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CHALLENGES AND PERSPECTIVES IN ONLINE MATHEMATICS TEACHING DURING THE PANDEMIC COVID-19 IN ZENICA-DOBOJ CANTON

Abstract

The aim of this research was to investigate the attitudes of mathematics teachers towards distance education in primary and secondary schools within Zenica-Doboj Canton throughout the COVID-19 pandemic. The study intended to solicit the views of teachers, pinpoint obstacles and difficulties they encountered, and assess the advantages and disadvantages of this pedagogical approach. Furthermore, the research sought to determine the most effective techniques and resources for delivering online math classes. An online survey was carried out in 2022. among 58 primary and secondary school teachers as well as mathematics educators in Zenica-Doboj Canton, to examine online mathematics courses during COVID-19 pandemic. Subsequent data analysis revealed various hindrances such as issues related to technology, internet accessibility, and transfer of knowledge. Nevertheless, the teachers conveyed a substantial level of contentment regarding their students' achievements and progression. Additionally, it was determined that online resources in Bosnian aligned with the curriculum are necessary.

Keywords: *online teaching, mathematics, pandemic, COVID-19*

Introduction

The COVID-19 pandemic has caused substantial worldwide and national transformations. On March 17, 2020, an extraordinary session of the Council of Ministers of Bosnia and Herzegovina declared a natural or other disaster within the country's territory (Sl. Glasnik BiH, 2022). These decisions resulted in the most extensive disruption to education ever recorded, affecting 1.58 billion children globally (United Nations, 2020). In Bosnia and Herzegovina alone, the impact reached 500,000 (Agencija za statistiku BiH, 2020). The COVID-19 pandemic prompted a swift transition to online learning as a substitute for

traditional classroom instruction. Tonković et al. (2022) investigate variances in online learning among nations, with a focus on instruments, platforms, obstacles, and outlooks. It emphasizes the significance of centralized planning and regional accommodations to ensure optimal outcomes. According to the results of a study conducted on mathematics education students (Agus & La Hadi, 2020), 60% of the students expressed a preference for face-to-face learning once the Covid-19 pandemic ended. This was followed by 2.7% who opted for online learning, and 37.3% who favoured blended learning. Pupils and students were obliged to leave their desks and almost overnight, the teaching process was transferred to various online platforms, TV screens, Viber groups and other media. From the outset, it became evident that no country, including Bosnia and Herzegovina, was adequately equipped to handle this type of situation technically or professionally, as stated in Bureković et. al. (2020). During the COVID-19 pandemic, the global education sector underwent a significant transformation that called for a rapid shift from traditional classroom teaching to remote online learning methods. This abrupt change highlighted the crucial role played by digital tools and technological infrastructure in enabling educational continuity. In a recent study by Pulungan et al. (2022) on the effects of distance education, it was found that 75% of students use WhatsApp for learning. YouTube is the second most used platform, accounting for 45% of usage, followed by Edmodo in third place with 30%. Zoom only accounts for 5% and Google Meet for 10%. As Tonković et al. (2022) findings reveal that Europe boasts a robust digital infrastructure with widespread internet access in schools and households. Educators faced the daunting task of transforming educational content and teaching strategies to align with the digital realm. They utilised a range of digital tools, from video conferencing platforms like Zoom and collaborative document editing tools such as Google Workspace, to Learning Management Systems (LMS) like Moodle and Canvas. However, a significant challenge emerged, as approximately 826 million students globally lack computer access, 706 million are deprived of internet access, and 56 million have no access to mobile 3G or 4G networks. This issue is particularly troubling during the current crisis, given that 82.2% of African households face inadequate internet access, due to the pandemic, low education rates, and early school leaving. The OECD presents noteworthy variations among student socio-economic groups. In Europe, over 95% of students have access to computer to facilitate their homework, and 91% can access a conducive study environment. In contrast, Indonesia reports only 34% of students with computer access, and 70% have a tranquil study setting. (Tonković et al., 2022)

