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CHAPTER 16

COMPUTER SCIENCE TEACHERS' OPINIONS AND ATTITUDES TOWARD ONLINE TEACHING DURING THE COVID-19 PANDEMIC

Abstract: The COVID-19 pandemic has brought to the fore online teaching which is very different from previous classroom learning. This paper aimed to determine and compare opinions about the online teaching process in the Republic of Srpska (RS) during the first wave of the COVID-19 pandemic from the perspective of computer science teachers. The sample consisted of 128 teachers (68% female), of which 53.91% were primary school teachers. The results show that teachers achieve higher average scores in several essential aspects, primarily related to difficulties and needs during online classes. According to the teacher, the most prominent disadvantage of online classes is the need for more direct contact with students, while the greatest need in the future is to adapt the curriculum to the needs of online classes. The results show that computer science teachers in the RS were dissatisfied with online teaching during the pandemic. Thus, the perceived level of satisfaction of computer science teachers is moderately low, with a total dissatisfaction rate of 10%. From the obtained results, it is possible to conclude that it is necessary to make a step forward in terms of the further development of teacher competencies and resources for new professional challenges, as well as more valuable insights that one can directly use as lessons for an optimal approach to the online teaching process in possible other extraordinary circumstances.

Keywords: *advantages, difficulties, needs in the future, online teaching, pandemic, teachers*.

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INTRODUCTION

On March 12, 2020, the World Health Organization officially declared the COVID-19 pandemic (Shereen et al. 2020). In response to COVID-19, many countries have implemented social distancing measures and "lockdown" policies (Malizar et al., 2020). The pandemic affected almost all social spheres, from the decline of industry to the transformation of the educational system (Bakhmat, Babakina, & Belmaz 2021). From the traditional way of teaching in classrooms, we switched to online teaching and distance teaching. This type of teaching implies using an online learning platform, such as Office 365 tools, and other communication systems, such as e-mail addresses, social networks, and messaging services. Through this, teachers shared materials and instructions for work and sent students assignments and feedback ("Online Learning" 2020).

Several questions have arisen regarding the changes in the education system caused by the COVID-19 pandemic. How did teachers and students adapt to the new teaching modality? Was the teaching delivered quality, what are the advantages of the latest teaching modality, and what are the difficulties and shortcomings? What challenges did teachers and students face? Researchers Adnan & Anwar (2020), tried to find an answer to some of these questions state that online learning cannot be satisfactorily effective in underdeveloped countries, where most students cannot have unhindered access to the Internet for technical and financial reasons. The lack of "face-to-face" interaction with teachers and the absence of socialization in traditional classrooms are some of the main disadvantages of online classes identified by students.

Similarly, the results of research by Abdullah & Kauser (2023) show that the lack of technological resources and problems with the Internet connection predict poor school performance of students. The authors suggest that educational institutions undertake thorough preparations in case of similar crises to ensure a smooth online educational environment for students. On the same track, Fabayla (2023) points out that they face problems such as weak internet connection and financial difficulties, which is why the successful implementation of online learning requires a well-designed strategy and an active approach to supporting students in these spheres.

Many studies (Lai et al. 2020; Niemi & Kousa 2020; Zhu, Liu & Hong 2022) have observed trends of increased concern regarding academic achievement, as well as stress resulting from the increased amount of teaching tasks that students received, complex communication and reduced interaction and support.

Regarding the teacher's perspective, for example, in the Mailizar et al. (2020) study on the barriers and difficulties mathematics teachers face during online teaching, most respondents stated that the most significant barrier was at the student level. Namely, they believed students must gain the knowledge and skills to use

online learning applications. Moreover, most respondents report that their students lack access to devices and internet connectivity, essential prerequisites for online learning. Similarly, Bakhmat et al. (2021) identify the main difficulties during online teaching as low-quality internet connection, software and hardware, a decline in the quality of student work, and generally poor computer and IT competence. At the same time, the main advantages of online classes are time efficiency, mobility, precise work control, and individualization. Problems related to low IT competencies and technological unequipped, especially in families and countries of lower socioeconomic status, have been pointed out as one of the biggest obstacles in the context of implementing online classes during the COVID-19 pandemic (Ali 2020; Bakker & Wagner 2020; Jorgić & Marić 2020; Qazi et al. 2020).

