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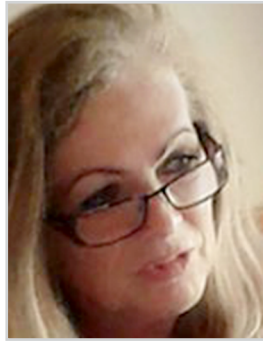
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## Sustainability aspects of distance learning in higher education during the COVID-19 epidemic in a Hungarian University

### Abstract

Our paper explores the impacts and sustainability of remote and online education framework introduced as a result of the COVID-19 epidemic in the case of two subjects (Macroeconomics and International Economics) taught at the Faculty of Commerce, Hospitality and Tourism, Budapest Business School. In our study we focused on specific aspects of shifting from traditional in-class learning to online education at our university. The most important pillars of the shift were the online implementation of all lessons, communication and examinations. We analyzed the measures of the education change, the effects of the change on the final results of the students and introduced the experiences of our students and teachers in this period, reflecting on the principles of sustainability. The primary data required for the analysis were diaries maintained by teachers and information available through the electronic study systems supporting online learning (CooSpace, Neptun), as well as student and teacher questionnaires and teacher interviews. The results for both subjects show that, despite the unmodified difficulty level of the exam questions, student performance improved during the remote learning period, that is, the learning process complies with the principles of sustainability. The implications of the study are therefore as follows: the coronavirus changed the educational framework of our university; the performance of students improved on both subjects; preparation time for teachers has increased, exam preparation time for students has also increased; consequently, online solutions used in distance learning period have changed the attitudes of the students and teachers as well. In the absence of personal feedback opportunities, regular monitoring tools were positively received by students, however, digital inequalities and previously less common tasks were more challenging for them. The experiences of the first semester affected by the epidemic were and can be utilized in later semesters as well.

**Keywords:** COVID-19 Pandemic; Online Learning; Distance Education; Sustainable Learning; Sustainable Lecturing; Teaching Methods; Universities; Efficiency

**JEL Classification:** M21; O31

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## 1. Introduction

Sustainability has long been at the focus of higher education. The coronavirus pandemic urged countries to compose and adopt new laws, having a grave effect on the higher education sphere, giving new incentive to sustainability principles in the sector. Sustainable e-learning is the adoption of technology to maintain teaching quality at reduced unit costs, according to the National Committee of Inquiry into Higher Education from 1997, in this terms institutions in the education sector achieving this through economies of scale, where programmes and courses are focusing on the development of learning materials as learning objects that are described by metadata, classified and stored in digital repositories, where they can be easily accessed, recombined and reused within online courses (Williamson et al., 2020; Zhang et al., 2020) After the SARS-CoV (Severe Acute Respiratory Syndrome) and H1N1, COVID-19 was the third epidemic to be classified by WHO as a pandemic in the 21st century, and the latter had the greatest impact on the education system. The global pandemic is, however, not only a severe public health emergency, but a political, economic and social crisis at the same time (Williamson et al., 2020; Karácsony, 2021) According to the data recorded on October 12, 2020, almost 37.5 million people tested positive for the disease, and it caused the death of more than 1 million patients (Bedford, 2020). With the rapid spreading of the epidemic, people were quarantined all over the world, and workplaces were closed one after the other, including universities. Politicians, health care professionals and other experts introduced numerous measures to control the epidemic and to provide the best possible care to the infected (WHO, 2021). The first measures of the kind were imposed in Wuhan, and then the entire city went into lockdown on January 23, 2020 (Xiang et al., 2020).

Even though the mortality rate of young people proved to be much lower than that of the elderly according to death statistics, such dense community networks as those existing on university campuses could accelerate the spreading of the epidemic. A series of measures had to be put in place in higher education to make the process of knowledge transfer sustainable. Thus, the interpersonal contacts promoting the spread of the virus were reduced significantly by shutting universities down (Weeden & Cornwell, 2020). The closing of educational institutions affected millions of students all across the globe (UNESCO, 2020). In addition to halting face-to-face teaching, universities also had to cancel all conferences, workshops, contests, sporting events and other programs.

Even though online education is far from being a new method in higher education, its emergency extension to all university courses still imposed a vast challenge (Lim, 2020). This is partly owing to the fact that the epidemic forced educational institutions to close down, and even those professors and teachers who previously had not integrated technology into their teaching, had to teach their students (Oranburg, 2020).

The majority of recommendations called on universities to remain flexible. If, for instance, a student could not participate in online education due to an illness or for any other reason, the universities had to make sure that they did not face any negative consequences in terms of grades. Some courses, laboratory sessions, visual arts, office work, dance, art, and music classes cannot be taught online. In such cases, teachers could either evaluate their students based on their performance up to that point or could opt for suspending their courses until things go back to normal (Sahu, 2020).

Our university, the Budapest Business School was subject to Hungarian legislation, and thus the institution formulated its own measures in compliance with those laws. The Hungarian government declared the state of emergency on March 11, 2020 in Government Decree No. 40/2020. (III. 11.) (Hungarian Journal, 2021). As part of the measures related to the state of danger, all Hungarian universities had to switch to distance education, and students were not allowed to enter the premises of the universities. The courses examined in our study were placed online as of March 12. As the annual spring break was between March 16 and 20, the management and teachers «gained an extra week» to prepare for online education. The semester continued after the spring break on March 23 - from then on, all courses were held online. From March 12, university administration services provided mainly by the Student Services Office and the faculty departments were only available via e-mail. In light of the epidemiological situation, the prohibition on students entering higher education institutions was also reinforced based on the normative resolution issued by the Chief Medical Officer on March 26 (Tiszti főorvosi határozat, 2020). The instruction issued by the rector and the chancellor and updated on March 10 broadened the possibility of remote working at the university subject to our study. The instruction allowed for the extension of home office up to

the 100% of the working time based on a management decision in deviation from standard rules. In spite of all these events and subsequent measures, the university was open to staff all throughout this time, which meant that university workers could enter the buildings without special permissions or prior notification, but no university events were allowed to be held.

Although a relatively short time has passed since the outbreak of the global pandemic, there are numerous academic publications examining the transition of institutions or national educational systems to distance learning and the digitization that followed (Daniel, 2020). The survey monitoring the opinion of the students in the United States serves as a fine example of presenting a complex view from the point of view of students (Cohen, 2020). A similar study was made with a more general scope, approaching the topic in a nation-state context, processing cases in the Philippines (Toquero, 2020), Vietnam (Trung et al., 2020), Australia (Drane et al., 2020), India (Kapasias et al., 2020), Spain (Odriozola-González et al., 2020), Georgia (Basilaia & Kvavadze, 2020), United Kingdom (Watermeyer et al., 2020), and China (Zhu & Liu, 2020). After introducing government measures in the respective countries, these studies usually analyse primary data to understand how the intervention and transition practices of institutions affect student and in some cases teacher communities.

The impacts of the COVID-19 epidemic on education have also been studied encompassing a narrower scope. Ute Kaden's 2020 study (Kaden, 2020) examined the performance and reactions of a number of students in the case of specific subjects in the form of a case study conducted in a Canadian small-town environment. The transformation challenges of the educational processes of special fields were examined in the fields of neurosurgery (Lewis et al., 2020), optometry (Rajhans et al., 2020), neuroanatomy (Hall & Border, 2020), traditional Chinese medicine (Zhang et al., 2020) and business training (Krishnamurthy, 2020).

