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TEACHING MATHEMATICS DURING THE COVID-19 PANDEMIC – EXAMINING THE PERCEPTIONS OF CLASS TEACHERS AND MATHEMATICS TEACHERS[**]

Abstract: The aim of this study was to investigate how class teachers and math teachers in Serbia perceived the possibilities, effects, and challenges of teaching mathematics online during the COVID-19 pandemic. We prepared a questionnaire that was implemented at the end of 2019/2020. The sample comprised 239 teachers, 141 class teachers and 98 math teachers. Both quantitative and qualitative methods were used for data analysis. The results suggest that, although the experience of online teaching had a positive effect on the teachers' self-reported competence in using ICT tools, even more attention should be given to strengthening teachers' pedagogical skills referring to teaching mathematics in an online learning environment. In general, teachers were satisfied with the quality of instruction they demonstrated. However, they were not satisfied with the quality of student knowledge. In addition, they faced certain challenges in the implementation of online teaching and learning, such as objective grading and assessment, as well as monitoring student progress, maintaining communication with parents, and motivating and engaging students. The majority of teachers stated that teaching math online had more disadvantages than advantages. Teachers' responses also indicated that they tended to use ICT tools in a more traditional way.

Keywords: *mathematics education, COVID-19, online teaching and learning, class teachers, mathematics teachers.*

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INTRODUCTION

The COVID-19 pandemic entered our lives suddenly and profoundly altered almost all aspects of life across the globe. Recommendations by the *World Health Organization*, such as social and physical distancing, imposed difficult choices and measures for each country to implement. The Republic of Serbia was not an exception. On March 15, 2020, the Government of Serbia declared a state of emergency due to the COVID-19 crisis (Official Gazette 29/2020), adopting large-scale social and physical restrictions, regulations and recommendations for working from home, including the suspension of classes in higher education institutions, primary and secondary schools and pre-school institutions (Official Gazette 30/2020). The Ministry of Education, Science and Technological Development (MoESTD) issued guidelines for distance education for students of primary and secondary school (*Implementation of Distance Education for Students of Primary and Secondary Schools*, 2020). The government organized massive, one-way TV broadcasts for primary and secondary school students, and teachers were instructed to carry out distance and online learning as a support to these resources. The MoESTD emphasized that distance and online learning should be carried out so as to provide meaningful learning experiences for students, without overburdening them with the demands of completing all curriculum requirements needed for grade promotion.

Distance education can be defined as "a form of education in which the teacher and the learner do not have to be in the same place" (Csachova & Jurečkova, 2020: 286), but they are separated by space or time and communicate at a distance (UNESCO, 2020). The use of modern technologies and media allows learners and teachers to communicate online. The form of distance education that refers to situations in which the Internet is used to support the learning process is known as online education (Fakhrunisa & Prabawanto, 2020). Online education allows teachers to provide students with immediate access to learning materials and create more opportunities for interaction between students and the teacher, and student-to-student interaction, as well as for students to work in groups (Ally, 2004; Fakhrunisa & Prabawanto, 2020). It also provides students with more flexibility with regard to learning time, place and pace (Csachova & Jurečkova, 2020), and gives both students and teachers an opportunity to use different web-based learning media (Fakhrunisa & Prabawanto, 2020). However, although digital technologies provide new opportunities for teaching and learning (Chauhan, 2017), the mere presence of computer technology does not necessarily results in student progress (Li & Ma, 2010; König, Jäger-Biela & Glutsch, 2020). Gurley (2018) indicates that teaching in an online learning environment requires different pedagogical approaches, abilities and practices than teaching in face-to-face settings. Teachers' readiness to teach in these settings might affect the quality of instruction in online learning courses (Fakhrunisa & Prabawanto, 2020).

