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# COMPARISON OF ON-SITE TESTING WITH ONLINE TESTING DURING THE COVID-19 PANDEMIC

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In the paper, we deal with the comparison of the evaluation of students' language skills in two environments, on-site and online. Testing took place through the moodle platform, where we used e-test, during the first and second waves of the pandemic. The main aim of the research was to find out what impact the environment in which the testing takes place has on the test results, i.e. in which environment students achieved better results. Printed tests were used for on-site testing. The on-site testing took place in the academic years 2018/2019 (summer term) and 2019/2020 (winter term). The online testing took place in the academic years 2019/2020 (summer term) and 2020/2021 (winter term). We compared the results of the testing, which took place in person at the university, with the results that the students achieved during the online testing. In the research of testing, we used the method of quantitative analysis and descriptive statistics, which allow us to better understand the correlation between the results obtained in on-site and online testing. Based on the data analysis, we confirmed the alternative hypothesis H1: Students who took part in on-site testing achieve better results than students who took part in online testing. Testing results show that students achieve better results in on-site testing than in online testing.

**Keywords**: e-test; Moodle; Microsoft forms; Google Forms; testing; Covid-19 pandemic.

## Introduction

The covid-19 pandemic has hit the whole world. Life has moved overnight into the online world. And what was previously mentioned only on a sci-fi level suddenly began to take place in real life. All areas of life have been affected, including teaching in schools and universities. In Slovakia, schools and universities were the first to respond to the impending pandemic. Already two days after the announcement of the first case of the corona, most schools, including universities, closed. The education process has gradually moved from stone universities to the world of the Internet. In this online world, teachers have had to switch from on-site teaching to online teaching. From face-to-face teaching in a one-way communication from the teacher to the unknown voice that came from the computer speaker. Namely, the switching off cameras by students has become a typical feature of the educational process in the online space. The shift from face-to-face to online teaching required an adaptation of university teachers and students, with both facing several challenges (Gradišek, Polak, 2021, p. 304). The education was more individualised (Poláková, Klímová, 2021), the student was isolated from his classmates, he was dependent on his technical equipment.

The transition of the education process is not easy and in the first wave, it was not well managed in Slovakia, because teachers and also students were not used to teaching and learning online. Practically from day to day, they had to learn to use new software and change didactic methods. During the second wave of the pandemic, teachers were better prepared for the situation. There were already more online teaching platforms on the market and teachers had plenty of time to get acquainted with the new software. However, there were more obstacles to distance education. Many teachers and students had to deal with insufficient hardware equipment, insufficient Internet speed. The educational process has also been affected by lesser interaction between teachers and students. It has resulted in losing motivation and lack of concentration (Gonçalves, Sousa, Pereira, 2020). On the other hand, modern applications and online platforms have made it possible to use new visual learning experiences (Jennifer, Lipin, 2020). Despite the fact that electronic materials and new communication methods have been used in teaching so far (Gayoso, 2016, Hrdličková, 2018; Sokolova, Ševečková, 2019; Klimova, Zamborova, 2020; Azarova et al., 2020; Trishchuk et al., 2020), the new situation has necessitated the involvement of these forms of teaching even more intensively. The integration of modern technologies into distance learning is one of the biggest didactic challenges today (Saienko, Lavrysh, Lukianenko, 2020). It is therefore natural that for the outlined reasons many academics are currently focusing on distance learning in their research (Önöral, Kurtulmus-Yilmaz, 2020; Triviño-Cabrera, Chaves-Guerrero, Alejo-Lozano, 2021; Lemay, Doleck, Bazelais, 2021).

One of the issues that teachers have to face during the COVID-19 pandemic is the issue of evaluation of students' skills. Achieving a fair evaluation in virtual space is not easy at all. We also need to keep in mind that some students may use unfair methods. For this reason, too, it is necessary to approach testing very carefully. This question often occurs when academics teach and test via the Internet during the COVID-19 pandemic.

In the paper, we deal with testing the language skills of students at the University of Economics in Bratislava, which took place in two different environments, on-site and online. Printed tests were used for on-site testing. The on-site testing took place in the academic years 2018/2019 (summer term) and 2019/2020 (winter term). Online testing took place in the academic years 2019/2020 (summer term) and 2020/2021 (winter term). The aim of the research was to find out how the different environments in which students took the tests influence the results the respondents achieved i.e. in which environment students achieved better results.

