Distance Learning in Difficult Conditions Due to the Pandemic State of Emergency

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Abstract

This paper represents the impact of new approaches to distance learning during the Covid-19 pandemic. The focus of the paper is on the quality of online teaching in relation to face-to-face teaching. The presented results represent documented empirical research that resulted from 2 years of working with a large group of students. The consequences of this way of everyday life have affected all spheres of business. The results indicate that the professors and students faced self-imposed obstacles, as well as pedagogical, technical, and financial or organizational obstacles. The results obtained are further verified by conducting relevant hypotheses tests.

Keywords: Education, Learning performance, Cloud technologies, Computers and information processing, Distance learning

1 Introduction

The world is currently going through the worst health crisis and the biggest economic shock that has befallen humanity since World War II. In March 2020, the whole world stopped. 90 million people are expected to be affected by extreme poverty. The long-term macroeconomic and microeconomic consequences of the impact of the pandemic cannot yet be seen. It is certain that during 2020 and 2021, the global economy will function with reduced capacities. The whole generation of today's students will feel the consequences of online teaching. Productivity will be greatly compromised due to lack of investment. The Republic Bureau of Statistics of the Republic of Serbia states that the World Economy has experienced a decline of more than -10% this year [1]. The current state of the economy is comparable only to the situation after the outbreak of the world economic crisis in 2009. After the outbreak of the pandemic, there was a decrease in demand for capital and consumer goods, which directly affected the slowdown in trade flows. A slight recovery in world trade is expected in 2021 (8%), followed by a moderate increase of about 4% in the coming years. In any case, the only country that has started a recovery is China. In this article we focus on impact on distance learning due to the pandemic state of emergency in the educational institutions. This way of learning has to some extent influenced the quality of teaching. Conditions created by the Covid-19 pandemic state of emergency provide opportunity for detailed quantitative and qualitative research in teleworking. This way of working offers the possibility of flexibility in different types of business. Compared to traditional teaching, online teaching offers a larger number of opportunities that positively affect the quality of work of employees. Employees are much freer and much more susceptible to changes in the work environment. The paper presents the impact of distance learning on the global economy. Testing of knowledge transfer in online teaching in comparison with face-to-face learning is presented. The results of the analysis show that online teaching has greatly improved the quality of knowledge transfer. On the other hand, with this analysis we have contributed to raising awareness of the importance of online teaching and the transition to blended learning. Qualitative and quantitative research led to the expected final test results. The current limit of this way of transferring knowledge is that practical exercises are not completely credible in relation to face-to-face learning.

2 State of Art

In relation to the biological history, our types of schools are the newest institutions. Hundreds of thousands of years before the advent of agriculture, we lived as hunter-gatherers. Children at this age have learned everything they need to know to become an adult through play and research. During this period, adults gave children unlimited freedom because they thought that these activities were a natural way for children to learn. The life of this period was understood as a game. The invention of agriculture in all parts of the world 10,000 years ago completely changed the way of life. For several thousand years after the advent of agriculture, the education of children was the biggest problem of creating good workers. As the industry progressed, a period of automation came that led to a decline in the need for labor. From this moment, the idea began to spread that childhood should be a time for learning, and modern schools were developed. This idea began to develop in Europe from the 16th to the 19th century and had many supporters. Education has never been stopped nor will it ever be stopped. Current methods of schooling are becoming less harsh, however the basic assumptions of learning have not changed. Children are

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still learning by doing, and those who acquire knowledge and master skills can use them as means of power.