One of the COVID-19 pandemic lockdown consequences was that teachers from all around the world were confronted with a sudden need to adapt to online education. The global pandemic forced schools and universities to switch to online teaching instead of the traditional face-to-face approach (Engelbrecht, Llinares, Borba, 2020). Teachers faced serious challenges in adapting to online teaching, while trying to maintain at least a minimum of communication with students and support their learning and development (König et al., 2020). Learning activities that were commonly carried out at school now took place online. Many teachers found themselves in a situation where they were forced to use digital tools and e-platforms they had never used before.

The COVID-19 pandemic made use the ICT in education and online and blended learning essential topics in teaching both mathematics and other subjects (Engelbrecht et al., 2020; Schleicher, 2020). The *Strategy for Education Development in Serbia 2020*, which was published in 2012, underlined the importance of digital technologies for the overall development of the education system. Nevertheless, the first official document − *Guidelines for Promoting the Role of ICT in Education* (2013), which deals with a comprehensive integration of digital and online learning in education, was adopted by the National Education Council of the Republic of Serbia in 2013. In 2017 and 2019, MoESTD presented *The Digital Competence Framework – Teacher for a Digital Age* (2017; 2019) in which teacher requirements concerning computer literacy and familiarity with ICT methods and tools applicable in the teacher's chosen discipline were described. However, the question is whether teachers had enough time to develop the necessary ICT skills and pedagogical abilities required to teach in an online learning environment brought about by the COVID-19 crisis.

Before the outbreak of the pandemic, online learning was a complementary form of education in Serbia used only at some universities. The compulsory restriction and quarantine measures in many countries have shown that it also could be used in primary and secondary education (Csachova & Jurečkova, 2020; König et al., 2020; Rasmitadila, Aliyyah, Rachmadtullah, Samsudin, Syaodih, Nurtano & Tambunan, 2020). In order to investigate how Serbian class teachers and mathematics teachers taught mathematics at a distance, how they maintained communication and interaction with students, and what were the main problems and challenges they faced, we conducted a survey at the end of 2019/2020. We believe that these data are important, because they can be used as the basis for further development of distance education and the process of digitalization in education. We expect the results of this study to provide policy makers and educators with data needed to incorporate the content related to online and blended learning in teacher education programs.

RESEARCH METHODOLOGY

The main aim of the survey was to investigate how class teachers and mathematics teachers in Serbian schools perceived the possibilities, effects, and challenges of teaching mathematics online during the first wave of the COVID-19 pandemic. The aim was accomplished through the following research tasks:

1) to examine the self-reported ICT competences of class teachers and mathematics teachers before and after the first wave of COVID-19;

2) to investigate the perceptions of class teachers and mathematics teachers about the quality of mathematics teaching and interaction with students in an online learning environment;

3) to determine the challenges and difficulties teachers faced while teaching mathematics in an online learning environment.

Instrument. The data were collected using the survey technique. We designed a questionnaire to examine the perceptions of teachers about teaching mathematics in an online learning environment. It was prepared in Google Forms and comprised 12 questions divided into three sections. The first section included demographic characteristics of the chosen sample: years of service and the study program the teacher attended (class teacher or mathematics teacher). The second section examined the self-reported level of competence for using ICT tools before and after the first wave of the pandemic, and gathered data on the technologies used to teach in an online learning environment. The third section investigated teachers' perceptions about the quality of mathematics teaching in an online learning environment, and challenges and difficulties they encountered during the spring COVID-19 lockdown. The questionnaire was anonymous and required 10 minutes to complete. All respondents who filled the questionnaire volunteered for the task.

The data collected by the questionnaire were analysed quantitatively. We conducted statistical analysis using the Statistical Package for the Social Sciences (SPSS) 23.0 for Windows. When it comes to statistical analysis, p values lower than 0.05 were considered statistically significant. The normality of the variables was evaluated using the Kolmogorov-Smirnov normality test. Descriptive statistics methods (frequency, percentage, mean, median, standard deviation, coefficient of variation) and non-parametric tests (Wilcoxon signed-rank test, Mann-Whitney and Kruskal-Wallis test) were used for quantitative data analysis. Independent variables in the data analysis were teachers' study program and years of service.