In addition to technical difficulties, at the beginning of the COVID-19 pandemic, several socio-psychological factors were observed that could significantly affect the quality of online teaching for pupils and students, including family climate and relationships, increased possibility of distraction in the home environment, complex organization of time, reduced motivation and generally elevated stress and accompanying mental health problems (Huckins et al. 2020; Li et al. 2020; Mishra, Gupta & Shree 2020; Zhang, Wang et al. 2020).

Technological means have enabled the teaching process during the pandemic to take place in an online modality, and researchers have been tasked with examining the factors that influence such an educational process. Two distinct and indispensable groups of the teaching process are students, as the subjects to whom the process is directed, and teachers, as professionals who are in charge of implementing the educational process. In order to be able to comprehensively describe, document and understand the teaching process that took place in these unusual circumstances in the history of the school as an institution, it was necessary to collect information from teachers, especially computer science, to map their view of the complete process, including their experiences, perceived key factors, advantages, disadvantages and problems.

Bearing in mind the specifics of the school system in the RS (BiH), the novelty of the entire situation, and the short time frame within which it was necessary to switch to the online modality of teaching, we conducted this research in order to understand better some of the relevant experiences of online computer science teachers during the COVID pandemic, and the advantages, difficulties, and needs of teachers during online classes. Also, the teachers were asked to answer directly to a simple question, more precisely, to directly compare their opinion about online classes with regular classes before the pandemic (see Figure 1).

METHOD

We collected data from two convenient samples: teachers in primary school (N=70) and teachers in secondary school (N=58) from the territory of RS. We conducted the data collection phase in April 2020 on a sample of computer science professors (N=128), of which 68% were female respondents during the first wave of the pandemic when the education authorities had already wholly transferred the teaching process to the online modality. At the beginning of the online survey, one stated the general objectives of the research, a declaration on the anonymity of the collected data, and an indication that the data are used exclusively for scientific purposes. We also informed respondents that participation in the research is voluntary, and they can stop completing the online survey anytime.

The scale for examining the advantages, difficulties, and needs of teachers during online teaching was formed during the research. The first phase of the scale formation involved active monitoring of preliminary research findings from other educational systems (no findings from BiH territory were available then). Based on the analysis of this information, we identified the main themes. We formatted the corresponding items (Likert format), which in the original version had 28 items. However, after the reliability analyses and factor analyses, we reduced it to 19 items. The method of principal components with varimax rotation resulted in a factor solution with four principal components cumulatively explaining 54.01% of the variance of the examined phenomenon (see Table 1). We previously checked whether the correlation matrix is suitable for applying factor analysis. The Kaiser-Meyer-Olkin (KMO) indicator of sample adequacy is .821, and Bartlett's indicator for the statistical significance of the correlation matrix (χ^2 = 1347.270; sig.=.001) confirms the suitability of the data for factor analysis.

Table 1: Characteristic roots and percentages of explained variance after varimax rotation

Main components	Latent roots	Variance explained %	Variance explained cumulatively %
1	2.84	25.63	25.63
2	1.90	19.33	44.96
3	1.78	10.01	52.15
4	1.50	7.19	54.01

After the accomplished varimax rotation, the matrix of the factor structure was determined (see Table 2), whereby we named four factors as manifest variables (items) during the analysis and interpretation of individual components (factors), as follows: 1) advantages of online teaching, 2) difficulties in conducting online classes 3) shortcomings of online classes, and 4) teachers' needs in the future.