On the other hand, students embarked on a process of digital adaptation that required the acquisition of key digital literacies and self-regulation abilities. They faced the intricacies

of taking part in online activities, refining their skills in actively participating in virtual discussions, and responsibly utilising web-based resources. Furthermore, students developed expertise in effectively managing their time to navigate synchronous lectures, self-directed learning, and the submission of assignments in a digital environment. As suggested by Habiyanti's (2021) study, researchers recommend that teachers create homework activities that are not only more creative but also more effective and manageable. This can be achieved through the use of appropriate tools or media that align with the material being taught. Moreover, teachers should be mindful when designing assignments, ensuring they sustain students' enthusiasm for online learning and do not impose undue psychological distress. (Habiyanti, 2021)

During the COVID-19 pandemic, educators utilised technology to introduce problem-solving tasks and imaginative homework assignments, promoting the acquisition of subject-specific knowledge alongside the development of critical thinking skills and creative problem-solving abilities among students. The objective of Jacinto's (2023) study was for participants to engage in problem-solving activities using technology without the need for advanced mathematical knowledge, rather than focusing on specific curricular content instruction. The questionnaires assessed the extent of enjoyment participants derived from solving problems presented in each session, along with their perceived level of difficulty. The participants reported significant levels of enjoyment across all four evaluated sessions, with values ranging between 4.50 and 4.82. Hence, a plethora of diverse solutions and models were employed to facilitate the continuation of the teaching process (COI Step by step & proMENTE Social Studies, 2020).

The newly established online teaching framework in Bosnia and Herzegovina faced a spectrum of technological, pedagogical, and organizational challenges. Key issues encompasss:

1. **Inadequate technological infrastructure and facilities:** A large number of students and teachers in Bosnia and Herzegovina lack access to adequate technological equipment and high-speed internet connections. Teachers frequently rely on their personal resources for work-related purposes.
2. **Lack of familiarity with teaching technologies and tools:** There exists a notable dearth of awareness and knowledge concerning the implementation of modern teaching technologies and tools among educators.

3. **Casual attitude towards learning among students:** A considerable number of students exhibit nonchalant attitudes towards learning, contributing to a lack of class accountability due to the geographical dispersion of students.

4. **Challenge of motivating and engaging students in online teaching:** The absence of personal interaction between teachers and students poses a significant challenge to maintaining student motivation and engagement in the online learning process.

5. **Pedagogical difficulties encountered by teachers:** Teachers encounter substantial pedagogical challenges, including the adaptation of their curriculum to the online environment, synchronization of online activities, and the effective utilization of various educational technologies.

The Ministry of Education, Science and Youth in Sarajevo Canton has released several documents tailored for teachers in response to the ongoing pandemic, with a particular emphasis on facilitating online teaching. These resources encompass guidelines for conducting online teaching, a methodology for the implementation of digital classes, instructions for organizing and executing educational tasks in both primary and secondary schools. Additionally, a comprehensive manual has been developed through collaboration between the Working Group for Support and Supervision of Online Teaching Practice in Canton Sarajevo and the Team for Support and Supervision of Digital Content Creation for Online Teaching in Primary Schools. (Koro, 2022)

In addition to the previously mentioned challenges, the instruction of mathematics faced the additional difficulty of elucidating abstract mathematical concepts, which are inherently challenging for children to grasp, even in a traditional classroom setting, let alone in a virtual environment. Nevertheless, the educators succeeded in maintaining student engagement, facilitating communication, and upholding the integrity of the education system. The shift from classroom to online teaching necessitated the enhancement of teachers' digital competencies and the development of online resources in the Bosnian language to enhance the effectiveness of online instruction. The study of Jacinto (2023) explores the Tecn@Mat Club, an after-school online program designed to augment the digital mathematics problem-solving skills of middle-grade students during the pandemic. The club aimed to promote mathematical problem-solving for all students, irrespective of their academic performance in the subject. Its focus on inclusivity distinguishes it from programs that single out only exceptionally talented or gifted students. The chosen tasks were designed to offer a brief yet diverse technological experience, using tools such as GeoGebra. In April 2022, the authors Gurrea et al. (2023) arranged a series of webinars under the title "Making Math Fun and Engaging through the

Use of Modern Technology: Capacity Building for Math Teachers". The webinars, conducted via the Zoom platform, were designed to enhance the knowledge and skills of mathematics teachers in utilizing online applications to make the online teaching of mathematics more enjoyable and engaging. Meanwhile, the Tecn@Mat Club, as detailed by Jacinto (2023), comprised of five synchronous sessions held via a videoconferencing tool, bolstered by free, accessible technological aids to promote collaboration and communication among participants. The technological tools provided further support for techno mathematical problem-solving in the face of challenges presented in each session. Examples of such tools include Zoom, various websites, Google Drive, Docs, and Sheets, as well as GeoGebra, spreadsheets, text and video editors (Jacinto 2023).