Sample. The research was conducted at the end of 2019/2020. The sample comprised 239 teachers, among which 59% were class teachers (141) and 41% were mathematics teachers (98). The majority of the teachers had less than 13 years of professional experience. The structure of the sample with regard to study program and years of service is given in Table 1.

*Table 1. Sample structure with regard to teacher's study program
and years of service*

	Teacher study program		Years of service		
	Class teacher	Math Teacher	0–12	13–24	25–
f	160	79	104	77	58
%	66.9	33.1	43.5	32.2	24.3

RESULTS AND DISCUSSION

The first research task was to examine teachers' self-reported ICT competences before and after the first wave of COVID-19. Results show that, in general, teachers self-reported competences for using ICT tools in teaching mathematics before the outbreak of the pandemic were at a high level (M = 3.53, SD = 1.05, Md = 4.00). Mathematics teachers reported a higher level of ICT competences used in mathematics classes (M = 3.74, SD = 1.14) than class teachers (M = 3.45, SD = 0.97).

When it comes to years of service, teachers with over 24 years of teaching experience reported a lower level of competences for using ICT tools in comparison to teachers with 12 or less years of professional experience, and those who had between 13 and 24 years of experience as a teacher. If we consider the fact that the first official document concerning the integration of digital and online learning in education was adopted only in 2013 (*Guidelines for Promoting the Role of ICT in Education*, 2013), these results are not surprising.

In general, teachers reported a higher level of self-reported competences for using ICT tools after the first wave of the COVID-19 pandemic (M = 4.05, SD = 0.79, Md = 4.00). Similar results were obtained both with regard to the teachers' study program and years of service. In order to examine if there is a statistically significant difference in the level of self-reported competences for using ICT tools before and after the first wave of the pandemic, we used the Wilcoxon signed-ranks test. Due to the non-normality of the variables with regard to the teachers' study program and years of service, a non-parametric test was used.

The Wilcoxon signed-rank test showed that there was a significant difference in teachers' self-reported competences for using ICT tools in general before and after online teaching (Z = − 7.201, p < 0.001). Teachers' self-reported competences for using ICT tools after the period of online teaching was higher. Similar results were obtained for each category with regard to teachers' study program (Table 2). Both class teachers (Z = − 5.867, p < 0.001) and mathematics teachers (Z = − 4.177, p < 0.001) reported a higher level of self-reported competences for using ICT tools at the end of the school year. From the standpoint of teachers, the experience of online teaching had a positive effect on their self-reported competences for using ICT tools in all categories with regard to years of service (Table 2).

Table 2. The level of the self-reported teaching competence for using
ICT tools before and after the COVID-19 first wave

		Pre-COVID-19			After the first wave of COVID-19				
		M	SD	Md	M	SD	Md	Z	Sig.
Teacher's study program	Class teacher	3.45	0,97	3.00	3.97	0.75	4.00	−5.867	0.000
	Mathematics teacher	3.74	1.14	4.00	4.18	0.83	4.00	−4.177	0.000
Years of service	0–12	3.89	0.93	4.00	4.32	0.74	4.00	−4.326	0.000
	13–24	3.53	1.11	3.00	4.01	0.80	4.00	−4.102	0.000
	25–	3.12	0.93	3.00	3.65	0.69	4.00	−4.056	0.000

As part of this research task, we wanted to examine how teachers acquired ICT skills which they used for teaching mathematics before the pandemic. The majority of teachers pointed out that they acquired ICT skills needed for teaching through self-training (51.9%), or professional development programs (26.4%), while others acquired them through training programs organized by their school (15.1%), or during university studies (14.6%).

19.4% of mathematics teachers received their training on the use of ICT tools during university studies, as opposed to only 11.3% of class teachers. As expected, the highest percentage of teachers who received training needed to use ICT tools during university studies were those who had less than 13 years of professional experience (29.8%). Only 5.2% of teachers with 13–24 years of service received their training during university studies, whereas none of the teachers with more than 24 years of professional experience acquired their ICT skills at the university. Class teachers with more than 24 years of service stated that they mostly learned to use ICT tools through self-training (58.6%), or in professional development programs (31%).