The occurrence of an epidemic has a direct impact on development distance learning systems. Currently there are various types of software solutions for distance learning. Some of them are free and some of them are paid. Distance learning provides a whole new way of functioning for the end uses of the system. The most popular software is Microsoft Teams, Zoom, Google Meet, Cisco Webex, etc. Each company tries to position itself on the market as well as possible and gain the status of a leader. Compared to other platforms, Microsoft Teams platform stands out the most. The platform offers a number of features that facilitate everyday work of end users. In addition to use of video calling platforms offers the possibility of chat messages, meetings and video recording. In addition to the large number of possibilities offered by the Microsoft Teams platform, one very important stands out, and that is the integration with other testing software such as Moodle platform. Integration with the Moodle platform is the most popular and offers the possibility of automation with an existing system. In this way, we directly influence the acceleration of the creation of a new system for the needs of online teaching. With this integration, it is possible to add existing courses, grades and created assignments. By synchronizing these two platforms, we create one separate platform for distance learning. In this way, we have the opportunity to accelerate the process of transition to the online model of teaching. Pal states in his paper that perceived usability is one of the fundamental components of user experience (UX). It is very reasonable to assume that a good user experience will lead to a higher level of satisfaction, which in turn can guarantee the success of online education platforms. The Microsoft Teams platform is considered to be the most relevant in this segment [2].

Samantha in her work "Promoting the engagement of nursing students in online learning: Use of the student-generated question in a nursing leadership course" gives an explanation in which it comes to the fact that with the use of quality LMS system knowledge transfer in medical educational institutions is possible. It also provides practical examples of 179 students. However, when making the analysis, Samantha refers to the limits that significantly influenced the truthfulness of the obtained results. One of the biggest influences, according to Samantha assumption, is the lack of demographic information of students by the LMS system [3].

On the other hand, Misha explains that the liberalization, globalization and privatization of education have been greatly exacerbated by the emergence of the Covid-19 virus. The appearance of the virus directly affected the mobility and exchange of information of academic activities between countries during the blockade and lockdown. Misha notes that third world countries are most affected due to increased academic incompetence as well as lack of resources. Low and middle-income countries are particularly affected because they have already run out of finances. Looking at the long term, all countries must adapt to live and survive the current crisis. Developing online learning tools contributes to better adapting to this situation in each country. Governments must ensure a high-quality digital experience and influence the promotion of online learning to compensate for the difference in access to traditional teaching [4].

Aras and Ramesh cite in their paper the fact that more than 1.5 billion students of all ages worldwide are affected by the outbreak of the Covid-19 virus pandemic (UNESCO, UNICEF). The impact has affected more than 90% of active students worldwide, while school closures have expanded learning inequalities and disproportionately affected already vulnerable students worldwide (UNESCO). Given that education has been a basic human right since 1984, rigorous measures have been taken and solutions have been immediately created to maintain the current education system. However, this does not change the fact that there will certainly be unforeseen consequences after the equilibrium of the Covid-19 pandemic is established [5].

3 Global Impacts on Further Development

From a macroeconomic point of view, the impact of online teaching has had a major impact on the global economy. It is reflected primarily in the quality of teaching around the world. Certainly, this model of teaching has greatly reduced the use of physical equipment as well as classrooms in which teaching was organized. However, the impact of this model is greatly emphasized in the increase in unemployment in all spheres of business. The global economic trend is reflected in finding ways to do business with a reduced number of contacts between employees. This directly reduces the potential for Covid-19 virus infection [6-8].

Based on the information obtained by the Republic Bureau of Statistics, it predicts that the world economy will have a contraction of -4.4% in 2020, and then a growth of 5.2% in 2021. Certainly, this forecast is much more optimistic than the one obtained in June 2020, when a decline of 4.9% in 2020 and then a growth of 5.4% in 2021 is projected. The pandemic has affected the world's economies differently, with some we can see relative stability, provided by government measures and financial assistance to the population (China, USA, EU), while others have significantly worse results (India, Mexico, Korea, Philippines), measures, intensity and prevalence of viruses, declining exports, etc. At the end of the previous year, the global economy was affected by the consequences of the psychological crisis in the middle of the third wave of the Covid-19 virus epidemic. The decline is most visible in the areas of tourism and hospitality, scientific and administrative services, arts and recreation. The impact on educational institutions is significantly smaller compared to other areas of business [9-11].

The online transition has affected the entire world's population.