The studies on different levels examining the impacts of the epidemic on different fields arrived at similar conclusions concerning the society as a whole. One of the most dominant phenomena was the inequality of access to digital learning, also referred to as digital inequality (Montacute, 2020; Jæger & Blaabæk, 2020; Thomas & Rogers, 2020). Digital inequalities do have a technical dimension, but it must also be noted that the user's autonomy, the extent of the social support network available to them, as well as their previous digital experience can also vary immensely, which may also serve as the sources of such inequalities (Beaunoyer et al., 2020).

The literature sources have drawn some conclusions in regards to expectations towards distance learning systems operating equally well in a digital context. In addition to taking digital inequalities into consideration, the aspect that distance learning should also preserve the mental health of the participating parties and that it should strive to reduce negative inequality impacts through developing the necessary digital innovations must also be highlighted (Thomas & Rogers, 2020). In terms of handling these inequalities, particular attention must be paid to the vulnerable groups of society who often do not even have proper internet connection. Only after (Drane et al., 2020) establishing these baselines can we examine which software, hardware as well as organisational and work schedule corrections could bring about a sustainable solution in the educational system (Basilaia & Kvavadze, 2020). Odriozola et al. (2020) call the attention of educational systems to students' stronger inclination towards anxiety and depression, as this problem must by all means be considered in the time of digital education. Another important aspect in the educational sphere is that they could only substitute a certain type of unidirectional, direct, classroom form of education properly with online courses (Zhang et al., 2020), but they could not properly replace field work, laboratory work or processes requiring quick personal interaction in the new distance education framework.

Krishnamurthy (2020) identifies the most important aspects to consider that a business school needs in the course of its transformation tailored specifically to business trainings. First, the points of organisational transformation of the given university must be identified, the changes taking place in business life need to be taken into consideration, and the changed attitude of students must also be incorporated into the system. The financial limits as well as the elements of the previously applied IT infrastructure must be considered. These elements will shape the new business education framework.

Zhu and Liu's paper published in 2020 does not only share the measures imposed by an individual country (China) and their experiences so far, but also formulates recommendations for the university sphere and governments for the future, which should be taken into consideration during the potential future waves of the epidemic or simply in the course of the further digitisation

of education. These recommendations include the following: systems putting the so-called open educational platform approach to use should be developed; measurement options for ensuring the long-term sustainability of online solutions should be developed; the continuous training of teachers and IT teams is necessary for the smooth operation of online education; all stakeholders must be involved in future developments, thus the participation of universities, international organisations, the private sector and the civil society is a crucial factor.

## 2. Research questions and methodology

### 2.1. Goal of the research and research questions

Our university was governed by Hungarian legislation during the pandemic, and our institution created its own measures and procedures accordingly. The most important socially responsible governmental and university measures concerning educational activities have greatly contributed to the sustainability of the operation of universities and their economic and social expectations.

In this study we aim to examine how teachers overcame new challenges and what impacts online education had on the learning effectiveness of students compared to face-to-face teaching. In the framework of our research, we examine two subjects: one of the subjects (Macroeconomics) (751 students) encompassing weekly lectures and seminars, while the other subject (International Economics) with only 68 students included one lecture a week.

We aimed to achieve our research goal by answering the following research questions:

- What differences could be observed between the two subjects in the course of transitioning to online education?
- To what extent was the acquisition of the material and student performance influenced by the methodological change taking place during the spring semester of 2020?
- How did the teachers perceive the transition to online education and what experiences did they gain?
- How did the students perceive the transition to online education and what experiences did they gain?

The findings of the study will increase the number of best practices in the field of implementing online education and could thus help university teachers in tackling similar situations in the future.

### 2.2. Methodology

The aim of our study was to share with the reader how the education process of our institution was affected by the change of distance education system, caused by the pandemic. Our research includes a systematic description and academic reflection in a community process. In this regard, it is the presentation of a case study. The literature on case study methods is quite complex. According to the type of time dimension, as Starman (Hungarian Journal, 2020) points to these types of classification our study is mostly a retrospective case study.

The ideal research subjects for the case study are new, emerging phenomena, in our case the transition to online education. Through this method, we wanted to examine the online educational process so that we could see from the outside the process we were involved in. This was important from several points:

- to reflect, what happened to the community of the university;
- the results lead to explanations of successes and failures;
- we can share our experiences with other communities.

Case study analysis is a frequently used qualitative methodology tool in researches carried out in the field of education (Starman, 2013), yet it does not have a legitimate status due to the lack of well-defined and structured protocols (Yazan, 2015). From the 1970s, the case study was used in the field of education primarily to evaluate training plans and materials. The aim was to be able to assess the user experience, opinion and socio-political impact of the trainings on the success of the output side (Yin, 2014).

The researchers who opted for case studies as their research methodology exceed the findings that can be concluded from quantitative research, as they get to see the events from the angle of participants, while the simultaneous examination of quantitative and qualitative data could help both the explanation of the process and the reconstruction of the events examined via complete monitoring and analysis (Simons, 2009).

If we only relied on quantitative methods when evaluating the effectiveness of educational programs and initiatives, some very important data would remain unexplored, and thus the survey would not be complete (Simons, 2009).

In a certain sense we could say that writing a case study is not simply a method, but also an approach at the same time. The essence of this is that in spite of all the apparent differences and distinctions, human behaviour does have certain features that can be generalised. Thus, monitoring a given unit also offers a great insight to the specificities of a certain type of behaviour or organisational operation (Zaidah, 2007).

In terms of research design, we have built up the methodological part of our work in a similar way as a study from 2020 on the subject of education (Jesionkowska et al., 2020; Mayer, 2011). We planned the steps for primary data collection; collected the data by the help of specific tools, described in the next section; analyzed the received data from the tools and from university databases; and finally, we presented the results of our work. We did not have a more sophisticated goal with the study, for example, we did not attempt to formulate a new theory by the help of our work. In this sense, our study does not strictly meet all the theoretical criteria, formulated in Andrade's study (Jesionkowska et al., 2020).

Researchers primarily use exploratory and explanatory case studies (Andrade, 2009; Yin, 2014; Yazan, 2015; Merriam, 2009). Our aim was also to describe the characteristics of the area under study (transition to online education) in a situation where there was no way to prepare students or teachers in advance.

### 2.2.1. Participants

Four teachers and more than 300 students participated in the questionnaire. Table 1 shows the characteristics of the teachers involved in the study. All teachers have a degree in economics.

In our study, we compared the experiences and results of two full-time subjects in the field of theoretical economics: Macroeconomics and International Economics. A common feature of the two subjects is that both are disciplines of theoretical economics. However, an important difference between the two is that while Macroeconomics is taught to hundreds of students on a mandatory basis, with a lecture of 2 contact hours and a seminar of 2 contact hours each week, International Economics only has one lecture of 2 contact hours per week, and only a maximum of 100 students attend this class as an optional subject.