It is interesting that 30% of all respondents stated that they never used ICT tools to teach mathematics before (26.2% of class teachers and 36.7% of mathematics teachers). When it comes to professional experience, 28.8% of teachers with less than 13 years of professional experience said they never used ICT tools to teach before, whereas 33.8% of teachers with 13–24 years of professional experience, and 29.3% of those with over 24 years of service gave the same answer.

The second research task was to investigate the perceptions of class teachers and mathematics teachers about the quality of math instruction they delivered, and

the interaction with students in an online learning environment. Since the MoESTD organized one-way massive broadcasts of lessons on TV and the Internet platform, teachers received instructions to give lessons in an online learning environment as support to these resources by using different online learning platforms and tools (i.e. Viber, Zoom, Microsoft Teams).

They were expected to provide additional guidelines and explanations to students, and to prepare various forms of learning materials (i.e. presentations, exercises, homework, etc.) in order to maintain interaction and communication with students and help them to master learning objectives (*Implementation of Distance Education for Students of Primary and Secondary Schools*, 2020).

Therefore, the first question concerning the second research task was to determine if the teachers carried out any form of instruction mentioned above in an online learning environment. The findings showed that 86,6% of all teachers-respondents taught in an online learning environment during the COVID-19 pandemic. The most frequently used ICT tools for online teaching were: Viber (69.9%), Zoom (24.3%), Microsoft Teams (10.9%), Whatsapp (9.6%), Skype (5.0%), Google Meet (5.4%), Edmodo (2.1%), Google Classroom (14.2%), Email (2.9%). Less than 1% of teachers also used Geogebra, Kahoot and Moodle.

During online classes, most teachers who used videoconferencing platforms shared PowerPoint presentations followed by oral explanation (77.8%). On the other hand, 20.5% of teachers used oral presentations only presented through video conferencing without sharing any content. Furthermore, 16.7% of teachers used the whiteboard and annotation tools to deliver the content without any student participation, and 8.8% teachers allowed students to use the whiteboard and annotation tools to participate in solving math problems during online lessons. A similar percentage of mathematics and class teachers stated that they used PowerPoint presentations (78.0% of class teachers, 77.6% of mathematics teachers) or oral presentation only (20.6% of class teachers and 20.4% of mathematics teachers) to deliver mathematics content. When it comes to the use of the whiteboard, we determined that a greater number of mathematics teachers used it for online math lessons compared to class teachers, both with students participating and collaborating on solving mathematical tasks (10.2% of mathematics teachers and 7.8% class teachers) and with no student participation (25.5% of mathematics teachers and 10.6% of class teachers).

Most teachers used videoconferencing tools for discussions with students (64.9%), or frontal instruction (42.7%), which is a practice traditionally used in a face-to-face settings. Engelbrecht, Llinares & Borba (2020) warn that "when one suddenly has to transfer to an entirely new teaching environment, many teachers tend to just convert their traditional courses to an online platform" (2020: 837). The same authors labelled this as "domestication of a new media", which actually means that teachers tend to simply use teaching practices from the traditional settings without taking into account the possibilities and advantages of new media. We

determined that a higher percentage of class teachers (46.1%) than mathematics teachers (37.8%) reported that they practiced the frontal teaching method through videoconferencing. On the other hand, mathematics teachers used videoconferencing for discussions with their students (77.6%) more frequently than class teachers (56%). A smaller percentage of teachers indicated that they used video conferencing for oral assessment (33.5%), as well as additional explanations and assistance to students who needed extra help (2.9%).

In general, teachers were satisfied with the quality of mathematics instruction they delivered in an online learning environment, and their responses were homogeneous (M = 3.82, SD = 0.87, C_V = 0.23). Class teachers expressed a higher level of satisfaction (M = 3.89, SD = 0.89) in comparison to mathematics teachers (M = 3.72, SD = 0.86). As for the quality of student knowledge and skills acquired during online instruction, teachers expressed a lower level of satisfaction (M = 2.96, SD = 0.94, C_V = 0.32). Class teachers were more satisfied (M = 3.19, SD = 0.96) with the quality of student knowledge and skills than mathematics teachers (M = 2.62, SD = 0.82).