4 Data and Empirical Strategy

All students with prior computer knowledge have created a very positive attitude regarding distance learning [12]. Their attitude was mostly influenced by the use of modern technologies and the improvement of current computer knowledge. It is important to note that this attitude is not

optimistic in all spheres of education [13]. One of the spheres of education that was affected by the outbreak of the Covid-19 virus epidemic and the implementation of online teaching is the medical sphere of education [14]. A great negative impact is visible in the transfer of practical knowledge processed in the exercises from the subject [15]. The main disadvantage of holding exercises through an online work model is that online teaching cannot sufficiently simulate a realistic practical environment. The main disadvantage of holding exercises through an online work model is that online teaching cannot sufficiently simulate a realistic practical environment. In order for testing to be possible, it was primarily necessary to check the quality of the implemented system. All external factors that affect the quality of knowledge transfer online are considered due to their degradation of the system. An important item that was considered when testing the system is that the quality of the Internet connection is not uniform for all students and professors. The quality of the Internet connection is affected by the package purchased from the provider as well as the type of Internet connection.

In this part of the paper, we will describe a positive (descriptive) analysis that describes and explains economic phenomena based on scientific research. We will take the initial assumption which represents the total number of university students. The total number of students is ~7000. All 7,000 students were assigned to teams on the Microsoft Teams platform. In addition to students, access to the platform is provided to about 300 lecturers in various groups within the Faculty Information System and within the Microsoft Office 365 groups.

The analysis includes student interaction with lecturers as well as mutual interaction between students. The results achieved are shown in relation to the results expected by Microsoft for this region. The elements that will be compared are the types of communication, the quality of teaching, the way of transferring materials as well as the amount of mutual learning. Comparative testing of several online learning software was performed in comparison with the real results of face-to-face learning. To get realistic results, we used a large number of different methods of testing the quality of knowledge transfer. All these methods have contributed to the fact that the results can be viewed from multiple angles and give accurate values. Based on the qualitative and quantitative analysis, the expected results were obtained.

Based on testing of communication channels for access to the application, it was determined that more than 21.4% of students use various devices to access the platform. Various devices include mobile phones as well as desktop devices. If we assume that the number of students is a x symbol and the number of students accessing the application with multiple devices is a y symbol, we get the following solution (the calculation time range is 90 days):

X - number of students

Y - number of students accessing the application with multiple devices

NS - the percentage of students accessing through two different devices

$$NS = \frac{Y * 100}{X}. \tag{1}$$

$$NS = \frac{1309 * 100}{6107}. \tag{2}$$

$$NS = 21.4\%. \tag{3}$$

Based on the calculations, we conclude that online teaching is much more flexible compared to traditional teaching. Number of people using more than one mode to communicate over time is shown in Figure 1 (Figure 1. Number of people using more than one mode to communicate).