Table 2: Grouping of variables (attitudes) and factor loadings

Item	Component			
	1	2	3	4
The possibility of fast and efficient IT literacy.	0.66			
The possibility of carrying out the teaching process, availability and speed of information exchange.	0.64			
Increased activism and independence in the work of students according to school obligations.	0.58			
More free time for students.	0.52			
Reduced possibility of transmission of infection.	0.49			
Obtaining the support of educational institutions in the realization of classes.	0.43			
Internet connection problems.		0.80		
Burdened by numerous messages and questions from students		0.78		
Unclear instructions received from competent educational institutions.		0.69	0.41	
Difficulties in harmonizing working hours with the needs of household members.		0.67		
Preparing the material takes too much time.		0.61	0.51	
Technical problems and inadequate working conditions.		0.61	0.70	
Lack of social contacts.			0.66	
Problems in the process of acquiring and assessing students' knowledge.			0.64	
Inadequate attitude of students towards work (motivation, concentration, excuses).			0.58	
More training in the use of ICT				0.49
More methodical training for preparing online classes.				0.53
More training for students to use ICT				0.75
More adaptation of the curriculum to the needs of online classes.				0.62
Note. Extraction method: Principal Components Analysis; Rotation: Varimax with Kaiser normalization; Factor saturations below 0.40 are not entered in the table.				

RESULTS

Since the answers to the set of questions were highly intercorrelated, they were reduced to one latent factor called "Computer science teacher's experience of online teaching during the pandemic." 54.01% explained the usual variance of the tasks. The average value of this dimension was 3.86 (SD =0.78), i.e., significantly above the theoretical mean of 3 ($d=0.50$, $p<0.001$). It indicates a moderately high

level of computer science teachers' experience with online teaching during the COVID-19 pandemic (see Table 3). Presents the value of effect size for Cohen's d Family (Morgan, Leech, Gloeckner & Barrett 2004: 91); d greater than .50 can be described as significant", between .20 and .50 is "medium or typical" and less than .20 is "small or smaller than typical".

We examined teachers' attitudes toward certain relevant aspects of online teaching with a scale. The items were grouped into four subscales, and the scores on each scale indicate the expressiveness of the attitude in the range from 1 to 5 (see Table 3). The average values on the subscales indicate the dominant attitude of teachers about the difficulties in conducting online classes (M= 4.22; SD= 1.30). This attitude is illustrated best by the items *Burdened by numerous messages and questions from students* (M=4, 43; SD=0.56) and *Unclear instructions received from competent educational institutions* (M=3.87; SD=0.67). The community of teachers, along with all the difficulties caused by online teaching, also recognized the benefits of online teaching in the form of forced IT literacy and familiarization with digital tools (M=3.42; SD=1, 20). Additionally, one recognized the very speed and availability of information as advantages of this type of teaching, and the preventive effect of the spread of infection (M=3.38; SD=1.52).

Table 3: Computer science teacher's experience with online teaching

Areas	*M*	*SD*	*Skew*	*Kurt*	*Cohen's d*
Advantages of online classes	3.38	1.19	-0,47	0,32	.43
Difficulties in conducting online classes	4.22	1.30	-0,25	-0,37	.78
Disadvantages of online classes	3.82	1.52	-0,08	-0,22	.84
The needs of teachers in the future	4.02	1.12	-0,40	-0,40	.58

The opinion of teachers about online teaching compared to regular teaching before the pandemic was significantly below 3.00 (M=2.42; SD=2.19; d=0.68, $p<0.001$). That is, significantly below the limit for equal satisfaction with online and regular classes (see Figure 1 for individual percentages). On the graph, we can see the low level of teacher satisfaction (10%) in comparing online computer science classes with regular classes. The teacher's satisfaction was examined by asking: What describes your attitude towards online teaching compared to regular teaching? The teachers marked the degree of agreement on the scale (1 = indicated that online teaching is much worse than regular teaching; 3 = online teaching is the same quality as regular teaching, and 5 = online teaching is much better than regular teaching (Figure 1). Therefore, the observed level of teacher satisfaction with online teaching during the COVID-19 pandemic is moderately low, with an overall satisfaction rate of 10%.