PREVIOUS RESEARCH

In June 2020, UNICEF and UNESCO jointly conducted a *Rapid Assessment of the Situation and Needs - Education in Bosnia and Herzegovina (Phase II)* to gain insight into the prevailing conditions and requirements in the education sector during the COVID-19 pandemic (UNICEF & UNESCO, 2020). The study found that a total of 1695 children had discontinued their primary school education, with 445 of these children located in the Zenica-Doboj Canton. Primary school students experienced more pronounces challenges, as highlighted by Rizai et al. (2023). Specifically, there were 393 children who did not attend secondary school, including 105 in the ZDK. Constraints to online education included a shortage of ICT equipment, limited internet access, the necessity for device-sharing among family members, and a lack of appropriate learning space. To address these challenges, various software and communication tools were employed in the teaching approach, and in certain cases, dedicated web platforms were designed and utilized. Schools commonly used the Viber platform for communication, message exchange, and video calls, whereas more sophisticated tools like Google Classroom and MS Teams were used to a lesser extent. Gurrea et al. (2023) demonstrated that Google Apps, including Google Docs, Slides, Sheets, Drive, and Classroom, were the most well-known online tools. These tools received an average rating of 3.37, indicating that teachers regarded themselves as "competent" in their use. However, the issue of digital access in the context of online learning may exacerbate inequality and widen the gap between students, potentially hindering the effectiveness of education, particularly for those from lower socioeconomic backgrounds. The impact of the pandemic on education is multifaceted and uncertain, with not all consequences necessarily negative (Tonković et al., 2022).

In 2021, Lathifah and Maryanti conducted a study to investigate whether Edugames, an online math game, could serve as a fundamental teaching tool amid the Covid-19 pandemic's online learning process. An Edugame is a video game with educational content intended to immerse players in a learning situation. The incorporation of educational games into digital learning platforms during the COVID-19 pandemic sparked a revolutionary era, significantly enriching lessons. This was achieved by providing students with immersive, interactive, and enjoyable educational experiences, resulting in a markedly improved comprehension and retention of material. Barnová et al. (2022) examined the initial results of their study, where participants were surveyed on their perceived quality of online education during the academic year 2020/2021. According to the findings, 50 participants (47.16%) reported an improvement in the quality of their lessons. However, it was surprising to note that an unexpectedly high percentage of students- 22 (20.75%)- reported a decline in quality (Barnová et al., 2022). Agus and La Hadi (2020) conducted a study on student assessments of online lectures during the Covid-19 pandemic. The data strongly suggests that online lectures during the pandemic were ineffective due to the lack of careful preparation. Approximately 1.3% of students reported the lectures to be highly effective, while 12% found them to be moderately effective. The majority, around 78.7%, considered them less effective (Agus and La Hadi, 2020). The COVID-19 pandemic has highlighted the significance of diverse distance learning techniques in facilitating educational advancement. The use of synchronous and asynchronous approaches, coupled with innovative instructional strategies and digital tools, constitute a flexible and responsive learning ecosystem that can circumvent physical limitations. Notably, in certain schools, online teaching was coupled with television instruction, primarily targeted towards younger students in the early primary school grades. The survey revealed that a considerable number of teachers engaged in professional development to acquire the requisite skills for effective online instruction. The conclusion of the study underscores the necessity for additional development of tools and networks to enhance online teaching, along with the need for robust mechanisms to monitor and ensure the quality of online teaching. Acknowledging certain aspects of online schooling during the Covid-19 pandemic, Koro (2022) presents several results and describes the following: the use of technology in homes for monitoring online classes, including the technical challenges and spatial prerequisites for this purpose; the complexity and extent of tasks completed by students during such classes; the methods employed for evaluating these tasks; the knowledge acquired by students; and the support provided by teachers and schools to students and parents during online classes. These aspects collectively underscore the quality of digital