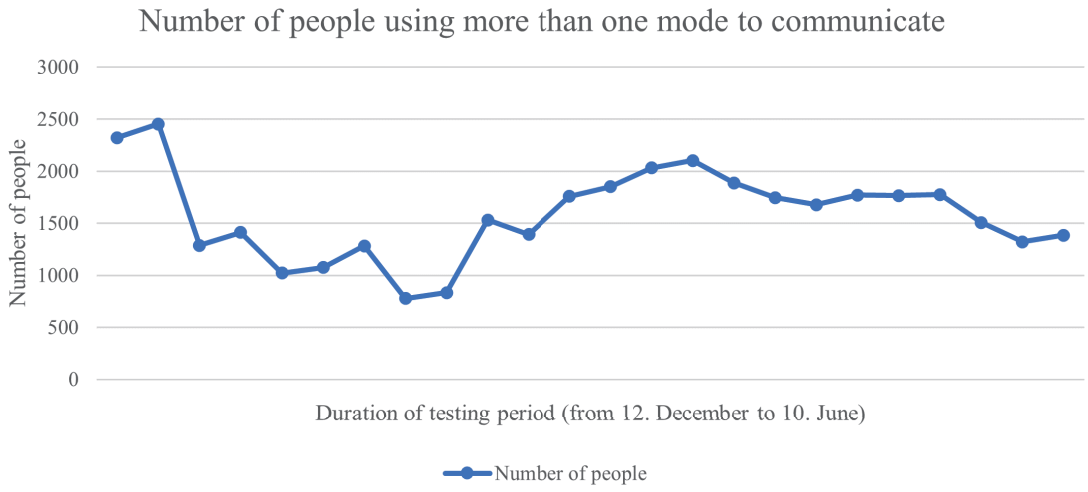

Figure 1. Number of people using more than one mode to communicate

One of the primary factors in terms of the quality of knowledge transferred is the impact of mutual communication between students during and after classes. Communication between students affects their commitment to achieving better results. Shared resources on the Microsoft Teams platform directly affect the teamwork of all students. This factor can be seen in several examples of resource usage on the Microsoft Office 365 platform. Based on the tests, we came to the following results, which led to 63.4% of students accessing shared resources uploaded by lecturers on a daily basis. If we define that the number of students tested x is equal to 5242, and the number of students accessing resources y is equal to 3327. With a simple calculation, we get information about the percentage of students who access shared resources.

X - number of students

Y - number of students accessing shared resources

NS - the percentage of students accessing shared resources

$$NS = \frac{Y * 100}{X}. \tag{4}$$

$$NS = \frac{3327 * 100}{5242}. \tag{5}$$

$$NS = 63.4\%. \tag{6}$$

Graphical representation of teamwork status between students is shown in Figure 2 (Figure 2. Graphical representation of Teamwork status between students).

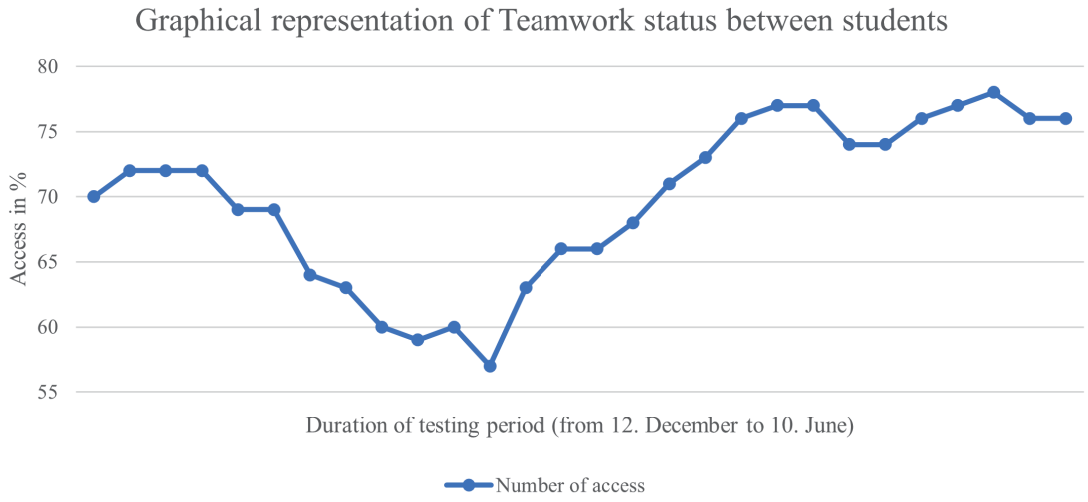

Figure 2. Graphical representation of Teamwork status between students

Undoubtedly, the largest number of people access resources directly by reading or creating them (77.6%) compared to those who access via the chat option. 95% of the shared resources of the entire platform are located on the Microsoft Teams application, which makes it the most popular application of the Microsoft Office 365 platform. The current number of unique shared resources is 871. Graphical representation of workspaces used in Microsoft Teams is shown in the Figure 3 (Figure 3. Graphical representation of workspaces used in Microsoft Teams).

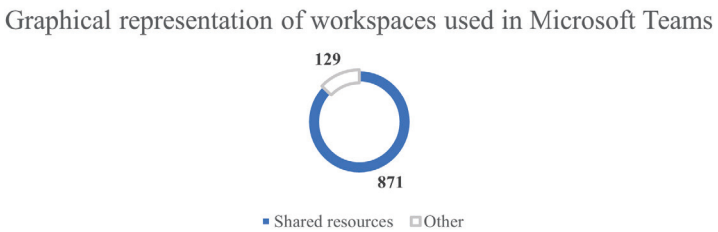

Figure 3. Graphical representation of workspaces used in Microsoft Teams

Graphical representation of number of readers, creators and collaborators in Microsoft Teams platform is shown in Figure 4 (Figure 4. Graphical representation of number of readers, creators and collaborators in Microsoft Teams platform).