Similarly, Cao, Zhang, Chan & Kang (2021) investigated how teachers in China perceived the effects of online mathematics instruction. They determined that 30.3% of teachers stated that online teaching did not promote student learning in the same way as face-to-face teaching and that their students' math grades were worse than they expected. On the other hand, only 4.6% of Chinese teachers were satisfied with student achievement. However, most of the Chinese teachers (65.1%) commented that it is difficult to provide a direct answer to the question whether online instruction had a positive or negative effect, and that they believed that effectiveness of online teaching largely depended on student self-discipline.

As part of the second research tasks, teachers were asked to rate their level of agreement with five Likert-type items concerning student engagement and participation in online math classes (1 denotes a complete disagreement and 5 a complete agreement). The findings are presented in Table 3. In order to examine if there were statistically significant differences in teachers' perceptions about the aforementioned aspects of online mathematics instruction between different teacher groups with regard to teachers' study programs, and years of experience, Mann-Whitney and Kruskal-Wallis tests were carried out, respectively.

*Table 3. Descriptive statistics regarding some aspects of student engagement
and participation in online mathematics classes*

Item codes	Items	M	SD	C_V
S1	Students positively responded to online teaching.	3.03	1.17	38.61
S2	Students displayed higher interest to learning online.	2.45	1.10	44.90
S3	Students felt more freedom to pose questions.	2.26	1.15	50.88
S4	Students were more active during online classes.	2.41	1.16	48.13
S5	More effort was required to motivate students.	3.43	1.20	34.99

In general, teachers expressed a high level of agreement with the statement that more effort is needed to motivate students to learn in an online environment. Similar results were obtained by some research carried out in the USA (Hamilton, Kaufman & Diliberti, 2020; Reich, Buttimer, Coleman, Colwell, Faruqi & Larke, 2020) – teachers reported that they struggled to motivate students. Student motivation represents one of the crucial ingredients of effective learning, and as Reich et al. (2020) indicate, motivation was even more crucial during the pandemic. Teachers had to deal with issues such as how to get students to participate in all distance learning activities, and how to help them focus despite possible distractions at home. Another important fact is that in an online environment, students become more responsible for their own learning process. They are required to be more independent and the emphasis is put on their autonomy, and capacity not just for independent learning, but also for executive functioning, self-monitoring and capacity for learning online (Schleicher, 2020). This forces teachers to put in extra effort to create materials for self-directed learning and individual work. We found no statistically significant differences concerning this item, neither in regard to teacher study programs, nor their professional experience.

As for the statement that "students positively responded to online teaching" teachers' responses indicated a moderate level of agreement. Mathematics teachers reported that their students reacted more positively to online teaching than class teachers (Table 4), but no statistically significant difference was found. There was no statistically significant difference with regard to years of service either.

As for the other statements about student engagement and active participation, teachers expressed a lower level of agreement. The values of the coefficient of variation indicate heterogeneity of teachers' responses. However, no statistically significant differences were found neither with regard to teacher study programs, or years of service. Active student participation and engagement is fundamental to effective learning, student achievement and well-being (Finn & Zimmer, 2012; Kalogeropoulos, Roche, Russo, Vats, Russo, 2021). Although engagement behaviors might be promoted or facilitated by some facets of the face-to-face classroom environment, the extent to which they exist in a distance learning

environment is questionable. In order to increase student engagement, online tools should be used to facilitate collaboration and the exchange of ideas and exploration among students (Shernoff, 2013).