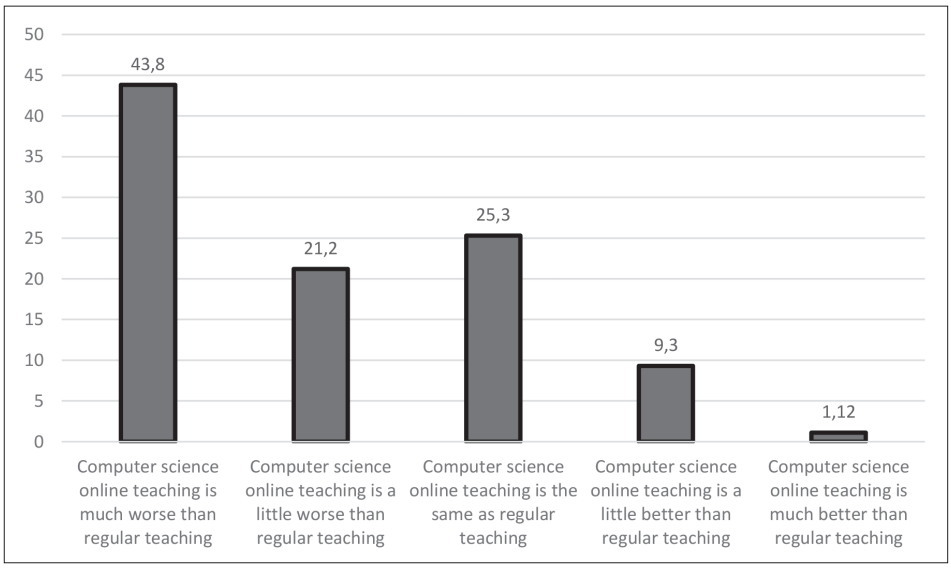

Figure 1: Satisfaction of computer science teachers with online teaching (%)

DISCUSSION

When it comes to the differences in teachers' opinions related to the advantages and difficulties of online computer science teaching in the RS during the first wave of the COVID-19 pandemic, there are specific recognizable differences between the teachers themselves. Overall, teachers assessed the problems of organization and implementation of the teaching process (burdened with numerous messages and questions from students, inconsistent instructions, and lack of support from competent institutions) as the most significant difficulties. The listed results raise the question of whether the students asked redundant and too frequent questions or whether the teacher's capacity, including the lack of adequate support from institutions, needed to be improved to deal with the educational needs of students during online classes. Indeed, this information raises the question of the quality of communication between teachers and students.

Teachers report a higher average level of advantages that the switch to online teaching brought with it, in terms of reduced possibility of transmission of infection and availability and exchange of information than in regular classes. However, the most important and the most pronounced item in terms of the intensity of the effect is undoubtedly related to the teacher's assessment of more significant preparation of teaching materials. While all other teachers' averages were in the general range of about 2-3.8 (on a scale of 1 to 5), this estimate was 4.32. It is a measured aspect of teacher dissatisfaction/anxiety that one can characterize as high. Similar

results were obtained in another available survey on the territory of Bosnia and Herzegovina, where more than half of the teachers stated that they work more than usual (Radetić Lovrić et al. 2022). Teachers from neighboring countries also encountered similar problems - for example, most secondary school teachers in Serbia stated that they have too many obligations, that is, too much preparation for teaching (Vasojević, Kirin & Vučetić 2021). The problem of the volume of tasks and the drop in student motivation due to task overload is present during the pandemic (Niemi & Kousa 2020). All these findings point to an inadequate organization of the teaching process in terms of the scope of tasks that one delegates to students. That segment needs to be revised and systematized so that we can react more adequately in similar situations in the future. From these findings, and supported by the teachers' suggestions for improving online teaching, we can finally conclude that it is necessary to introduce an organized type of teaching through applications that enable participant interaction while reducing the scope of tasks that students accomplish independently.