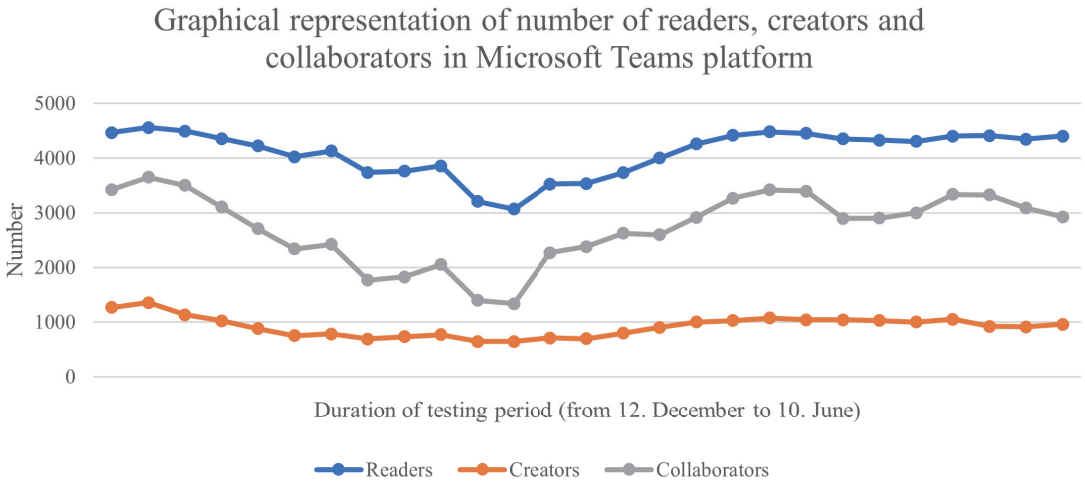

Figure 4. Graphical representation of number of readers, creators and collaborators in Microsoft Teams platform

After the communication and teamwork test, it was necessary to test the quality of the lectures held in the previous 90 days. If we start from the assumption that 1217 meetings were held, and we define them as a variable x and that out of all meetings 1038 meetings were held according to Microsoft standards and we define them with y we come to the following result.

X - number of meetings in the past 90 days

Y - number of meetings in organization which includes one or more meeting best practices

NS - the percentage of meetings in organization which includes one or more meeting best practices

$$NS = \frac{Y * 100}{X}. \tag{7}$$

$$NS = \frac{1038 * 100}{1217}. \tag{8}$$

$$NS = 85.2\%. \tag{9}$$

Graphical representation of meetings with best meeting practices in Microsoft Teams platform is shown in Figure 5 (Figure 5. Graphical representation of meetings with best meeting practices in Microsoft Teams platform).

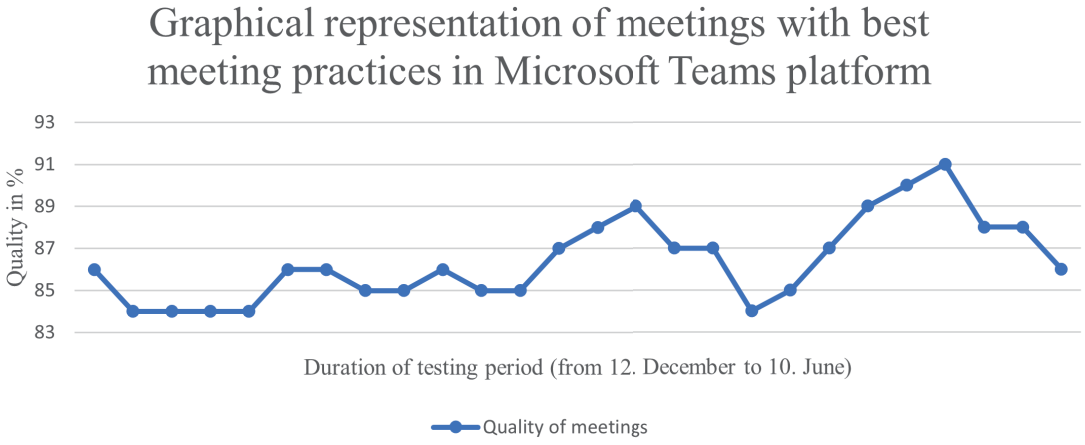

Figure 5. Graphical representation of meetings with best meeting practices in Microsoft Teams platform

A group of students in the 2019/2020 and 2020/2021 generation in the subject of Internet marketing was considered. The 2019/2020 generation listened to lectures in the classic way while the 2020/2021 group listened to lectures online using the Microsoft Teams platform. The example of 164 students was considered.