Table 4. Teachers' perceptions about student engagement
and participation in online math classes with regard to teachers'
study program and years of service

| | Teachers' study program | | | | Years of service | | | | | |
| | Class teachers | | Mathematics teachers | | 0–12 | | 13–24 | | 25– | |
Code	M	SD	M	SD	M	SD	M	SD	M	SD
S1	2.97	1.21	3.11	1.10	3.14	1.22	3.03	1.15	2.84	1.08
S2	2.47	1.20	2.42	0.94	2.48	1.11	2.47	1.09	2.37	1.11
S3	2.16	1.14	2.40	1.16	2.19	1.18	2.37	1.16	2.23	1.09
S4	2.37	1.20	2.48	1.10	2.50	1.17	2.41	1.08	2.28	1.23
S5	3.42	1.16	3.45	1.27	3.52	1.33	3.41	1.11	3.29	1.08

The third research task was to determine the challenges and difficulties teachers faced while giving math lessons in an online learning environment. In order to investigate the challenges and difficulties teachers encountered in online mathematics education, we asked them about perceived advantages and disadvantages of teaching mathematics in an online learning environment. 47.3% of teachers (50.4% of class teachers and 42.9% of mathematics teachers) stated that online teaching has more disadvantages than advantages, while 31.8% stated the opposite (29.8% of class teachers and 34.7% of mathematics teachers). 20.9% of teachers expressed a neutral opinion (19.9% of class teachers and 22.4% of mathematics teachers) by pointing out that online teaching has both advantages and disadvantages. It is interesting that although the majority of teachers declared that online teaching has more shortcomings than traditional teaching, only a small number of them provided an adequate explanation as to why. The most frequent responses were: poorer communication and insufficient teacher-student, and student-student interaction, lack of social interaction, additional responsibility for parents, and the fact that teachers sometimes couldn't be sure if they were grading parents or students. It seems that the transition to online learning might be particularly difficult for class teachers, which is in line with the results of studies conducted in other countries (Flack, Walker, Bickerstaff, Earle, Margetts, 2020; Hamilton et al., 2020). We believe that the reason might be the fact that class teachers teach students age 7–10 who need more face-to-face contact and interaction, and visual manipulatives to aid their understanding of mathematical concepts. Furthermore, class teachers also experienced additional challenges in adapting to digital instruction, because younger students have a limited executive functioning, technology, and language skills. Most teachers were worried about the lack of social contact, fearing for educational and

psychological welfare of their students, particularly those in junior grades of primary school. Studies conducted in other countries yielded similar results (Flack et al., 2020). A number of participants pointed out that face-to-face interaction was essential in monitoring student understanding, providing immediate assistance and feedback, and keeping students engaged. In the traditional classroom, interaction not only includes verbal communication, but also eye contact and other nonverbal cues that help teachers to establish connection with students and monitor their learning (Cao, Zhang, Chan, Kang, 2021). As one of the class teachers noted when talking about the disadvantages of online teaching: "I cannot see the faces of students and therefore I cannot see if they understand the mathematical task, and observe how they are thinking. This results in a limited feedback". Teachers agree that distance and online teaching represents a useful tool to additionally support in-class teaching (especially when some students are ill or need some extra help), but, as they further state, it cannot fully compensate for the loss of social interaction in the classroom.

On the other hand, advantages that teachers stressed were the following: individual approach to students, more flexible learning time, location independent learning, improvement of student ICT competences, increased student interest for the subject, parents have more chance to actively participate in their children's education, it activates introvert students, students feel more free to ask question, it offers more varied content for students, more possibilities of working with students who require additional help, it is more convenient when grading homework, students become more independent in learning, immediate feedback, content is available at all times, students can hear and watch the same lesson more than once, students are more active, parents have a better insight into their child's knowledge, it is more easy to monitor student progress, teachers can use different teaching approaches, and it allows more time for effective teaching.

In addition, we asked teachers to evaluate how difficult it was for them to perform certain activities related to online mathematics teaching (1 = not difficult at all, 5 = very difficult). The results are presented in Table 5.