**Literature review**

An important part of the teacher's work is not only to teach students a foreign language but also to assess their knowledge. Assessment is an essential component in the learning process because most students focus on assessment and consider it as a success indicator of their performance; hence, it has the power to drive students 'learning (Kearney, 2013; Khalaf et al, 2020)

Especially during the covid-19 pandemic, the question of how to assess students' knowledge in online teaching comes to the fore. It is important to define and distinguish what is online learning, e-learning, or blended learning. Online learning relies on a web-based delivery platform and requires internet access, pure e-learning can take place without internet access, for example, by using DVDs to deliver the educational content. Blended learning combines the e-learning component with another traditional face-to-face, lecture-based learning in and outside of the classroom (Frehywot, et al., 2013, Hijril et al., 2020). E-learning can be defined as the delivery of training material via information and communication technology (ICT), including the internet, CD-ROM, DVD, smartphones, and other media, both inside and outside of the classroom (Ruggeri et al., 2013, Frehywot et al., 2013; Morozova et al., 2020). At present, pure e-learning is being applied at Slovak colleges and universities.

Unfortunately, the number of scientific and pedagogical research and works on the use of information technologies in the implementation of foreign language education in non-linguistic universities is still insufficient (Pyanzina, 2013, Zubro, 2018). We anticipate that the covid-19 pandemic will affect this area as well, and research into the use of information and communication technologies in the educational process will come to the fore.

In this paper, we compare two environments in which students took tests. The on-site environment, where students had to be physically present during testing, was changed by the advent of the pandemic into the online environment. This change in the learning environment influenced changes in conducting the assessment of knowledge. The online environment also affected the level of quality of education, which went down rapidly. Information technologies can significantly increase the level of education in the case of blended learning, but they cannot replace a teacher who has an irreplaceable role in the educational process.

The researchers were tasked with selecting the most appropriate testing platform. They had three options: Microsoft Forms, Google Forms, and e-test in the Moodle platform.

Google Forms is a full-featured forms tool that comes free with the Google account. We can add a standard question, drag-and-drop questions. We can customise the form with a simple photo or colour themes, and gather responses in Forms or save them to a Google Sheets spreadsheet. Forms are among the Internet's most versatile tools (Sivakumar, 2019).

The term Moodle was introduced by Stephen Downes and George Siemens in the year of 2008. Moodle T-L tool has gained popularity from 2012 to 2018 in various top universities in the USA like Stanford, Pennsylvania, MIT, Harward, Washington, and Michigan (Voogt et al., 2015; Van Niekerk, 2015, Basetty et al., 2020). Moodle is an e-learning software platform that can potentially be integrated into delivering any subject matter. Although Moodle has been integrated into language acquisition courses in colleges and universities, it is not a panacea for language learning and/or teaching in schools (Amer, Abu Jaber, 2012). Moodle is a popular learning tool for new-age learners that can be used for E-Learning in Computer Science education and can be developed with pedagogical principles (Basetty et al., 2020). The moodle platform was one of the options with which testing can be performed. Besides, Moodle, Microsoft Forms, and Google Forms were considered.

**Methods**

In the research of the results of testing in two different environments, we used the method of quantitative analysis and descriptive statistics, which allow us to better understand the correlation between the results obtained in on-site testing and online testing.

We set H0 (null hypothesis): *Students whose language skills were tested online achieved better results than students whose language skills were tested on-site.*

H1 (alternative hypothesis): *Students whose language skills were tested on-site achieved better results than students whose language skills were tested online.*

Knowledge testing is always performed at the end of the semester because the assessment of learning is more comprehensive when it is undertaken at the end of the programme to ensure that a student has reached a set of defined goals and objectives (Anziani, Durham, Moore, 2008).

Standardised tests were used to test the knowledge. The student could reach 100b in each test. We chose the standardised test to ensure validity and objectivity in the evaluation of results (Butašová, Lalinská, 2014). The testing took place on the university premises. During the covid-19 pandemic, teaching shifted from an on-site environment to an online environment. Online teaching took place through MS Teams, which is part of Office 365.