751 students attended the Macroeconomics course in the spring semester of 2020. The number of students involved in the questionnaire is 334. 76% of the students are female and 24% are male. In terms of age groups, the respondents aged 19 and 20 comprise 58.1%, those 20 to 22 years 35.3%, those 23 to 24 years 5.4%, while the rest of the students are 25 years old or older. More than 90% lives in the capital (45.5%) or in other cities (45.5%), the rest lives in smaller settlements.

68 students attended the International Economics course in the spring semester of 2020. 10 students participated in the study: 8 students are females and 2 are males. In this group distribution in terms of age: 22.2% is 19-20 years old, 66.7% is 21-22 years old, 11.1% is 23-24 years old, and no students are older than 25. The majority of respondents live in the capital (44.4%) or in other cities (33.3%), and 22.2% lives in villages.

A large majority of respondents used PCs and laptops in the course of online education (304 students and 10 students respectively), 18 students used tablets, while 12 students used mobile phones to participate in online learning. 2 students borrowed devices, while 8+2 students bought new ones (Table 2).

91.3% of Macroeconomics students and 90% of International Economics students had unrestricted access to internet prior to online education. The internet did not work perfectly in many cases, only 47% reported no problems, the rest of the respondents experienced issues on a monthly, weekly or daily basis (Figure 1).

Table 1:  
**The characteristics of the teachers involved to the analysis**

Name	Sex	Age	Post	Educational experience expressed in years
Éva	Woman	62	professor	30
Farkas	Man	56	associate professor	34
Tibor	Man	33	associate professor	10
Róbert	Man	32	assistant professor	3

Source: Own research

Table 2:  
**Characteristics of the devices used by students in distance learning**

	PC/laptop		Tablet		Mobile phone	
	Macroec.	Int. Econ.	Macroec.	Int. Econ.	Macroec.	Int. Econ.
I have already owned a device	298	8	14	0	12	0
I borrowed the device	2	0	0	0	0	0
I bought a new device	4	2	4	0	0	0
Altogether	304	10	18	0	12	0

Source: Own research

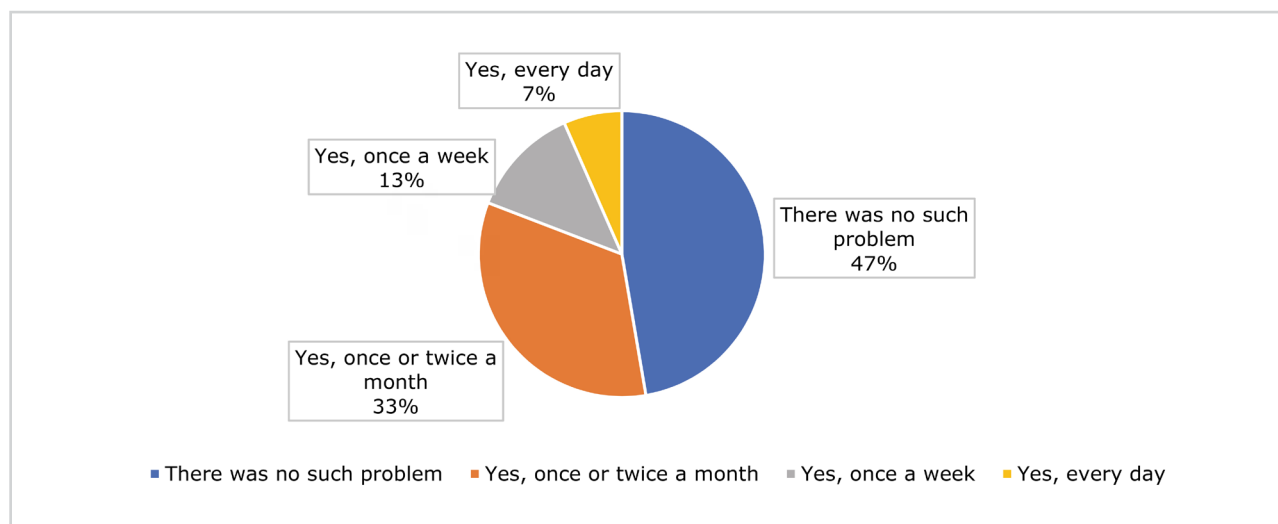


Figure 1:

**How often did students of Macroeconomics experience internet connection problems?**

Source: Own research

With the exception of one person, all students studying International Economics experienced problems with internet connection on a regular basis (10% on a daily basis, 30% on a weekly basis, while 50% experienced issues one or two times per month).

### 2.2.2. Subject description

As part of our research, we focus on the analysis of two subjects: one of the subjects (Macroeconomics) held in two consecutive semesters (751 students during the examined semesters) and both lectures and seminars were held on a weekly basis. The other subject (International Economics) concerned only 68 students (compulsory subject for senior graders) and their schedule included one lecture a week. Macroeconomics is a subject with a practical course (a seminar) grade, which means that grades reflect the students' course performance during the given term. The final grade consists of several components in the case of this subject: in addition to two classroom tests, the students' project work also included, and one can also obtain additional points by doing extra tasks. In contrast, International Economics is a subject with an exam grade, which means that students take a written exam in the exam period.

### 2.2.3. Educational context

The description of the two subjects highlights that there are commonalities and differences in the educational context. In the case of International Economics, the process of teaching, the communication, interactions took place online on the Microsoft Teams interface (during a live online conference) and on the Coospace interface. Coospace only allowed video calls between two people (this is true for both subjects) and it was possible to send forum messages on this interface. Ppt and Pdf files were also shared on Coospace for both subjects. The end-of-semester exams were completed online by students for both subjects. In previous semesters students of the International Economics course had to write a paper-based test whereas students of Macroeconomics had already written an online test, and they also had to submit the project work online, so in their case only the Teams conference was a novelty, as well as the completion of the tests from home.

#### 2.2.4. Data collection

We collected data in various ways.

We obtained important information at the online classes held each week. The meetings were held each week from mid-March until the end of May, over two and a half months, during which we logged the teachers' method of preparation for the classes each week. The log contained the following key information: the exact date of the lesson, the name of the teacher holding the given lesson, the place of the lesson (title of the online interface), the date of the consultation related to the lesson, the outline of the presented topic, listing the supporting materials in connection to the topic, determining the student's contact information, describing the information provided to the students, determining the author and subject of the control test.

We made semi-structured interviews with the concerned teachers, which we examined with the method of content analysis once recorded. To compare the responses of the teachers, first we constructed the main questions. Questions for teachers covered the following areas: comparison of the experiences of the online and offline education, the method of the preparation of online course materials, conclusion of the changes in the education methods, the processes of the control and assessment systems in the online period of the education, the most important best practices. We also sent an anonymous questionnaire with the total of 21 questions to the teachers. The questionnaire could be completed by the teachers over a given period which was between the 27<sup>th</sup> of August and 5<sup>th</sup> of September 2020. A Google questionnaire link was sent via e-mail to our colleagues.