competency among teachers. Additionally, it is crucial to weigh the advantages and disadvantages of conducting online classes during a pandemic. Blagojević (2022) addressed this by posing a question in their survey: *"What is the most suitable method for distance learning?"*. Among the 295 participants, 54.9% preferred being taught using Microsoft Teams, 24.8% chose video conferences, and 16.8% reported Yammer as their preferred method. The popularity of Microsoft Teams, the most preferred choice, might be attributed to its widespread use among many students. Blagojević's (2022) study indicated that only 10.3% of participants reported an improvement in mathematics learning through online classes, with 4.3% fully agreeing and 6% partially agreeing. By contrast, around 48.1% stated that distance learning made taking exams easier, with 26.3% fully agreeing and 21.8% partially agreeing. The effective administration of assessments and the evaluation of student performance in online education necessitated both the functional expertise of teachers in utilizing digital platforms and the digital literacy and adaptability of students. This collaboration between educators and learners in the digital realm facilitated the organization of exams and tests, leading to the development of modern pedagogical practices in online education. An analysis of consultative teaching implementation through information and communication technologies in primary and secondary schools within the Zenica-Doboj Canton, conducted in August 2020, reveals that possession of ICT equipment, internet access, and functional knowledge of online platforms/applications by students and teachers significantly influenced the quality of organization and implementation of consultative classes (Ministry of Education, Science, Culture, and Sport; Pedagogical Institute Zenica, 2020). The teachers reportedly adapted the teaching material for online classes, but the students deemed it challenging and time-consuming. Moreover, concerns have been raised about the increase in mobile phone usage, particularly among juveniles. As per the findings and discussions presented by Rizai et al. (2023), online learning exhibits both positive and negative effects. However, opinions vary, with some asserting that it should not be mandatory. Some correspondents argue that online learning is necessary and unavoidable due to circumstances that compel education to continue (Rizai et al., 2023).

COI Step by Step and proMENTE Social Studies (2020), with the support of the FOD BiH, conducted a survey during the period of April to May 2020 among parents, students, and teachers to gather information on their experiences with online schooling. Their conclusions were categorized into five areas: accessibility and non-discrimination, online teaching models including communication tools, duration and organization, teacher and family cooperation, and maintenance of mental and physical health during the teaching process. The debate over

whether traditional or virtual classes provide a more effective form of education has been extensive. It is crucial to acknowledge that the efficacy of both formats can fluctuate depending on a range of factors, such as the subject matter, educational objectives, student inclinations, and technological resources. Therefore, selecting between face-to-face and virtual courses frequently relies on the particular context and aims of the educational encounter, rather than a universal remedy. The survey results from Pulungan et al. (2022) also reveal that the platform teachers employ to teach mathematics online is inadequate for providing a competent explanation. Additionally, only 0.5% of students had access to a private tutor during the pandemic. These data uncover the challenges presented by online-based math learning and warrant attention to improve students' outcomes. Students struggle to comprehend the material, as revealed in a study by Pulungan et al. (2022), where 86.4% of participants indicated a preference for offline math learning over online methods. Regarding the third survey question posed by Blagojević (2022), which asked *"What was the most effective method of learning mathematics through distance education?"*, most participants (34.6%) selected "a combination of methods". Furthermore, 155 pupils (28.9%) specifically identified videoconferences as their preferred mode of instruction, whilst 50 respondents (9.3%) reported obtaining assistance from parents or friends. Recommendations from the study suggest that both teachers and students should undergo continuous training to effectively use various tools and platforms (COI Step by step & proMENTE Social Studies, 2020). Technical support should be ensured, and content and materials should be adapted for online classes. The study emphasizes the importance of proving continuous training to teachers and students for effective utilization of various tools and platforms (COI Step by step & proMENTE Social Studies, 2020).