In the summer term, 2019/2020, and winter term 2020/2021 3124 students took part in the online testing. During the summer term 2019/2020, we explored testing options. We had 3 testing platforms available. Microsoft Forms, Google Forms, and e-test in Moodle. Office 365 includes Microsoft Forms, which lets you create simple tests. In these tests, it is possible to create questions with a choice, and questions with a short answer. Google Forms is part of the Google Account. Google Forms can be used for testing. The options are similar to Microsoft Forms, but offer a wider range of options such as short answer, paragraph, select one of the options, drop-down menu, file upload. E-test within the Moodle platform provides a wide range of knowledge testing tools such as multiple-choice, true/false, matching, short answer, numerical, essay, drag and drop into text, embedded answers (Cloze), random short-answer matching, select missing words. After comparing the individual tools within the Google Account, Office 365, and Moodle platforms, we decided on an e-test within the Moodle platform, which offers the widest range of suitable testing tools. Testing via e-test online took place in the academic years 2019/2020 (summer term) and 2020/2021 (winter term). 1483 students took place in the online testing in the summer term and 1641 students took place in the online testing in the winter term

*Participants*

The research was attended by 6068 students. 1466 students took part in testing in the academic year 2019/2020 (winter term (WT)). 1478 students carried out the tests in the academic year 2018/2019 (summer term (ST)). During this period, testing was performed in an on-site university environment. Testing via e-test took place in the academic years 2019/2020 (ST) and 2020/2021 (WT). 1483 students took part in the summer term 2019/2020. 1641 students carried out e-test in the academic year 2020/2021. The respondents were first-year bachelor's students at the University of Economics in Bratislava, whose first foreign language was English.

*Apparatus and materials*

During testing, standardised tests were used. These tests took the same form in on-site and online testing. The test consisted of 3 parts. The first part was focused on checking the knowledge of respondents from the professional vocabulary. The exercises used in this section are matching, short answers. The second part tested the knowledge of grammar. In this section, we used the short answer exercise. The final part was focused on the respondents' ability to work with the text, i.e. here we checked reading comprehension and used the drag and drop into text exercise.

*Procedures*

In the research, we compared 2 testing environments (on-site and online) and the results that students achieved. During the testing, which took place on-site in the period before the covid-19 pandemic at the university, the students registered for the exam via the AIS (Academic Information System) platform. They had a choice of at least 3 exam dates. The on-site form of testing knowledge took place in the lecture rooms. Before testing, students' participation was checked on the basis of printed attendance sheets from the AIS platform. Students had 70 minutes to complete the test.

Due to the covid-19 pandemic, the educational process has been moved into online space at colleges and universities. From this situation, the task to find a way to evaluate students in an online space arose. During the summer semester, we tried out 3 platforms that the University of Economics in Bratislava made available to us. The first platform which we tried was Microsoft Forms. This platform is part of Office 365. Microsoft

Forms can be used for testing. Subsequently, we tried Google Forms, which are part of the Google Account and are very similar to Microsoft Forms. The last platform we decided to test was the e-test in Moodle. To maintain the validity and reliability of the data, the form of online testing was practically identical to the form of on-site testing. Students had to register for the exam through AIS. They had a choice of at least 3 exam dates. The test had 100 points. If a student does not manage to obtain 51% of the grade assessment at the due date, he/she is entitled to have a second examination by the end of the exam period of the relevant semester.

**Results**

To compare the course of testing, which took place in two different environments, we used data obtained from AIS. To maintain the validity of the data we decided to compare the same number of semesters, i.e. 2 semesters (summer term 2018/19, winter term 2019/20), in which students 'knowledge of English was tested on-site at the university and 2 semesters (summer term 2019/20, winter term 2020/21), in which students' knowledge of English language was tested online.

In the comparison, we took into account the number of students who enrolled in the English language course, the number of students who successfully passed the test in due time, the number of students who successfully passed the test in the remedial period, the students who had to resit the exam, the number of students who did not attend the exam (X). In addition to the number of students, we decided to compare the ratings achieved.

In the period (summer term 2018/19, winter term 2019/20), 2944 students were to carry out the tests on-site. In the period (summer term 2019/20, winter term 2020/21), 3124 students were to carry out the tests online.