We applied questionnaires in the case of students so that we could document and understand their experiences regarding distance learning. The structure of the questionnaire had several distinct parts. After the personal data we focused on the technical conditions of the students in the online education framework. In the next part we explored the main experiences of our students in the online period. To make it easier to assess the changes, we asked a number of comparative questions between previous normal and online education. Finally, students were able to make suggestions for improving online education. A total of 22 questions had to be answered by the respondents. We sent the same anonymous questionnaire to the students of the two subjects separately, we worked with these two questionnaires in our study, concerning students. The questionnaires could be completed by the students over a specified time period between the 5<sup>th</sup> of August and 22<sup>nd</sup> of August 2020. A Google questionnaire link was sent to students through the Neptun and Coospace systems.

In addition, we also examined the effectiveness of distance learning by comparing the students' current grades with those of the previous year. These grades are accessible in two main electronic education systems, we used both: Coospace and Neptun.

#### 2.2.5. Data Analysis

As we have collected data in various manners in our study, we opted for various analysis methods for processing them, as well.

Logging the meetings qualifies as a descriptive research method. This allowed us to collect and cumulate personal experiences and to understand the subject of the research, the underlying causal links, mechanisms and metacommunication aspects.

We processed the answers received in response to the structured questions in the course of the interviews as well as the casual conversations with content analysis.

We analysed the data of the questionnaire with the help of Microsoft Excel spreadsheets. Except for demographics, the availability of technical devices to students and three open questions, we assessed the students' attitude and experience gained in the course of online education with Likert scale questions. We opted for an odd scale (1-5) in order to allow students to give neutral responses. This is more suitable for measuring attitude than odd scales (Stewart, 2014; Boone & Boone, 2012; Joshi et al., 2015). When examining data, we primarily assessed frequency and composition.

We exported the students' grades into Excel sheets, then calculated their means and standard deviation, as well as additional descriptive statistical indicators.

### 3. Results

In this chapter of our study, we present the results and main implications of our research in specific subchapters. These subchapters are arranged according to the topic concerned by the subchapter and not according to the research questions.

### 3.1. Main changes in the assessment process of the two subjects in question during the distance learning period

In terms of the formation of students' grades, differences are shown between the two subjects also during the offline, regular education period. Macroeconomics is a subject with a practical course mark, which means that the grade of the student reflects their performance during the given term. The two classroom tests give 70% of the final grade, while the student groupwork (essay and presentation in the case of traditional in-class education, only essay in the case of distance education) gives 30%. In contrast, International Economics is a lecture course, which means that the 100% of total points can be obtained at the written exam held during the exam period. In this sense, we can conclude that the effectiveness of the International Economics subject was completely influenced by the online education framework also in terms of conveying the course material to students (after the mandatory online education was announced), and students also had to obtain the credits necessary for their grade within a completely new framework. A new framework also prevailed in the case of Macroeconomics in terms of conveying the course material, and also in terms of the tests, however, there was no change whatsoever in the case of groupwork giving 30% of their final grade compared to previous periods. In our opinion, students had better chances at online tests, as before the announcement of mandatory online education and the severe spreading of the virus, they had to complete the test in a computer room, in the case of online education they had to pass the subject by completing the test at home, offering more ideal circumstances, and the use of aids also became possible in this case.

### 3.2. Changes of student grades in the case of Macroeconomics

We examined the change of student performance by comparing the grades of the spring semester of the school year 2018/2019 with those of the spring semester of the school year 2019/2020 in the case of both subjects. It is true for both subjects that they are only held in the spring semesters, thus we had to go back an entire calendar year for correct comparison. We considered it sufficient to compare grades with those of the previous year because we did not experience any significant differences in the course of the regular annual comparisons.

When comparing the final results, we examined the mean, standard deviation and mode of the grades achieved, as well as the ratio of students in the case of Macroeconomics that did not obtain a signature in the two periods. In Hungarian higher education, 1 is the worst grade: it means that the student does not pass the subject, while 5 is the highest possible grade. Thus, the range of the possible grades is 4, this did not change during the two periods. In the case of Macroeconomics, getting a signature also has a separate precondition, and those students who did not meet this precondition for any reason receive an entry stating «signature denied» as an evaluation, and thus do not qualify for a grade at the end of the semester and do not pass the subject.

Table 3 contains the relevant descriptive statistical data pertaining to the Macroeconomics subject. The number of students in the two periods was not identical, more students attended the class in 2020. In terms of effectiveness, the performance of students was better in the latter school year, when they studied in an online education framework. This improved performance also manifests in the fact that the ratio of students failing to obtain a signature decreased from 10.17% to 7.06%. In addition, the arithmetical mean of students obtaining a grade increased from 3.41 to 3.56, resulting in a 0.15 rise. The mode of the grades was 3 in

Table 3:  
Descriptive statistics of Macroeconomics in the two periods analyzed

Descriptive statistics of Macroeconomics in the two periods analyzed			
School year 2018/2019		School year 2019/2020	
Students with signature	618	Students with signature	698
Students without signature	10.17%	Students without signature	7.06%
Mean of the grades (618 students)	3.41	Mean of the grades (698 students)	3.56
Mode	3	Mode	4
Standard deviation	1.16	Standard deviation	1.1
Variance	1.33	Variance	1.21
Kurtosis	-0.92	Kurtosis	-0.94
Skewness	-0.16	Skewness	-0.25

Source: Own research



spring 2019 and rose to 4 by spring 2020. Standard deviation decreased from 1.16 to 1.1, the decrease also manifested in variance naturally, calculated as the square of the former value. The kurtosis of the basic sample of the two years takes almost the same value, and it is true for both years that the distribution of grades is flatter compared to normal distribution based on the negative indicator. There is a more significant difference in terms of skewness: in both years there are more outliers in the negative side of distribution, this changed from -0.16 to -0.25 by 2020. In our opinion, the students' grades improved in the period of distance education owing to the effectiveness of the well-thought-out educational framework and as a result of completing tests at home.

### 3.3. Changes of the grades of students in International Economics

Table 4 contains the relevant descriptive statistical data pertaining to the International Economics subject. The number of students in the two separate periods was not identical in this case either because more students attended this class in 2020. In terms of effectiveness, the performance of students improved in the latter school year, when they studied in a distance education framework. Signature does not have special preconditions in the case of this subject, as a result of which there is no difference in terms of students failing to obtain a signature, but there are differences in all other aspects. The arithmetical mean of grades increased from 3.85 to 4.15, resulting in a significant increase of 0.4. The mode took the highest possible value in both years. Standard deviation and variance decreased in the case of this subject, too, basically this value is lower in both years than in the case of Macroeconomics. Kurtosis allows us to conclude that the distribution of grades are flatter compared to normal distribution based on the negative indicator, however, it deviates from normal distribution a lot less in the case of this subject, presumably due to the smaller number of students. The absolute value of skewness also increased in this case, from -0.62 to -1.07, which once again shows outliers on the negative side of distribution, most certainly stemming from the fact that the cumulative results are quite good, and thus the weaker performances qualify as outliers.