Digital tools such as Google Classroom, YouTube, Zoom, WhatsApp, Viber, and Microsoft Teams are digital tools have been utilized in the context of online teaching, each serving distinct purposes and features. When selecting a tool for online education, several considerations should be taken into account. These may include the institution's existing technology infrastructure, the preference for synchronous or asynchronous communication, and the preferences of educators and students. Google Classroom is ideal for organized course management, while YouTube excels in providing additional multimedia content. Zoom stands out for live virtual classes and meetings, while WhatsApp and Viber offer speedy communication. Microsoft Teams is a thorough platform suited to organizations with a pre-existing Microsoft ecosystem. Ultimately, the efficacy of these tools in online education hinges on their alignment with the precise objectives and standards of the relevant educational

establishment or individual instructors. Agus and La Hadi's (2020) findings indicate that WhatsApp is the primary and most commonly used platform in lectures (65.3%), followed by Google Classroom (18.7%), YouTube (2.7%), e-mail (2.7%), Facebook (1.3%), and a combination of various media (9.3%). Notably, Zoom is reported as the least preferred platform. The study employed a descriptive survey design and was conducted on 75 selected semester II-VI maths students.

The recommendations stress the importance continuous training for both teachers and students to effectively utilize various tools and platforms (COI Step by step & proMENTE Social Studies, 2020). To enhance children's learning abilities and develop higher-order thinking skills, it is crucial to develop bespoke digital platforms and high-quality online content and materials. This allows children to use these resources independently and actively engage with the material, moving beyond passive consumption (COI Step by step & proMENTE Social Studies, 2020). Blagojević (2022) found that primary school students rated their motivation in online classes the highest (3.13), while secondary school students had the lowest rating (2.55). Regarding the comprehension of covered material, college students achieved the highest score (3.75), while their high school peers reported the lowest level of understanding (2.69). Motivating students and conscientiously preparing teaching materials are essential components for successful online instruction. Encouraging and maintaining students' engagement in the digital environment is crucial for promoting their active participation and overall academic achievements. The effective development and organization of educational resources, specifically designed for online use, are fundamental for delivering informative and engaging content. This is vital for promoting accessibility and clarity, leading to an enriching and pervasive online learning experience. Omerdić et al. (2021) assert that instructors primarly utilize their own materials in conducting virtual classes. Their study reveals that online instruction demands increased time investment in both preparation and execution of activities compared to face-to-face instruction. Consequently, the workload of both teachers and pupils rises in online teaching. The authors note that the alterations induced by the COVID-19 pandemic in education brought to light one of education's objectives, specifically, lifelong learning. Ponce et al.'s (2023) study highlights dimensions with the highest means as *"motivation for learning"* (4.32), *"computer/internet self-efficacy"* (4.07), and *"self-directed learning"* (4.01). It is worth noting that pre-service teachers demonstrate motivation, confidence, and proficiency in internet and computer system operations. Mehić and Hadžić (2020) claim that the analysis of online teaching revealed the need to adapt teaching staff to modern teaching processes, which now include both traditional school

education and distance learning. As a result, teacher training programs should place greater emphasis on IT tools and technological advancements in order to ensure satisfactory implementation. The adjustment of teachers to the constantly changing world of online education is crucial in determining the quality of mathematics education. In today's technologically advanced era, educators need to have an extensive comprehension of mathematical principles while being proficient in utilizing online teaching strategies and technology to promote student involvement and empowerment. This versatility includes designing and delivering efficient online lessons, using interactive and multimedia resources, offering prompt feedback, and cultivating a collaborative and inclusive online learning community. By adopting these adjustments, educators can enrich the standard of mathematics education and guarantee that learners benefit from extensive and enriching knowledge in accordance with current educational requirements. Many study programs globally offer IT-related courses for teaching, and the Study Program for Mathematics and Computer Science at the Faculty of Philosophy in Zenica is no exception to this trend. In terms of teaching quality, college students gave the highest rating of 3.6, whereas high school students rated it the lowest at 3.22. Concerning the quality of mathematics learning during distance education, primary school students were content with a grade of 3.18, while college students were most pleased with a grade of 2.46. (Blagojević, 2022)

OBJECTIVE OF THE RESEARCH

The aim of this research is to provide insights into the experiences of mathematics teachers regarding online teaching and to provide guidelines for enhancing online mathematics education in the Zenica-Doboj Canton. This objective is pursued through several research questions:

- Examine the experiences of teachers in schools in the Zenica-Doboj Canton regarding online mathematics lessons;
- Gain an understanding of how teachers have navigated and coped with the challenges of online learning and teaching, and assess whether there is a demand for online resources in mathematics, especially in the native language, to complement the National Curriculum Program (NPP);
- Identify the problems and challenges associated with online teaching of mathematics, along with an exploration of the advantages and disadvantages of this instructional method.