Collected data achieved from AIS we can see in table 1 and table 2 (ST – summer term, WT – winter term; A -100-91, B – 90-81, C 80-71, D 70-61, E 60-51, FX 80-0, X – student did not take part in testing).

**Table 1. On-site testing**

| term | number of students | examination in the due time | resit | X | A | B | C | D | E | FX |
|---|---|---|---|---|---|---|---|---|---|---|
| 2018/2019 ST+2019 /2020 WT | 2944 | 2136 | 418 | 390 | 268 | 416 | 530 | 584 | 505 | 251 |
| | | 73% | 14% | 13% | 9% | 14% | 18% | 20% | 17% | 9% |

**Table 2. Online testing**

| term | number of students | examination in the due time | resit | X | A | B | C | D | E | FX |
|---|---|---|---|---|---|---|---|---|---|---|
| ST 2019/2020 WT 2020/2021 | 3124 | 1641 | 1122 | 361 | 290 | 412 | 618 | 628 | 339 | 476 |
| | | 52,5% | 36 % | 11,5% | 9,2% | 13,1% | 19,9% | 20,1% | 11% | 15,2% |

The data presented in the tables were the basis for the statistical evaluation of the obtained data.

We used descriptive statistical methods to analyse the data because descriptive statistics expresses the results of statistical research in a clear form using tables, graphical representations, calculations, and descriptive characteristics. In table 3 we present a frequency distribution table which gives us information on the basic properties of the statistical file in terms of the examined feature that is provided by the frequency distribution indicators related to the on-site testing: absolute frequency ($n_i$) representing the number of students who got the specific number of points, the cumulative frequency ($N_i$), relative frequency ($f_i$), the number of all students who took part in the testing (n). The class interval ($x_i$) representing the number of points corresponding to specific grades (A – FX). $x_i'$ is the midpoint (of the class intervals).

**Table 3. On-site testing**

| Class interval | $n_i$ | $N_i$ | $x_i'$ | $x_i'*n_i$ | $\|x_i' - \bar{x}\|*n_i$ | $(x_i' - \bar{x})^2*n_i$ | $f_i$ |
|---|---|---|---|---|---|---|---|
| **91-100** | 268 | 268 | 95 | 25460 | 9468,406421 | 334517,6125 | 0,104933 |
| **81-90** | 416 | 684 | 85,5 | 35568 | 10745,22788 | 277547,8898 | 0,162882 |
| **71-80** | 530 | 1214 | 35,5 | 18815 | 12810,16641 | 309623,3271 | 0,207518 |
| **61-70** | 584 | 1798 | 65,5 | 38252 | 3404,646829 | 19848,66443 | 0,228661 |
| **51-60** | 505 | 2303 | 55,5 | 28027,5 | 2105,913273 | 8781,922207 | 0,197729 |
| **0-50** | 251 | 2554 | 25 | 6275 | 8702,201449 | 301706,4146 | 0,098277 |
| | 2554 | x | x | 152397,5 | 47236,56226 | 1252025,831 | 1 |

In data analysis, we focused on the evaluation of mode, median, quartiles, absolute deviation, and standard deviation in on-site testing and online testing. The statistical evaluation of the achieved data is used to confirm or refute hypothesis H0.

Based on the definition of modus, a modal interval is the one with the highest abundance, i.e. mode is the number that has the maximum frequency in the entire data set. In our case, most students had an evaluation of 64.65 points (grade D).

$\hat{x} = a_{\hat{x}} + h_{\hat{x}} * \frac{d_0}{d_0+d_1}$ Mod (x) = 61+9*((584-530)/((584-530)+(584-505))) = 64,65414

The median represents the mean value of an ordered statistical file. Median is the point that divides the entire data into two equal halves. One-half of the data is less than the median, and the other half is greater than the same. Half of the students who took the test on-site have 61, 97 points or less and half of the students have 61, 97 points or more.

$\tilde{x} = a_{\tilde{x}} + h_{\tilde{x}} * \frac{r-N_{\tilde{x}-1}}{n_{\tilde{x}}} \quad r = \frac{k}{\alpha} * n \rightarrow median: r = \left(\frac{1}{2}\right) * n$

r = (1/2)*2554 = 1277

Med (x) = 61+9*((1277-1214)/584) = 61,97089

Quartiles are the points in the data set that divides the data set into four equal parts. $Q_1$, $Q_2$ (median), and $Q_3$ are the first, second, and third quartiles of the data set.