First of all, it is necessary to consider the number of years of students who have listened to classes online. Based on the number of years of students, an analysis of their computer knowledge can be performed. The number of years of students based on a certain range is shown in Table 1 (Table 1. Years of students (2019/2020 generation)).

Table 1. Years of students (2019/2020 generation)

20-24	24-30	30+
71	23	2

The number of years of students based on a certain range is shown in Table 2 (Table 2. Years of students (2020/2021 generation)).

Table 2. Years of students (2020/2021 generation))

20-24	24-30	30+
128	32	3

The analysis of the quality of work between classical and online teaching lasted 3 months. All students listened primarily to classical lessons (generation 2019/2020) and then online (generation 2020/2021). A comparative analysis of the quality of materials submitted by students of these two generations was performed. All results are based on several tests performed. The sections of the done tests are divided into practical tests and theoretical knowledge tests.

In addition to the age of the students, it was important to make a comparison of students based on gender. Based on the comparative analysis, we concluded that the gender of the students did not affect the difference in the quality of the tests performed by the students. An overview of student schedules by gender for the 2019/2020 and 2020/2021 generations is shown in Table 3 (Table 3. Overview of student schedules by gender).

Table 3. Overview of student schedules by gender

2019/2020 generation	
Male	53
Female	43
2020/2021 generation	
Male	59
Female	38

As already mentioned in the text, the generation of students in 2019/2020 listened to classes in the classical way. This part of the paper describes the achieved results of students who listened to classes in the classical way. The tests are divided into four categories of tests and one category that represents attendance at lectures and exercises. The minimum number of points for successfully passed exams I and II is 15 points, while the maximum number of possible points is 30. Theoretical and practical final exams do not have a minimum number of points for successful passing, while the maximum number of points in theory and practice is 15 per exam (in total 30). In order for a student to successfully pass the exam, it is necessary to achieve a minimum of 51 points on the I exam, II exam, theoretical and practical final exam. After the student in total achieves more than 51 points on the tests, the student is added points for the activity. Testing was done on 96 students. The information obtained on the basis of testing students who listened to classes in the classical way can be found in Table 4 (Table 4. Results obtained by conducting classes in the classical way).

Table 4. Results obtained by conducting classes in the classical way

	EXAMS (4 exams + activity)						
Calculations	Activity 10 pts	I exam 30 pts	II exam 30 pts	Theoretical final exam 15 pts	Practical final exam 15 pts	SUM 100 pts	TOTAL GRADE Max 10
Average	7.5	20.1	21.2	10.2	10.47	61.47	~ 7
Number of students	91	93	91	90	89	96	~ 7.75

The average grade of all students who listened to classes in the classical way is 7.75. This part of the paper presents the achieved results of students who listened to classes online through the Microsoft Teams platform. The testing was done on the basis of 97 students. Information obtained on the basis of testing students who listened to classes online can be found in Table 5 (Table 5. Results obtained by conducting classes online).

Table 5. Results obtained by conducting classes online

	Exams (4 exams + activity)						
Calculations	Activity 10 pts	I exam 30 pts	II exam 30 pts	Theoretical final exam 15 pts	Practical final exam 15 pts	SUM 100 pts	TOTAL GRADE Max 10
Average	7,75	19,98	21,46	10,48	11,91	71,58	~ 8
Number of students	78	94	93	81	49	97	~ 8,01

The average grade of all students who listened to classes online is 8.01. This means that based on a similar number of students, the average grade was better for students who listened to classes online. All student tests shown were done online.