Koro (2022) suggests that Mathematics should be considered as one of the most frequently sought subjects for academic assistance due to its inherent complexity. As concluded by Lathifah and Maryanti (2021), online math games can play a crucial role in elementary arithmetic learning for primary school students during the pandemic. The research indicates that the percentage of students scoring above 70 has increased from 40% to 50%. Although the improvement may not be statistically significant, possibly due to the brief research duration and varying individual learning paces, learning fundamental arithmetic through online math games remains highly effective in enhancing students' basic arithmetic skills (Lathifah & Maryanti, 2021).

RESEARCH METHODOLOGY

The study population comprised mathematics educators employed in both primary and secondary schools within the Zenica-Doboj Canton. A total of N=58 individuals participated in the research, with the majority (53.4%) working in *primary schools*, 34.5% in *secondary schools*, and 12.1% having roles in *both levels*. The survey, conducted in June 2022, utilized a questionnaire containing closed, open, and combined inquiries. Participants completed the questionnaire online using Google Forms on a voluntary and anonymous basis.

RESEARCH RESULTS WITH DISCUSSION

The primary research objective was to explore the implementation of online mathematics lessons as perceived by teachers in schools within the Zenica-Doboj County. The research was carried out during 2022, on a sample of 58 respondents. As for the inquiry on satisfaction with students' work and performance in online mathematics lessons (*"Are you satisfied with your students' work and performance in online mathematics lessons?"),* the majority of teachers (43 or 74.1%) expressed a *neutral stance*, while 12 (20.7%) stated *dissatisfacion*. Only 3 teachers (5.2%) claimed *satisfaction* with their students' work and performance. Teachers provided similar responses when asked if students solved tasks independently during online lessons. Out of the 58 respondents, 42 teachers (72.4%) believe students partially solved tasks independently, 14 (24.1%) believe students did not work independently, and only 2 teachers (3.4%) believe students worked independently and solved tasks. Satisfaction with academic performance in online lessons is closely linked to the conditions that enable students to effectively engage in digital learning. This conditions encompass reliable internet access, appropriate devices, and a supportive learning environment in their homes. Optimizing these factors significantly enhances students' overall

online learning experiences and their capability to effectively interact with educational content. Koro (2022) argues that it is a fundamental responsibility of educational systems to ensure the inviolable rights of all children, particularly with respect to access to education and freedom from discrimination. These rights were significantly jeopardized during the pandemic, as students often lacked the necessary tools to participate in the virtual classroom. Participants in the study noted that families commonly possessed only one device, impeding consistent participation in online classes due to parental work commitments and other children's school obligations.

Table 1: Satisfaction with students and their independence at work

Correlation

		satisfaction	independence
satisfaction	Pearson Correlation	1	.453 **
	Sig. (2-tailed)		.000
	N	58	58
independence	Pearson Correlation	.453 **	1
	Sig. (2-tailed)	.000	
	N	58	58

**. Correlation is significant at the 0.01 level (2-tailed).

Barnová et al. (2022) found that despite some students' complaints about their teachers' work, a large majority (86-79.9%) observed some level of *progress* in the subject area. These findings suggest that remote learning has now become an intrinsic part of students' educational journey and is no longer considered a novelty.

Calculating the correlation between two variables in SPSS showed a statistically significant positive correlation between *teachers' opinion about students' independence in solving tasks during online classes* and *satisfaction with students' work and achievements during online classes* (Pearson's correlation coefficient = 0.453, $p < 0.01$), shown in Table 1.