Table 5. Descriptive statistics regarding some aspects of online mathematics teaching

Activity code	Activities	M	SD	Cv
A1	Preparing lessons and lesson materials	2.42	1.03	42.56
A2	Delivering online lessons	2.61	1.23	47.13
A3	Evaluating homework	3.12	1.22	39.10
A4	Communication with parents	2.54	1.28	50.39
A5	Assessment	3.32	1.32	39.76
A6	Monitoring student progress	3.90	1.08	27.69
A7	Grading students objectively	4.16	0.96	23.08

Teachers stated that what they found most difficult was to monitor student progress and to perform assessment (Table 5). They were also concerned about their grading objectivity in online teaching. We believe that this item might be partially explained by teachers' observation that sometimes they are not sure if they are evaluating the work of students, or their parents. The same finding was also reported in other studies (Kalogeropoulos et al., 2021). Teacher could not be sure about the level of support students got at home. In order to assess student learning outcomes, some researchers recommended formative assessment to improve remote monitoring of the learning process (Fakhrunisa & Prabawanto, 2020). They pointed out that formative assessment should be implemented a few times a week and feedback should be given not just in the form of scores, but also in qualitative terms.

Another activity that teachers found particularly difficult was homework. Exercises that are usually administered after classroom instruction represent an important piece of information, since the manner in which students complete them helps teachers to get a general picture of what students have learned (Cao et al., 2021). But handing in their written homework is not possible in online instruction, teachers couldn't know how they solved the problems and finished homework, which can usually be determined by their handwriting and calculation drafts.

Table 6. Teachers' perceptions about some aspects of online mathematics teaching with regard to study program and professional experience

Activity codes	Teacher study program				Years of service					
	Class teachers		Mathematics teachers		0–12		13–24		25–	
	M	SD	M	SD	M	SD	M	SD	M	SD
A1	2.37	1.03	2.51	1.02	2.34	1.06	2.56	0.98	2.39	1.02
A2	2.51	1.14	2.75	1.32	2.51	1.31	2.71	1.13	2.65	1.20
A3	3.00	1.23	3.29	1.18	3.09	1.28	3.07	1.18	3.23	1.18
A4	2.37	1.23	2.79	1.32	2.61	1.38	2.56	1.14	2.39	1.30
A5	3.33	1.33	3.32	1.31	3.25	1.38	3.44	1.24	3.29	1.33
A6	3.79	1.16	4.06	0.93	3.84	1.05	3.94	1.08	3.94	1.14
A7	4.02	0.97	4.37	0.91	4.04	1.03	4.21	0.94	4.29	0.86

Given that the teachers' opinions were heterogeneous for the majority of items (Table 6), we wanted to investigate if there were any significant differences with regard to the study program teachers attended, and their professional experience. Due to the non-normality of the variables in regard to teachers' study program and years of service, Mann-Whitney and Kruskal-Wallis tests were performed, respectively.

The findings indicate that there was a significant difference between two activities with regard to study program: "grading students objectively" (U = 4080, z = − 2.811, p = 0.005), and "communication with parents" (U = 4247, z = − 2.283, p = 0.022). Math teachers reported that they found it more difficult to grade students objectively in an online learning environment, and to maintain communication with parents, in contrast to class teachers. Unlike class teachers, math teachers usually teach and grade more than one class which means that they have to monitor the progress and assess more students than class teachers. More students means formative assessment is more difficult to perform. On the other hand, since math teachers teach older students (age 11–18), they had the opportunity to use the advantages of online learning and different ICT tools which enabled them to provide immediate feedback to students (i.e. Google Classroom assignments and Google Forms for creating tests). However, we must take into consideration that only 14.2% of all teachers responded that they used Google Classroom in their lessons. This result indicates that more attention should be given to professional development programs (in the form of seminars, workshops, webinars) so as to equip teachers with the necessary skills to create and use online assessment tools.

Another important issue is communication and collaboration between teachers and parents. It is particularly important to maintain collaboration between teachers and parents in primary schools, because most parents possess the hardware used as a learning support, such as mobile phones or laptops (Rasmitadila et al., 2020). Class teachers were more satisfied with the existing communication with parents than their colleagues who teach math. We believe that this might be partially explained by the fact that younger students need more parental support than older ones, especially in handling electronic devices and using Internet platforms and ICT tools. Class teachers reported that they were constantly in touch with parents through applications such as Viber and Whatsapp.