A visual representation of the difference in the number of points achieved by two generations of students is shown in Figure 6 (Figure 6. Visual representation of the difference in the number of points achieved by two generations of students).

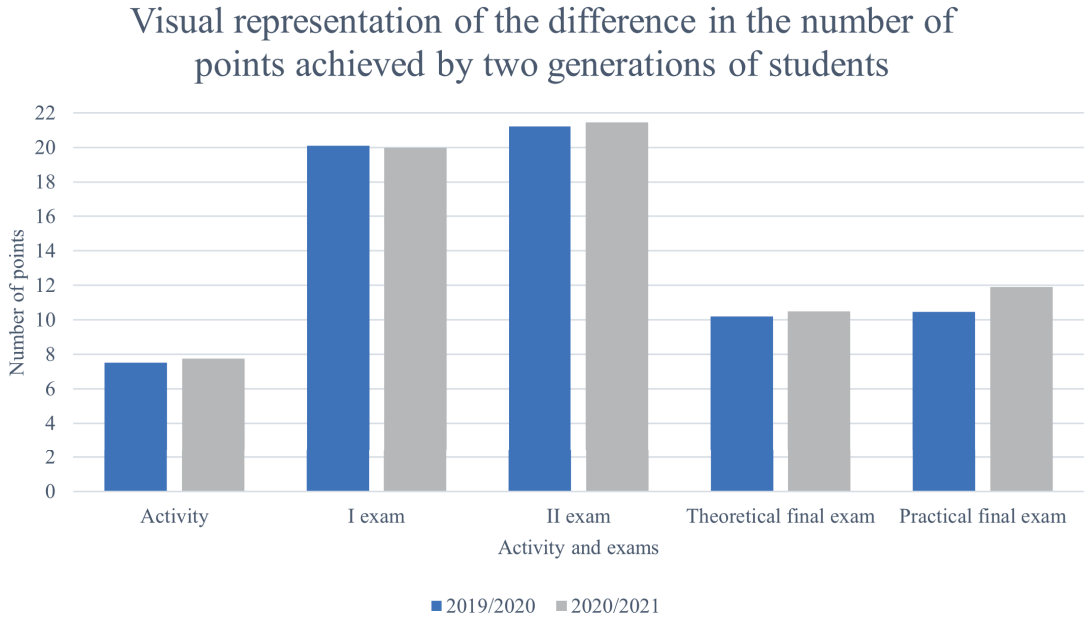

Figure 6. Visual representation of the difference in the number of points achieved by two generations of students

Based on the presented results, it can be concluded that the I exam was done better when the teaching was realized in the classical way. The reason for this is the process of adapting online teaching by students and professors. Better results of the II exam prove that the adjustment after a certain period by using online tools led to the fact that the students exceeded the results of the students who realized the teaching in the classical way.

The obtained results were expected considering the initial assumption which was a positive attitude of students and professors towards online teaching. Logically, the increase in the number of students in lectures was expected. An important reason for this fact is that students were not obliged to come inside the classrooms. The fact is that a large number of students do not live in the city where they study. In the case of online learning, students do not have to

rent apartments to live in because physical attendance is not required. These are some of the ways in which students can save money.

Due to the increase in the reliability of the data, we believe that the obtained results needed to be compared with the results obtained by The Republic Bureau of Statistics of the Republic of Serbia. The Republic Bureau of Statistics of the Republic of Serbia states in this year's report that 56% of companies in the Information and Communication sector use cloud services. During the Covid-19 pandemic, 30,1% of companies in the Republic of Serbia increased the number of employees who have remote access to the company's email, while 25,4% of companies increased the number of employees who have remote access to the entire infrastructure. The number of companies that have increased the volume of online meetings, with the help of Skype, Zoom or Microsoft Teams is 37,7% [16]. Overview of access to online platforms in the Republic of Serbia can be found in the Table 6 (Table 6. Overview of access to online platforms in the Republic of Serbia).

Table 6. Overview of access to online platforms in the Republic of Serbia

Online (Email)	Online (Whole system)	Online meetings
30,1	25,4	37,7

The results obtained by The Republic Bureau of Statistics of the Republic of Serbia are very similar to our results. Based on the results, we can assume that online access to resources is on the rise and that this trend will become a daily occurrence for most employees in all spheres of business.