This suggests that teachers who believe that students were more independent in solving tasks tend to be more satisfied with students' work and performance during online classes, and vice versa - teachers who believe that students were less independent tend to be less satisfied with their work. The second research question focused on teachers' experiences of online mathematics teaching and the necessity for online resources in their native language.

A significant challenge that these educators encountered was the requirement for more preparation time for online lessons than for usual classes, with 87.9% of teachers responding that they required additional time to prepare. To investigate further, educators were questioned about Bosnian language resources that could potentially aid the implementation of online mathematical sessions. 67.2% of respondents indicated unfavourable resource availability, while 10.3% were uncertain and 22.4% expressed satisfaction with the available resources. The impact of teacher experience in delivering online lessons on the effectiveness of remote education is significant, with experienced educators typically better equipped to navigate digital platforms, engage students, and adapt to evolving online teaching strategies. Concurrently, the COVID-19 pandemic-induced remote learning measures have posed distinctive obstacles to the student body, necessitating alterations to their study habits and time management, impacting their academic experiences. Blagojević's (2022) study of 7th-grade students from 23 elementary schools in Zagreb, Croatia, found that their experience with distance learning resulted in an average score of 3.14, and their overall attitude was neutral. The respondents neither expressed satisfaction nor dissatisfaction. Blagojević (2022) also reported that students prefer aspects of classroom learning, especially the ability to understand the material. Additionally, a significant proportion of respondents (71%) believe that distance learning is associated with an increased workload characterized by numerous tasks to be completed within a limited timeframe. Comparing the responses to the two questions, a statistically significant negative correlation is evident between the variable "more time for preparation" and the variable "having sufficient resources", with a Pearson's correlation coefficient of -0.279 and a significance level of $p < 0.05$.

This negative correlation suggests that teachers who report needing more time for preparation for online lessons perceive insufficient resources in the Bosnian language to support the execution of online mathematics lessons. Conversely, educators who required less preparation time believe adequate resources exist in the Bosnian language.

Table 2: Time needed to prepare compared to resources in Bosnian

Correlation

		more_time_to_prepare	enough_resources
more_time_to_prepare	Pearson Correlation	1	-.279 *

	Sig. (2-tailed)		.034
	N	58	58
enough_resources	Pearson Correlation	-.279 *	1
	Sig. (2-tailed)	.034	
	N	58	58

*. Correlation is significant at the 0.05 level (2-tailed).

Moreover, based on the results of the survey, it seems that the majority of mathematics teachers (82.8%) believe that *online teaching would be of better quality if there were online resources available that followed the curriculum*. A small percentage of teachers (5.2%) *disagreed* with this statement, while 12.1% responded with *"I don't know"*.

To address the third research query, the survey included an open-ended question asking educators to declare the benefits and downsides of mathematics education via the internet as they see them. Some of the advantages highlighted by teachers are:

- Greater availability and accessibility of digital content;
- Students are more independent in their learning and progress at their own pace;
- It is a more interesting way of working for the students;
- Students who were unable to attend school for any reason were now able to do so;
- This allows the learner to re-watch the part of the video that has not been understood.

Some of the disadvantages mentioned by teachers include:

- Impossibility to control students' independence during knowledge tests;
- Insufficient verbal communication with students;
- Students lacking digital skills;
- Lack of digital skills among teachers;
- Misuse of online lessons by students and parents;
- Students' lack of interest in participating in the work.

These insights provide a nuanced view of the challenges and benefits associated with online mathematics education from the perspective of teachers.

CONCLUSION

The challenges and benefits associated with online mathematics education, as highlighted by teachers, are reflective of the broader landscape of virtual learning. Teachers in online math education face several challenges, including limited internet and technological access, to the and tools, reduced teacher-student interaction, distractions impacting concentration, and the need to adapt teaching methods to an online environment. Overcoming these challenges requires additional time, training, and assistance to ensure the quality and efficiency of the teaching process.

On the positive side, online mathematics education offers flexibility in terms of time and space, the ability to revisit material, personalized teaching approaches, and the utilization of various digital tools and resources. Educators emphasize the importance of mastering digital tools alongside mathematical problem-solving skills.