As for the other activities (A1, A2, A3, A5 and A6), there were no significant differences in responses among class teachers and mathematics teachers. We haven't found a significant difference in any of the items with regard to teachers' professional experience either.

CONCLUSION

The COVID-19 outbreak has significantly affected almost all areas of society, including educational systems across the globe. Many educational institutions were forced to use technologies without previously considering best practices and research. Teachers around the world suddenly had to switch from face-to-face to online teaching. The main purpose of our research was to obtain early perceptions of class teachers and mathematics teachers about mathematics teaching in an online learning environment during the first wave of COVID-19. We believe that the teachers' opinion about teaching and learning math online during the pandemic is essential. We are not sure how long the pandemic will last and whether there will be more outbreaks in the future. But, what we learned from this experience is that educators must be prepared for future challenges. The world is now aware that it is important to continue the ongoing efforts to develop the infrastructure for distance and online education, and to continue to develop the capacity of both students and teachers to learn and teach in this way.

The results of our study indicate that teachers were satisfied with the quality of teaching that they delivered. However, they were not satisfied with the quality of student knowledge, believing that online teaching and learning have more disadvantages than advantages. They faced certain challenges in implementing online teaching and learning, such as objective grading and assessment, monitoring student progress and maintaining communication with parents, and motivating and engaging students. Although they listed many advantages of online mathematics teaching, they also stressed the negative sides, such as poorer communication and insufficient teacher-student and student-student interaction, lack of social interaction, and additional responsibilities for parents. We determined that teachers were in the habit of using ICT tools in a more traditional way (frontal instruction, discussions, PowerPoint and oral presentation, etc.). We believe that this is because they did not have adequate training on using pedagogical approaches which are more suitable for teaching in an online learning environment.

The findings of this study could be used as a foundation and reference for improving online mathematics teaching and learning quality in the future. Policy makers in the field of teacher education should find ways to incorporate topics on online mathematics teaching in teacher education programs and professional development programs. We are aware that the scope of this study is somewhat limited, because it focused on the perception of challenges and possibilities in an online learning environment based on one point of view only – that of teachers'. Some follow-up studies should investigate the perceptions and opinions of students and parents. Moreover, the extent to which teachers have successfully mastered the challenges mentioned above, and the most relevant factors remain unknown.

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НАСТАВА МАТЕМАТИКЕ У ДОБА КОВИД-19 ПАНДЕМИЈЕ – ИСПИТИВАЊЕ МИШЉЕЊА УЧИТЕЉА И НАСТАВНИКА МАТЕМАТИКЕ

Резиме

Циљ рада је да се испита како учитељи и наставници математике у Републици Србији перципирају могућности, ефекте и изазове онлајн наставе математике током пандемије ковид-19. У том циљу реализовано је истраживање крајем 2019/2020. године техником анкетирања на узорку од 239 наставника, од којих је 141 учитељ и 98 наставника математике. У анализи добијених резултата примењене су и квантитативне и квалитативне методе истраживања. Добијени резултати показују да, иако је самоперцепција компетентности за извођење онлајн наставе и коришћење ИКТ алата од стране учитеља и наставника позитивна, неопходно је јачати компетенције наставника за извођење наставе математике онлајн. Наставници су задовољни квалитетом сопственог рада, али нису задовољни квалитетом знања ученика. Највећи изазови са којима су се суочили наставници у онлајн настави и учењу су објективно оцењивање и праћење напретка ученика, одржавање комуникације са родитељима и мотивисање и подстицање ученика на веће ангажовање у учењу. Већина наставника слаже се са ставом да онлајн настава математике има више недостатака, него предности. Одговори наставника показују да су у онлајн настави тежили коришћењу ИКТ алата на традиционални начин.

Кључне речи: *математичко образовање, ковид-19, online настава и учење, учитељи, наставници математике.*