Table 4:  
**Descriptive statistics of International Economics in the two periods analyzed**

Descriptive statistics of International Economics in the two periods analyzed			
School year 2018/2019		School year 2019/2020	
Students with signature	48	Students with signature	66
Students without signature	0.00%	Students without signature	0.00%
Mean of the grades (48 students)	3.85	Mean of the grades (66 students)	4.15
Mode	5	Mode	5
Standard deviation	1.09	Standard deviation	1.04
Variance	1.19	Variance	1.08
Kurtosis	-0.46	Kurtosis	-0.31
Skewness	-0.62	Skewness	-1.07

Source: Own research

### 3.4. Comparison of the changes of grades in the case of the two examined subjects

Seeing the descriptive statistics presenting the results of the two subjects, in the followings we will formulate a few professional conclusions. It can be concluded that the students' performance improved in the case of both subjects examined during the period of distance education, while the level of difficulty of tests did not change. Out of basic statistics, mode, kurtosis and skewness depended mainly on the number of students forming the statistical sample, as well as on the average grade fundamentally different between the two subjects and the process of examination. Standard deviation was not significantly different in the case of either of the subjects, neither when compared to each other nor when compared to the previous period. A positive deviation could be observed in the simple arithmetic mean in the case of both subjects, and a significant difference is shown in terms of International Economics in this regard. In the case of this subject, the average of students' grades improved almost by half a grade in the online education framework, which constitutes a significant difference compared to Macroeconomics. In our opinion, this is closely linked to the fact that in the case of International Economics, the online test plays a larger role in forming the final grade of the student, and thus online testing could have a graver impact on student's performance, which had a significant positive effect on average grades, in line with our expectations.

### 3.5. The most important implications regarding the student' questionnaire

The students' perception of online education could be an important criterion, due to its potential application in the future. 334 Macroeconomics students and 10 International Economics students shared their experiences in the course of our study.

The fear of Macroeconomics students from online education was distributed between all values almost evenly (between «Strongly disagree» and «Strongly agree»): 16% - 22% - 20% - 25% and 17%, while the majority of Macroeconomics students felt frustrated (70%). Thus, it is not surprising that the latter were more pleasantly surprised: 60% of them felt this way completely, while 10% reported that they rather felt this way. In the case of the other subject, these values are 35% and 37% (Figure 2).

Online education did not only put a lot of pressure on teachers, but on students too. The majority (approx. 60%) felt in the case of both subjects that they had to dedicate more time to studying in the course of online education compared to regular education. In the case of International Economics, none of the students thought that this was «Not true at all», and only 26 Macroeconomics students gave this answer (Figure 3).

How the work of students was facilitated by the materials uploaded during online education compared to regular education is demonstrated by Figure 4. The students thought that the course materials provided by their teachers facilitated their learning and preparation significantly in the

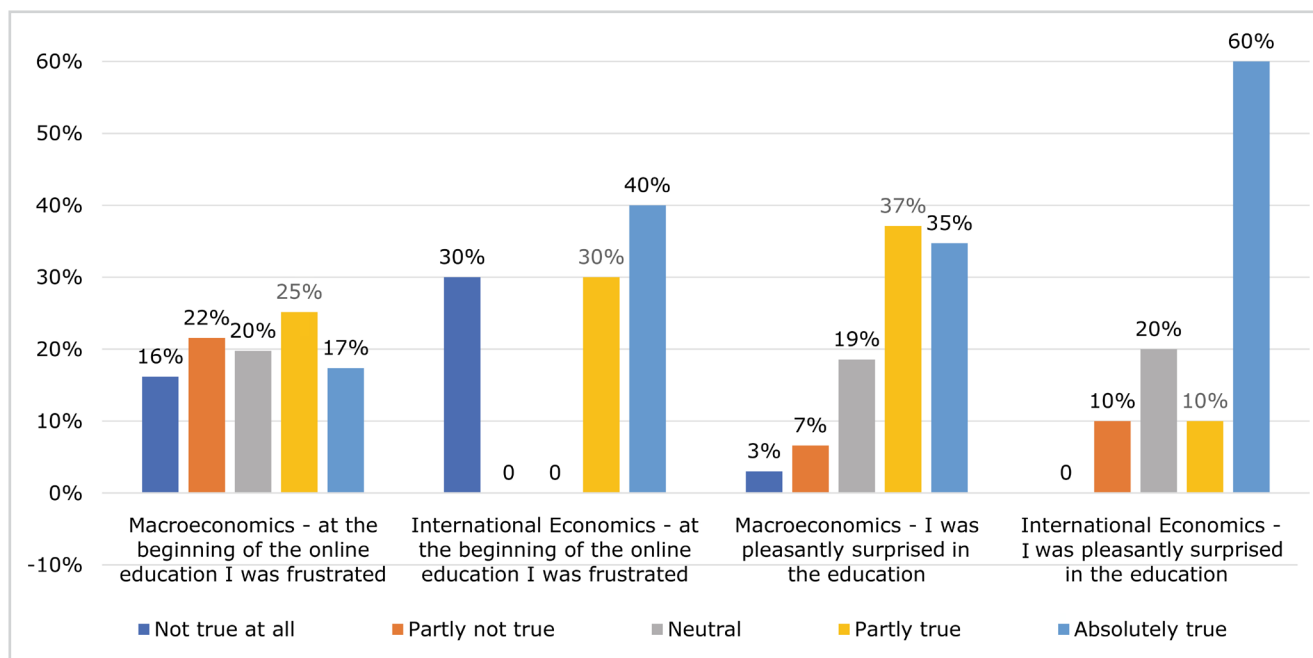


Figure 2:

The student's opinion on the online education - at the beginning and at the end of the course

Source: Own research

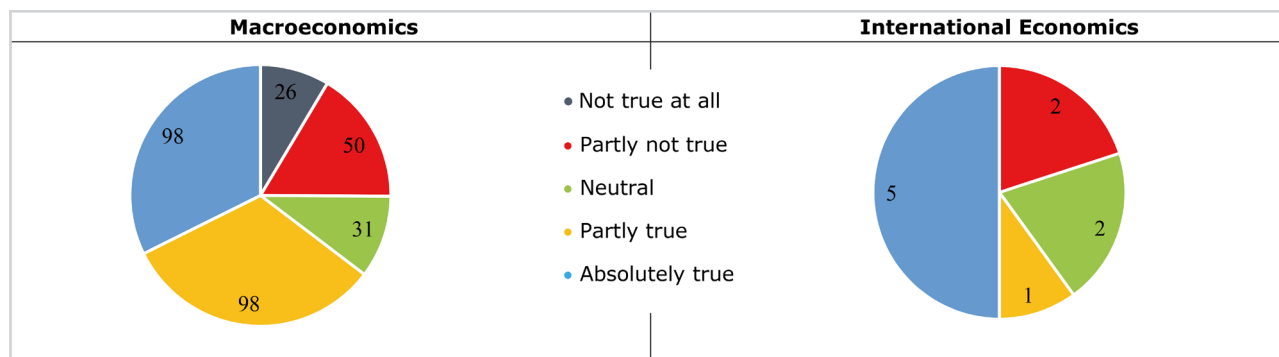


Figure 3:

Students had to spend more time learning in online education than in normal education (a number of the students)

Source: Own research

case of both subjects. 154 Macroeconomics students (46.1%) and 6 International Economics students (60%) thought that they received maximum support from their teachers. If we add the «Partly true» responses, the ratio of satisfied students is quite high in terms of both subjects: 82.6% and 80%, respectively.