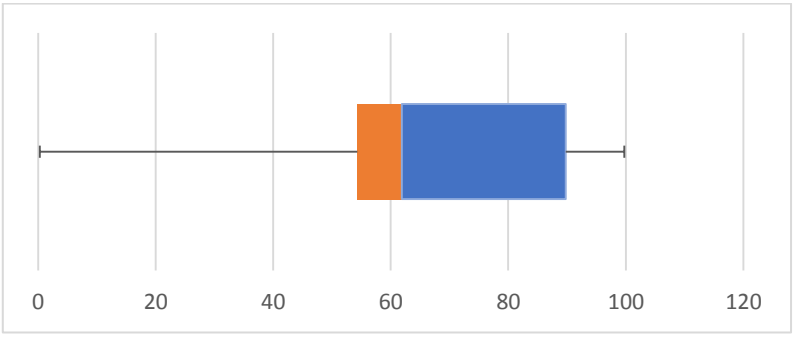
$\tilde{x} = a_{\tilde{x}} + h_{\tilde{x}} * \frac{r-N_{\tilde{x}-1}}{n_{\tilde{x}}} \quad r = \frac{k}{\alpha} * n \rightarrow Q1: r = \left(\frac{1}{4}\right) * n \quad r = \frac{k}{\alpha} * n \rightarrow Q2: r = \left(\frac{3}{4}\right) * n$

$Q_1$ r = 638,5 Q1 = 81+9*((638,5-268)/416) = 89,01563

$Q_3$ r=1915,5 Q3 =51+9*((1915,5-1798)/505) = 53,09406

The lower quartile means that 25% of students have 89.02 points or less and 75% of students have 89.02 points or more. The third quartile means that 75% of students have 53.09 points or less and 25% of students have 53.09 or more points. These values are also expressed in the box and whisker plot graph.

| | | Difference |
|---|---|---|
| Min. | 0 | 0 |
| Q1 | 53,09406 | 53,09406 |
| Q2,Med(x) | 61,97089 | 8,87683 |
| Q3 | 89,01563 | 27,04474 |
| Max. | 100 | 10,98437 |




**Graph 1. Box and Whisker Plot – Online Testing**

The Absolute Deviation from Mean (MAD), describes the variation in the data set, in the sense that it tells the average absolute distance of each data point in the set. In the on-site testing, it is 18,49513. The number of points for individual students differs from the average value by an average of 18.50 points.

$\bar{d} = \frac{1}{n} * \sum|x_i' - \bar{x}| * n_i$ $\bar{d}$= (1/2554)*47236,56226 = 18,49513

The standard deviation (s) is the average amount of variability in the dataset. It tells us, on average, how far each value lies from the mean. In this research it is the number of points that students gained during on-site testing, differing by an average of 22.14 points.

$S^2 = \left(\frac{1}{n}\right) * \sum(x_i' - \bar{x})^2 * n_i$ s = $\sqrt{(s^2)}$

$s^2$ = (1/2554)*1252025,831 s = $\sqrt{(s^2)}$ = 22,1409

Table no. 4, in contrast to Table no. 3, provides information related to online testing. It presents a frequency distribution table which gives us information on the basic properties of the statistical file in terms of the examined feature that is provided by the frequency distribution indicators related to the online testing such as absolute frequency ($n_i$) representing the number of students who got the specific number of points, the cumulative frequency ($N_i$), relative frequency ($f_i$), the number of all students who took part in the testing (n). The class interval ($x_i$) representing the number of points corresponding to specific grades (A – FX). $x_i'$ is the midpoint (of the class intervals).