The most frequently mentioned lack of online teaching is the lack of physical contact between teachers and students, problems in the acquisition and assessment of the knowledge, and the lack of "adequate" involvement of students in the teaching process. Although the above-mentioned difficulties in various technical aspects are some of the shortcomings, it seems that the essence of the problem points to the inability of teachers to control and maintain the quality of the teaching process in a wholly digital environment that completely neutralizes the known classic pedagogical methods and tools. It is precisely the problems in the organization of the teaching process that are most often recognized as the main difficulty of work during the pandemic, as well as problems in the acquisition and assessment of knowledge, the lack of social interaction that accompanies online teaching, as well as reduced student motivation and various technical and organizational problems.

Additionally, the perceived level of satisfaction of teachers with online teaching during the pandemic is moderately low, with an overall dissatisfaction rate of 65%. However, most believe they need additional support and training in information literacy (more methodical training in using ICT). One also obtained dissatisfaction with online teaching in the research report by Radetić Lovrić et al. (2022), stating that about 90% of teachers had no experience in distance learning. Teachers have an extremely negative attitude about all the examined qualities of online teaching, with a particular emphasis on the difficulties in the transfer and acquisition of knowledge by students. Non-negligible problems of teachers with the availability of IT infrastructure, as well as students in rural areas, especially during the initial stage of the pandemic, have been recorded (Jorgić & Marić, 2020).

Likewise, Marić and Subotić (2022) compared the perspectives of high school students and determined that students evaluate the experience of online classes significantly less favorably than traditional (regular) classes. In other words, the

dominant trend in mutual comparisons of the experience of different teaching modalities is that online teaching is perceived as worse and inferior compared to traditional teaching, primarily in the context of the difficulty of conducting online teaching, the inability of students to express their knowledge, excessive preparation of teachers and generally lower effectiveness of teaching (with particular reference to reduced satisfaction).

CONCLUSION

The primary goal of this research was to examine how computer science teachers of primary and secondary schools from Republika Srpska experienced online teaching during the pandemic, compared to the traditional way of teaching, that is, to conduct a direct comparison between online teaching and regular teaching. It was possible to expect differences in average experiences, i.e., teacher satisfaction regarding regular and online classes during the pandemic. Considering the results of previous research and the fact that the modality of online teaching was implemented massively for the first time in the school system at a time when most people were in fear due to the pandemic situation, the general expectation is that the experience of online teaching will be the most negative, i.e. that difficulties and shortcomings, and the feeling of lack of knowledge during online classes to be the greatest, and satisfaction the least (Zuković, Stojadinović, & Slijepčević 2023). Certainly, all obtained effects are of low to moderate intensity.

An emergency, such as the COVID-19 pandemic, indicates the need to have and set up carefully designed didactic methodical materials, not only for the teaching of computer science but for all teaching subjects. Although online teaching had its advantages, such as pandemic prevention temporal and spatial flexibility, teachers pointed out many disadvantages, one of the biggest of which is the lack of social contacts. In order to bridge the gap of physical separation and avoid the feeling of isolation, there should be more and more frequent contact with students in real-time, and one could achieve the listed by organizing and using video communication tools and applications (Zoom, Google Meet, Google Classroom). In light of the frequency of use of platforms on which it is possible to achieve more interactive teaching, such proposals represent an objective criticism and an adequate proposal for improving the teaching process.

Furthermore, one of the challenges is that teachers had many more obligations and tasks compared to regular classes, where greater autonomy, independence, and student work were required. Research findings on the needs of teachers in the future imply not only the importance of the development of teacher competencies but also the broader context, the development of professional experience in methodical education, and teacher preparation in a digital environment.

One should highlight the periodization of the data collection phase as the main limitation of this research. Namely, a sample of teachers was included in the research during April, in the first half of the implementation of online classes. Therefore, the period in which the respondents filled out the survey is a potential factor in the occurrence of assessment differences.

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