In the case of Macroeconomics, 2 students were completely dissatisfied and 12 students were partly dissatisfied with the materials the teachers uploaded for them. No students gave such responses in the case of the International Economics course.

The students evaluated the information provided by teachers about the accessibility of course materials and the consultation dates quite positively. Approximately 60% of students considered the information provided to be completely adequate in both courses. By adding the «Partly true» answers, the rate rises to 80% (Figure 5). This is particularly praiseworthy in a situation when the institution was forced to switch to fully online education practically overnight.

The students also expressed their positive and negative experiences with their own words. In Table 5, we collected the TOP 5 most frequent statements from their comments.

The students highlighted in this section, that in this first online education framework, their experiences were mainly positive, and they would not consider it negative, to apply more online solutions in the normal education framework as well. The regular online monitoring and tests and the opportunity to create an own tempo and time management by the help of the video lectures were

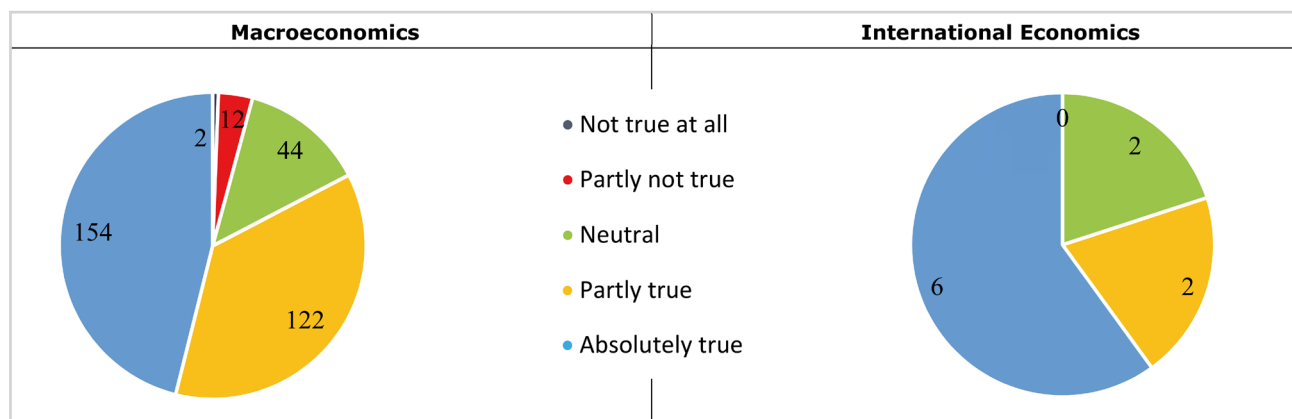


Figure 4:  
**The course materials provided by the teachers greatly facilitated its acquisition (a number of the students)**  
Source: Own research

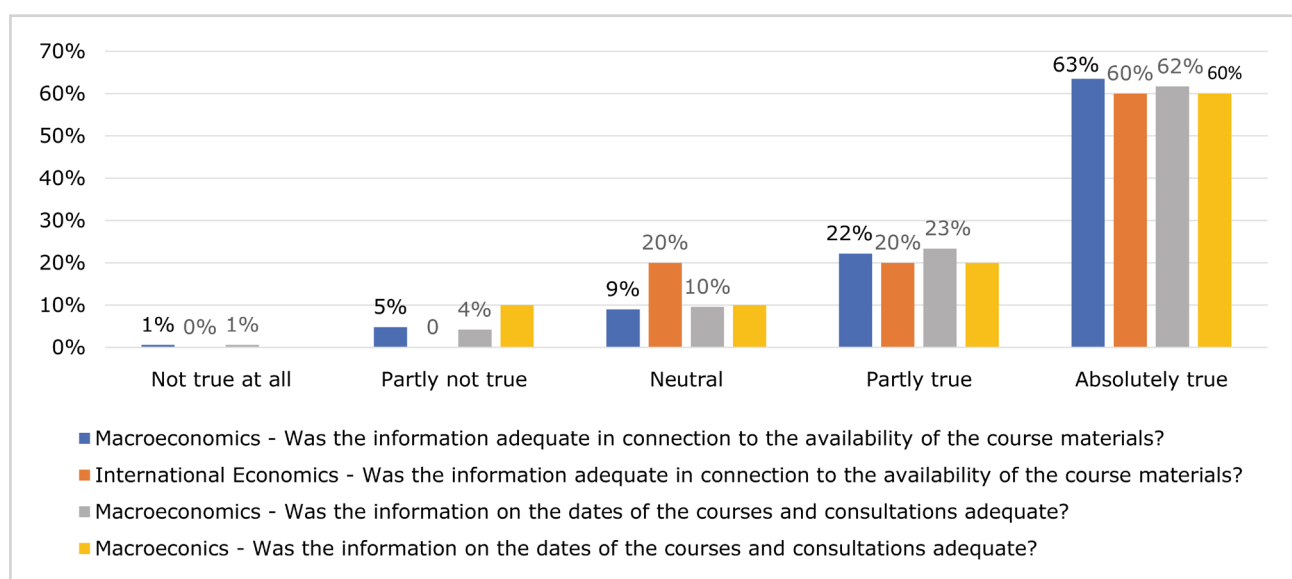


Figure 5:  
**Was the information adequate in connection to the accessibility of the course materials and the date of the consultations?**  
Source: Own research

Table 5:

**The TOP 5 most frequent statements of the students in connection to the education and the teachers**

Suggestions of the students	What the students liked best	What the students were least satisfied with
It was all right	Own tempo and time management	There was not much trouble with online education
«Just keep going»	Possibility to watch videos multiple times	Lack of personal contacts
More interactive tasks	Additional practical exercises	Internet problems
More online solution in the normal education process	Attitudes of teachers	More detailed evaluation of essays
Additional calculation tasks	Regular online tests	Previously less common task than in the normal education process

Source: Own research

highly popular options. The constant problems of the internet and digital inequalities, and the lack of real personal contacts to teachers and to each other were stated as negative features of the distance learning framework.

**3.6. The most important implications regarding the experiences of the teachers**

Macroeconomics was taught by 4 teachers, one of whom also holds the International Economics lectures, thus the teachers' experiences of online education were not separated based on the two subjects.

The 4-member teacher group had worked together effectively already before the measures were imposed due to the epidemic. They provided maximum support to each other, asked for the opinion of the other in professional matters and they made and implemented all decisions together. This way, their cooperation also remained unbroken in the course of online education. All members were present at all weekly Teams meetings held at a fixed date. They planned the key points of the events of the upcoming week at these meetings, including for instance the preparation of teaching aids in addition to the core material, the course of preparing the classroom tests and appointing the persons to execute them. Students were informed about the upcoming week by every Friday. They were informed, among others, about where to find the learning aids (videos, PPT files of presentations, glossaries and practice exercises), the dates of the Teams seminars of teachers, as well as about consultation options and the regular short tests for extra credit.

The fact that the seamless teamwork of teachers not all 4 of them shared the same opinion about the changes taking place due to online education (Figure 6).

