and society and the digital world are applicable in everyday life, with parents responding on a five-point Likert-type assessment scale. The instrument used for this empirical research included a total of ten questions related to the subject of our research and three demographical questions concerning the gender of the parents, their age, and their level of education. An electronic Google questionnaire was created and sent to parents to fill out. The parents were given instructions in the instrument, they were informed about the subject and purpose of the research, and we asked them to be honest in their answers, because the conduct of the research and the collection of data are anonymous. The calculated Cronbach's alpha coefficient for the used instrument is 0.722.

2. 4. Data Analysis

The data obtained was processed in the SPSS program. From the statistical parameters we used: calculation of frequencies (f) and percentages (%), arithmetic mean (M), standard deviation (SD), chi-square test (χ^2), Pearson's correlation coefficient (r), while to check the reliability of the instrument Cronbach's alpha coefficient (α) was applied. We presented the structure of the sample graphically, while we presented individual results in tables.

3. Results and discussion

The results show that parents of students declare that they are not informed about the characteristics, purpose and application of the STEM learning concept by the teachers at school ($M=2.26$), and they reached similar results Watson, Williams-Duncan and Peters (2020) who point out that parents were not informed about STEM opportunities in schools, nor about the importance of engaging in STEM activities with their children. In modern education, the idea that teachers and parents are partners in the realization and popularization of the STEM concept of learning is pursued, whereby action research is one of the expedient possibilities of realizing this idea, from which everyone benefits (Milanović et al., 2024a). There are statistically significant differences between the level of education of parents and their responses to the item that they were introduced to the characteristics, purpose and application of the STEM concept of learning by teachers at school ($\chi^2=30.863$; $df=16$; $p<0.05$). Parents with college and master's degrees answer that they do not agree with this item at all. There are no statistically significant differences between the gender, age and level of education of the parents and the answers to the mentioned item ($p>0.05$).

Table 1. Answers of parents as to whether they are familiar with the teaching and learning program for the subject of mathematics

		f	%
Are you familiar with the teaching and learning program for the subject mathematics?	Yes, I am familiar	78	60.5
	I am partially familiar	39	30.2
	I am not familiar	12	9.3
	Total	129	100.0

From the results shown in Table 1, we can see that even 60.5% of parents are familiar with the program of teaching and learning the subject of mathematics. Mothers more often answer that they are familiar with the teaching and learning program for the subject of mathematics ($\chi^2=7.735$; $df=2$; $p<0.05$), unlike fathers. There are no statistically significant differences between other socio-demographic variables and parents' responses to the item whether they are familiar with the teaching and learning program of the subject usually. Results show that, "pupils from families with higher socio-economic and socio-cultural status achieve better grades and more often choose schools with a large number of math lessons" (Baranović et al., 2014, p. 307). The results of the research that examined the students show that "boys have more positive attitudes towards mathematics than girls, and students of class classes have more positive attitudes than students of subject classes" (Vidić, 2016, p. 26). Primary education lasts eight years in two educational cycles. In the first cycle, classroom teaching is carried out for students of the first, second, third and fourth grades, and the second cycle covers the fifth, sixth, seventh and eighth grades and subject teaching is carried out for these pupils (Zakon o osnovnom obrazovanju i vaspitanju u Republici Srbiji, 2023).

Table 2. Answers of parents as to whether they are familiar with the teaching and learning program of the subject world around us/nature and society

		f	%
Are you familiar with the teaching and learning program of the subject the world around us/nature and society?	Yes, I am familiar	80	62.0
	I am partially familiar	38	29.5
	I am not familiar	11	8.5
	Total	129	100.0

Parents answer that 62% of them are familiar with the teaching and learning program of the subject world around us/nature and society. The authors state that "besides the well-being of the individual, education in the field of natural sciences and mathematics is a strategic goal of every country that strives for competitiveness in the international context, which is why special attention is paid to the results of international studies of student achievement in the aforementioned fields" (Stanišić et al., 2021, p. 195). The authors indicate the activities and contents, within the national subject nature and Society, which the school and the parent can achieve and implement through extracurricular activities (Miletić & Milanović, 2024). Also, improvement of cooperation between family, school and local community is achievable through STEM activities and contents (Milanović et al., 2024b). Statistically significant differences exist between the parents' gender and the parents' answers to the question of whether they are familiar with the teaching and learning program of the subject world around us/nature and society. The largest number of mothers answered that it was familiar ($\chi^2=8.066$; $df=2$; $p<0.05$). There are no statistically significant differences ($p>0.05$) between other socio-demographic variables and parents' responses to the item whether they are familiar with the teaching and learning program of the subject world around us/nature and society.

Table 3. Answers of parents as to whether they are familiar with the teaching and learning program of the digital world subject

		f	%
Are you familiar with the teaching and learning program of the digital world subject?	Yes, I am familiar	64	49.6
	I am partially familiar	48	37.2
	I am not familiar	17	13.2
	Total	129	100.0

In contrast to parents' familiarity with the teaching and learning program of the subject mathematics and the world around us/nature and society, a slightly smaller number of parents answered that they were familiar with the teaching and learning program of the subject digital world. About half of the surveyed parents answered that they were familiar with the teaching and learning program of the digital world subject. As with the previous items, there are statistically significant differences between the gender of the parents and the answer to the question of whether they are familiar with the teaching

and learning program of the digital world subject ($\chi^2=7.842$; $df=2$; $p<0.05$). Mothers are more familiar with the teaching and learning program of the digital world subject. There are no statistically significant differences ($p>0.05$) among other sociodemographic variables and parents' responses to the item whether they are familiar with the teaching and learning program of the digital world subject. Table 4 shows the mean value of parents' answers to the question whether, according to parents, the subjects of mathematics, the world around us/nature and society and the digital world are fun.