The case study presented by Bikić et al. (2021) in the Zenica-Doboj Canton illustrates successful outcomes in high school students' online learning through mathematical modelling during the COVID-19 pandemic. Engaging students in learning through mathematical modelling has the potential to expand their horizons, increase their motivation and curiosity for research, improve problem-solving skills, and enhance their critical thinking (Bikić et al., 2021).

Ponce et al. (2023) assert that achieving success in the current learning paradigm necessitates the formulation of strategies by educational institutions, administrators, and teachers to augment students' intrinsic, comprehensive, and extrinsic motivation for knowledge acquisition. The significance of enhancing the information literacy proficiencies of both students and instructors is underscored to navigate the challenges of virtual learning effectively and leverage the benefits of technology. Moreover, the enhancement of online mathematics instruction is underscored by the pivotal role played by tailored pedagogical materials and resources. These resources, meticulously prepared by educational professionals, are designed to complement the curriculum effectively. Numerous advantages associated with such resources include:

- Facilitating and expediting lesson preparation,
- Allowing students to progress at their own pace, revisiting material as necessary,
- Providing access to materials at any time,
- Enhancing accessibility of mathematics education for students,
- Fostering the development of IT skills and competence.

While it is a widely accepted view among educators, families, and learners that exclusively relying on online teaching is not recommended, the blended learning approach demands improvement. Implementing measures to enhance the standard of digital mathematics teaching and effectively plan for the future is crucial. These measures include:

- **Making online sources readily available:** Creating online resources and materials that students can access at any time, developed using modern methodologies and instructional principles, and utilized in a blended learning approach.
- **Training for Teachers and Students:** Providing additional training for teachers and students on the effective use of digital tools in mathematics education.
- **Technical Infrastructure:** Ensuring efficient technical infrastructure, alongside internet access and appropriate technological tools for all teachers and students, to achieve balance and equity in accessing online teaching.

Implementing these measures can elevate the quality of online mathematics instruction in primary and secondary schools, equipping educators to navigate similar scenarios in the future. Continuous research and evaluation of online mathematics teaching practices are crucial to identify emerging challenges and opportunities, tailoring teaching strategies accordingly. This ongoing crisis presents a unique opportunity to reassess instructional approaches in Bosnia and Herzegovina. The insights gained from the COVID-19 pandemic can inform improvements, innovations, and the development of an integrated learning model to strengthen the resilience of the education sector (Promocija pismenosti i kvalitetnih ishoda učenja kroz unapređenje online i kombinovanog obrazovanja, 2021). COI Step by Step and proMENTE Social Studies (2020) present teachers' suggestions for amending the NPP, including decreasing the amount of classes for disciplines like language and mathematics, organizing more interactive classes, limiting student-teacher contact hours, reducing reading material volume in the Bosnian language, decreasing written tasks, promoting quizzes, and encouraging students to explore particular topics.

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IZAZOVI I PERSPEKTIVE U ONLINE NASTAVI MATEMATIKE TOKOM PANDEMIJE COVID-19 U ZDK-u

Sažetak

Cilj ovog istraživanja bio je istražiti stavove nastavnika matematike prema obrazovanju na daljinu u osnovnim i srednjim školama Zeničko-dobojskog kantona tokom pandemije COVID-19. Istraživanje je imalo za cilj da prikupi stavove nastavnika, ukaže na prepreke i poteškoće na koje su nailazili, te procijene prednosti i nedostatke ovog pedagoškog pristupa. Nadalje, istraživanje je nastojalo utvrditi najefikasnije tehnike i resurse za održavanje onlajn časova matematike. Provedeno je online istraživanje 2022. godine među 58 nastavnika osnovnih i srednjih škola, kao i edukatora matematike u Zeničko-dobojskom kantonu, kako bi se ispitala online nastava matematike tokom pandemije COVID-19. Naknadna analiza podataka otkrila

je razne prepreke kao što su pitanja vezana za tehnologiju, dostupnost interneta i transfer znanja. Ipak, nastavnici su iskazali značajan nivo zadovoljstva u pogledu postignuća i napredovanja svojih učenika. Dodatno, utvrđeno je da su neophodni online resursi na bosanskom jeziku usklađeni sa nastavnim planom i programom.

Ključne riječi: *online nastava, matematika, pandemija, COVID-19*