5 Future Steps, Recommendations and Discussion

According to the current situation the next step in the knowledge transfer process is still unpredictable. The next

step is expected to be the use of classical and online teaching in one model. The combination of these two types of learning is called Blended learning. Blended learning represents learning that combines face-to-face and online learning experiences. It is important to note that hybrid education uses online technology to not just supplement but transform and improve the learning process for listeners [17-18].

Blended learning is also used in professional development and training centers. For instance, most university professors in blended learning use some software which include course management system applications to connect with students online.

There are two types of online learning, and these are synchronous and asynchronous. The hybrid model represents a synchronous type of learning while blended learning represents asynchronous type [19-23].

The paper perceives the usability of the online learning platform as assessed by taking Microsoft Teams as a reference. Given the current situation of the Covid-19 pandemic, it is important to assess the usability of the most popular tools for the purpose of providing online education. This is important because the way education is provided has changed to "online only". The usability of these tools is becoming an important aspect to ensure that online learning is very effective and useful for all listeners. In developing countries, there is also the problem of the digital divide and there is a variation in the consumption of online learning platforms. The existing literature states that the end-user experience largely depends on the size of the device screens through which they access the platform. Based on the results, we see that the usability of the application increases with increasing screen size. All this indicates that developers who develop online learning platforms make the same effort when developing applications for computers and mobile phones. It is important to note here that there is no negative effect that leads to a worse user experience for users who access the platform via mobile phones. The mobile platform is mature enough to offer the same experience as a PC application. Thus, the quality of knowledge transfer is not reduced on mobile phones [24].

6 Conclusion

Distance learning has become an urgent necessity for higher education institutions, imposed by the nature of emergency conditions in which we live. All educational institutions were forced to make transition to the online way of teaching, a large number of institutions very quickly accepted this way of teaching. Adaptation to such a system of knowledge transfer was directly influenced by the computer literacy of lecturers and students. In addition to the quality of knowledge transfer in the online form, the transition to this way of teaching has had an impact on reducing the cost of physical premises. The impact of transition to online teaching has directly affected the global macroeconomy. It is predicted that this impact will be visible in the coming period until the beginning of the normalization of the economy. It is important to note that this way of transferring knowledge has not only affected the world economy. In addition to the economy, this way of transferring knowledge has also affected the reduction of interpersonal relations. In the coming period, we will only see the negative consequences due to the reduction of interpersonal relations. The main purpose of this paper is to raise awareness of the importance of moving to online knowledge transfer. The increase in the number of users on the Internet before the Covid-19 pandemic has accelerated the adjustment of online teaching. Online learning is an active research area. It could be useful for remote work research in the future.

By comparing the results obtained by researching hybrid learning, we have contributed to reducing the fear of online learning. This paper has shown that by increasing the number of listeners, we do not affect the quality of the transferred knowledge. The fact that separates this research from other research aimed at hybrid learning is a large practical test on a large data set.

It is very important to mention the shortcomings of this paper, such as the use of the Microsoft Teams platform only

as a reference platform for measuring the usability of learning platforms. For further research, it would be desirable to consider other platforms such as Google Classroom or Zoom. We tried to make up for this shortcoming by considering the large sample based on when the testing was performed. One of the shortcomings that we think would be good to investigate is the geographical location of the students who participated in the testing. All students come from one country. However, given that the behavior in use and thus the perception of the usability of the platform may change with culture, we believe that future studies must focus on access between several countries in order to generalize current findings. Online learning is a very complex process that has a number of factors that can affect the quality of teaching such as the quality of course content, the quality of the platform used for online learning, the quality of video lectures and many others. The usability of the platform is only a small part of the overall user experience that this paper encompasses, while future studies may focus on a broader aspect of user experience and benefits [25].

This model of online teaching can be realized in all types of educational institutions, regardless of what activities the educational institution is engaged in [26-27]. It is very important to continue research on the impact of online teaching on the world macroeconomics. Further application of this model of online learning enables a larger sample that will contribute to better analysis and better application of blended learning.

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