Table 4. *Answers of parents whether the subjects of mathematics, the world around us/nature and society and the digital world are fun*

	N	Min	Max	M	SD
The contents of the Mathematics subject are fun.	129	1	5	3.43	1.261
The contents of the subject the world around us/nature and society are fun.	129	1	5	3.70	1.177
The contents of the digital world course are fun.	129	1	5	3.61	1.155

Parents' answers range from undecided to agreement for the items describing that the contents of the subjects of mathematics, the world around us/nature and society and the digital world are fun. From the values shown, we can see that the arithmetic mean calculated for the item that the contents of the subject are the world around us/nature and society is fun is slightly higher. There are no statistically significant differences ($p>0.05$) between sociodemographic variables and parents' responses to the item that the contents of the mathematics subject are fun. It was observed that there were no statistically significant differences ($p>0.05$) and between sociodemographic variables and parents' responses to the item that the contents of the subject are the world around us/nature and our society are fun and between sociodemographic variables and parents' responses to the item that the contents of the subject are the digital world fun. The results of the research can also be influenced by the fact that parents are not sufficiently informed about STEM subjects, as the authors point out Ceylan & Akçay Malçok and that because of that parents "could not find any connection between STEM education and the observations of curiosity, asking more questions, focusing on solutions and showing an increasing interest in Mathematics they had observed in their children" (2020, p. 732). The results show that parents have different opinions about whether STEM subjects are fun, but it should also be noted that research was conducted on a sample of 1045 high school students who "they do not evaluate any subject as particularly useful, nor particularly interesting" (Maksimović et al., 2024, p. 36) which can be the subject of further research.

Table 5. *Answers of parents whether the subjects of mathematics, the world around us/nature and society and the digital world are applicable in everyday life*

	N	Min	Max	M	SD
The contents of the mathematics subject are applicable in everyday life.	129	1	5	3.81	1.223
The contents of the subject the world around us/nature and society are applicable in everyday life.	129	1	5	4.09	1.068
The contents of the digital world course are applicable in everyday life.	129	1	5	4.03	1.152

Based on the data in Table 5, we can see that parents estimate that the contents of the subject mathematics, the world around us/nature and society and the digital world are applicable in everyday life. Somewhat lower agreement of parents is noticeable for the item that the contents of the

mathematics subject are applicable in everyday life. There are statistically significant differences between the gender of the parents and the answer that the contents of the subject are the world around us/nature and society applicable in everyday life ($\chi^2=10.092$; $df=4$; $p<0.05$). Mothers more often answer that they agree and that they completely agree that the contents of the subject of the world around us/nature and society are applicable in everyday life. There are no statistically significant differences between other items and sociodemographic variables ($p>0.05$).

A positive and statistically significant correlation was calculated between the item that the contents of the mathematics subject are fun and the item that the contents of the mathematics subject are applicable in everyday life ($r=0.665$; $p<0.05$). There is a positive and statistically significant correlation between the subject the world around us/nature and society is fun and the world around us/nature and society is applicable in everyday life ($r=0.624$; $p<0.05$). There is a positive and statistically significant correlation between the item that the content of the digital world course is fun and the item that the content of the digital world course is applicable in everyday life ($r=0.714$; $p<0.05$).

3. Conclusion

The results of the research show that teachers are not committed to introducing parents to the STEM concept of learning, and how can they "parents' child-specific beliefs and messages have shown to be the crucial socializing factors in this area" (Šimunović & Babarović, 2020, p. 701), it is necessary to involve parents and introduce them to the STEM concept and its advantages. In order for parents to help children, they need to be informed about why STEM is important (Ghani, et al., 2020) and why their participation in STEM subjects is important. Considering that "teachers are key leaders in the execution of effective curriculum" (Majeed & Khawaja, 2024, p. 668), it is expected that they will be the initiators in encouraging cooperation with parents in order to provide timely information about STEM subjects and opportunities for their inclusion, both through teaching and through activities. As "parents and teachers play an important role in stimulating student motivation" (Jungert et al., 2020, p. 275) joint cooperation is important in order to encourage students to study subjects from the STEM field. The largest number of surveyed mothers answered that they are familiar with the mathematics teacher's teaching and learning program, the world around us/nature and society, and the digital world. Parents' answers range from undecided to agreement for the subjects describing that the contents of the subjects mathematics, the world around us/nature and society and the digital world are fun. Slightly more positive answers from parents that the subjects of mathematics, the world around us/nature and society and the digital world are applicable in everyday life. It was determined that there is a positive and statistically significant correlation between parents' familiarity with the teaching and learning program of the subject mathematics, the world around us/nature and society and the digital world, and parents' opinions about whether the subjects are mathematics, the world around us/nature and society and the digital world of fun. We can focus further research on the involvement of parents in the educational process through seminars, workshops and more intensive cooperation between schools and parents, as well as the opinions of teachers and students about STEM subjects. The limitations of the conducted research are related to the size of the sample of respondents, so it would be good to implement a similar research with a larger number of respondents.

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