Their openness towards introducing several new technological solutions shows the flexibility of all 4 teachers, and they did all this to better facilitate students' learning with the course materials. However, their opinions regarding the performance of students varied to a great extent. Only one teacher thought that students achieved better results at tests in the framework of online education. Our findings regarding Research Question 2 support this opinion, as the students achieved a

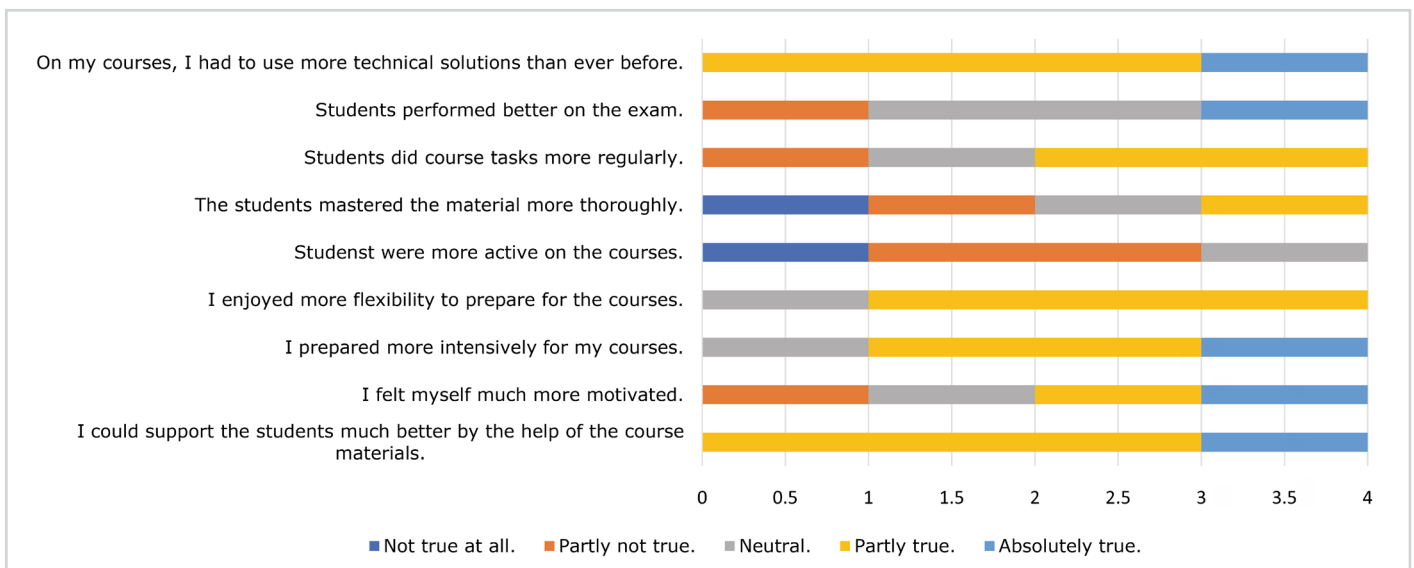


Figure 6:

**Comparison of the first, traditional in-class teaching to half of the school year in online education**

Source: Own research

higher average in Macroeconomics and in particular in International Economics. Even though the teachers' levels of motivation were completely different, a more intense preparation can be observed in comparison with normal school semesters (Figure 6).

According to teachers, course materials were available to a varying extent. The difference between their opinions is the most prominent in the case of seminars: every teacher gave a different answer. According to the four statements, the course material they taught was available in 25%, 50%, 75% and 100% respectively.

This is surprising since the teachers developed the majority of course materials together, and half of the teachers primarily used this material in the course of teaching. This statement is further contradicted by the fact that one of the teachers claims that they made the course material completely by themselves in the course of distance education. However, the fact that they not only used already existing materials but prepared several new ones should be appreciated greatly (Figure 7). Presumably, this is why all of them reported that they dedicated double the amount of work to online education compared to normal education.

Out of the elements of online education, the teachers participating in the study would primarily keep video lectures that remain available for students, the online learning aids, practice exercises and the online exam. All in all, they do not consider online education more effective than regular education, the majority of them (3 people) would be willing to adopt a hybrid form of teaching in the future, too, while one teacher voted for offline education.

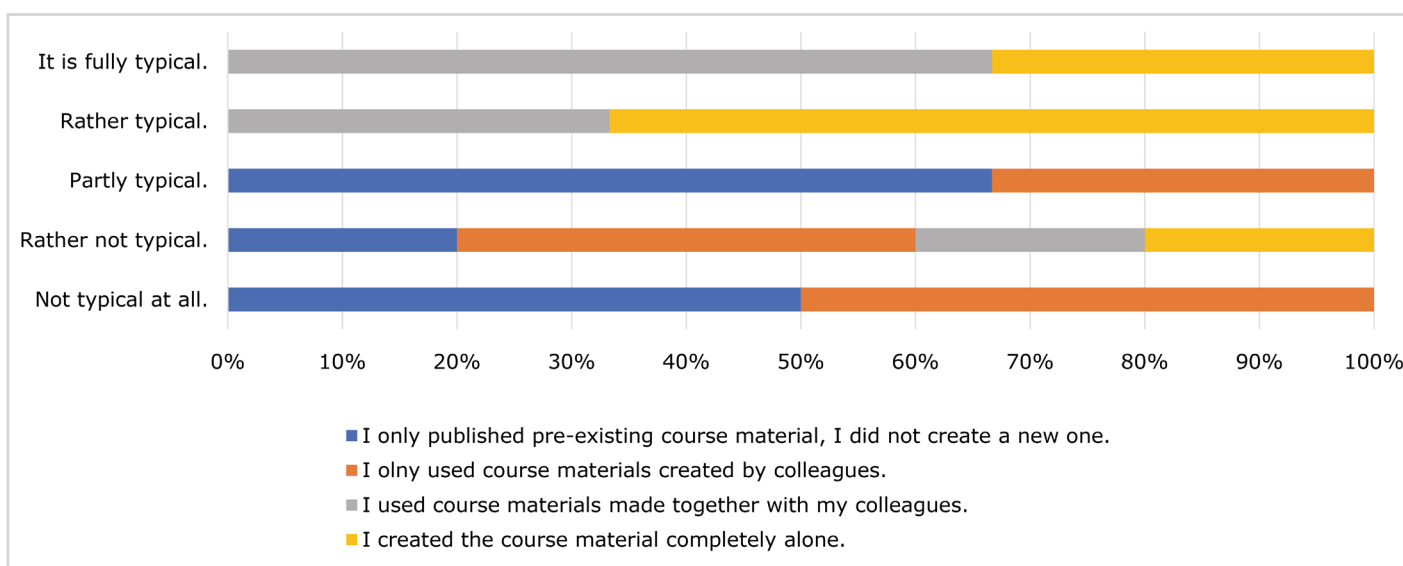


Figure 7:  
How did you prepare the course materials used in remote education?  
Source: Own research

#### 4. Discussion

The main results of the study on the online education are in line with the main findings of some recent research presented in the literature review. Main findings of our study were based on data from interviews with colleagues and student questionnaires. As the results of the study of Lassoued et al. (2020) show, the professors and students faced four main types of obstacles concerning education in the Arab world: self-imposed, pedagogical, technical, and financial or organizational obstacles. Regarding the first research question, our results show, that in the case of Macroeconomics and International Economics, it was important to integrate the system of requirements into the online education framework. Chaka (2020) reported similar measures, in connection to the higher education institution system for selected universities from overseas.

In the context of the second question, we examined the change of student performance by comparing the grades of the spring semester of the school year 2018/2019 with those of the spring semester of the school year 2019/2020 in the case of both subjects. We found that the student grades were higher in the online framework, and the standard deviation was even on lower level in both cases. This approach was not very common based on the literature review; however, it seemed to

us to be a clearly adequate indicator to measure and express the performance and effectiveness. Angelova (2020) also showed efficiency improvement in the management subject, another work (Bylieva et al., 2020) in the subject philosophy. Similar results were obtained in a Spanish study (Gonzalez et al., 2020), where students' performance was examined in three subjects. They argued that university closures due to COVID-19 significantly increased the results/grades of the students. According to the research, behind this performance stands the efficient scheduling of students. All of this is confirmed by our research as well, with the addition that completing home tests have certainly been a relief for students. In another paper, the effect of the transformation from offline to online exam on student grades were examined (Eurboonyanun et al., 2020). For this, the results of the online examination for 8th semester medical students were compared to 3 previous paper-based (written exam on paper) exams. Results of this research showed that the average points achieved on the online tests were significantly higher than in the past offline education period. Responses to essay and multiple-choice questions (MPQs) achieved significantly higher mean scores. Short responses resulted significantly lower mean scores in the online period. In the case of our subjects, only essay and multiple-choice questions were in use, questions with short responses have not been applied. In addition to effectiveness, remote online examinations raise several questions, including some ethical as well. The issue of student fraud is also relevant, as is the issue of violation of privacy by online exam supervision (Coghlan et al., 2020). These latter issues were not addressed in our research.

Regarding the third research question, we discussed the experiences of teachers in the online education period, by the help of the tools described above (summary of logging experiences and interview questionnaire). At the end of the Results chapter, we described the relevant results, because we arranged the subchapters based on the topics involved. The main challenge of the colleagues was the smooth acquisition and mastery of the use of online platforms in such a short time. However, course materials adapted to the online system and frequent teamwork were tasks to solve rapidly. This period required constant renewal from the teachers, Shuck and Lambert (2020), Giovannella et al. (2020), Elhaty et al. (2020) also referred to such challenges. We consider it important to apply the acquired experience to later school years as well, this issue will certainly be researched in many more scientific papers in the future.

In the case of the last research question, we went around the topic: How did the students perceive the transition to online education and what experiences did they gain? One of the most common shared experience of our students was the inequality of access to digital learning, also referred to as digital inequality (Montacute, 2020; Jæger & Blaabæk, 2020; Thomas & Rogers, 2020). Digital inequalities do have a technical dimension, but it must also be noted that the users' autonomy, the extent of the social support network available to them, as well as their previous digital experience can also vary immensely, which may also serve as the source of such inequalities (Beaunoyer et al., 2020). In addition, students also admitted that they had to spend more time studying. In addition to technical and internet problems, they also lacked personal connections, but overall, they were satisfied with the online education system. Zhang et al. (2020) highlights that that success of distance learning is based on the effective use of smart technologies and self-adjusting learning strategy and this way it is possible to reach sustainable and quality learning process. In a study, where the experiences of 100 Indonesian students were summarized (Arifiatib et al., 2020), the importance of own schedule was highlighted, as the main advantage of the online education, this result is quite similar to the conclusions of our questionnaires. In a Polish study (Rizun & Strzelecki, 2020), where almost 1,700 students were interviewed, increasing self-efficacy was identified as one of the benefits of online education. In addition, the enjoyment of distance learning was emphasized by the respondents. In contrast, according to a Turkish survey (Elhadary et al., 2020), 69.7% of students' learning motivation was markedly negatively affected by the anxiety they felt about the spread of COVID-19. However, 80.6% of students find it very advantageous to record online lectures. In this case, they can view it later at any time. Comfort considerations also play a significant role in this, such as not having to get up early, which was also confirmed by our research findings. The feedback from our students was highly positive regarding the online education framework. Compared to other similar studies, our students rated us more favourably.

The results of the study are thus directly relevant only to the students at our own university, which places a limit on generalisation. In addition, our results are in line with the findings of the international literature related to online education.

## 5. Conclusions

In our study, we examined how the COVID-19 epidemic and the resulting social changes influenced the education of theoretical economics at the Faculty of Commerce, Hospitality and Tourism of Budapest Business School. Restrictive measures affecting the teachers and students of our institution as well as the methods of teaching and examination were in place in the early phase of the epidemic. We collected and processed the grades, teaching and examination methods of two theoretical economics subjects (Macroeconomics and International Economics) as well as the experiences of the teachers teaching them, while also assessing student perceptions.

The online teaching experiences of the two university subjects were presented by answering four research questions. We asked our students, to fill a questionnaire and made interviews with our teacher colleagues. Of course, we also presented, based on the findings of the international literature, what kinds of measures and changes characterized the education system in different countries during the epidemic period. After presenting the data and the main concluding remarks in connection to the data, we also compared results with literature findings in the discussion section.

The most important conclusions of the study include the followings. In the distance learning period the revisions of the course materials, and the routine use of online interfaces were the main challenges to face by the teachers. In the distance learning framework system, students also had to adopt a different approach towards learning and towards participation in the educational process. In the case of the subjects examined, the effectiveness and sustainability of examinations significantly improved, which was influenced by the fact that students completed the tests at home, and they were able to learn by the help of newly developed online course materials. We should also stress in relation to students that certain aspects of digital inequality also influenced their approach to distance education and their performance, too. In spite of the relatively rapid and thorough transition process, all in all both students and teachers evaluated the experiences of the online education framework more positively than negatively. According to the teachers' experience, the most important task was the acquisition of coordinated online teamwork and smooth technical solutions. Students had to spend more time with learning in online education than in normal education, but this was not experienced as a sacrifice, moreover by achieving quality knowledge transfer, it also leads to long-term sustainability. Approximately 60% of students considered the information provided to be completely adequate in both courses in the online education period, and only the lack of personal contacts and permanent internet problems served as negative experiences.

The main implications of our article are manifold. The coronavirus changed the entire educational framework of our university, the performance of students improved in both examined subjects; lesson preparation time for teachers has increased, student learning time for exams has also increased, consequently, online solutions used in distance learning period have changed the attitudes of the students and teachers in a sustainable way as well. In the absence of personal feedback, regular testing opportunities were positively received by students, however, digital inequalities and previously less common tasks were more challenging for them. Although the work of the four teachers involved was more complex during the online education framework, they stated that they were happy to use some online solutions in later classroom courses as well. This statement is also confirmed by the educational tools in the current school year.

The results and implications identified in this paper and our conclusions give basis for the continuous improvement of distance education solutions. Beyond all that, the educational solutions of the institution and the faculty could also be regarded as a sort of «best practice», which we consider valuable on an international level as well.

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