**Table 4. Online testing**

| Class interval | $n_i$ | $N_i$ | $x_i'$ | $x_i'*n_i$ | $\|x_i' - \bar{x}\|*n_i$ | $(x_i' - \bar{x})^2*n_i$ | $f_i$ |
|---|---|---|---|---|---|---|---|
| **91-100** | 290 | 290 | 95 | 27550 | 11117,3489 | 426191,1948 | 0,104958 |
| **81-90** | 412 | 702 | 85,5 | 35226 | 11880,30257 | 342576,6727 | 0,149113 |
| **71-80** | 618 | 1320 | 35,5 | 21939 | 13079,54615 | 276819,6236 | 0,22367 |
| **61-70** | 628 | 1948 | 65,5 | 41134 | 5548,810713 | 49027,54829 | 0,227289 |
| **51-60** | 339 | 2287 | 55,5 | 18814,5 | 394,7024973 | 459,5577031 | 0,122693 |
| **0-50** | 476 | 2763 | 25 | 11900 | 15072,21354 | 477251,3044 | 0,172277 |
| | 2763 | x | x | 156563,5 | 57092,92436 | 1572325,901 | 1 |

The most frequent value that appears in the online marking is 61,30, i.e. the most students had a score of 61.30 points (grade D).

$\hat{x} = a_{\hat{x}} + h_{\hat{x}} * \frac{d_0}{d_0 + d_1}$ mod (x) = 61+9*((628-618) / ((628-618) + (628-339))) = 61,301

The median of 61,88137 indicates that half of the students who took the test online have 61,88 points or less and half of the students have 61,88 points or more.

$\tilde{x} = a_{\tilde{x}} + h_{\tilde{x}} * \frac{r - N_{\tilde{x}-1}}{n_{\tilde{x}}}$ $r = \frac{k}{\alpha} * n \rightarrow median: r = \left(\frac{1}{2}\right) * n$

$\tilde{x}$=61+9*((1381,5-1320)/628) = 61,88137

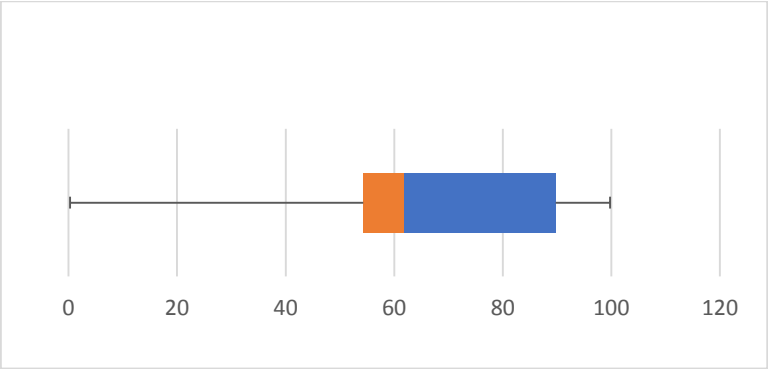
The lower quartile, denoted as $Q_1$, is 89,7542. It is the middle number that falls between the smallest value of the dataset and the median. The lower quartile means that 25% of students have 89,75 points or less and 75% of students have 89,75, and more points. The third quartile or the upper quartile is 54,2986 and it is the central point that lies between the median and the highest number of the distribution. The third quartile, denoted as $Q_3$, means that 75% of students have 53.30 points or less and 25% of students have 53.30 or more points.

$\tilde{x} = a_{\tilde{x}} + h_{\tilde{x}} * \frac{r - N_{\tilde{x}-1}}{n_{\tilde{x}}}$ $r = \frac{k}{\alpha} * n \rightarrow Q1: r = \left(\frac{1}{4}\right) * n$ $r = \frac{k}{\alpha} * n \rightarrow Q2: r = \left(\frac{3}{4}\right) * n$

Q1 =81+9*((690,75-290)/412) = 89,7542

Q3 = =51+9*((2072,25-1948)/339) = 54,2986

| | | Difference |
|---|---|---|
| Min | 0 | 0 |
| Q1 | 54,29867 | 54,29867 |
| Q2, Med. | 61,88137 | 7,5827 |
| Q3 | 89,75425 | 27,87288 |
| Max | 100 | 10,24575 |




**Graph 2. Box and Whisker Plot – Online Testing**

The absolute deviation from the mean in the online testing is 20,66338, i.e. the number of points for individual students differs from the average value by 20.66 points on average.

$\bar{d} = \frac{1}{n} * \sum|x_i' - \bar{x}| * n_i$ $\bar{d}$= (1/2763)*57092,92436 = 20,66338

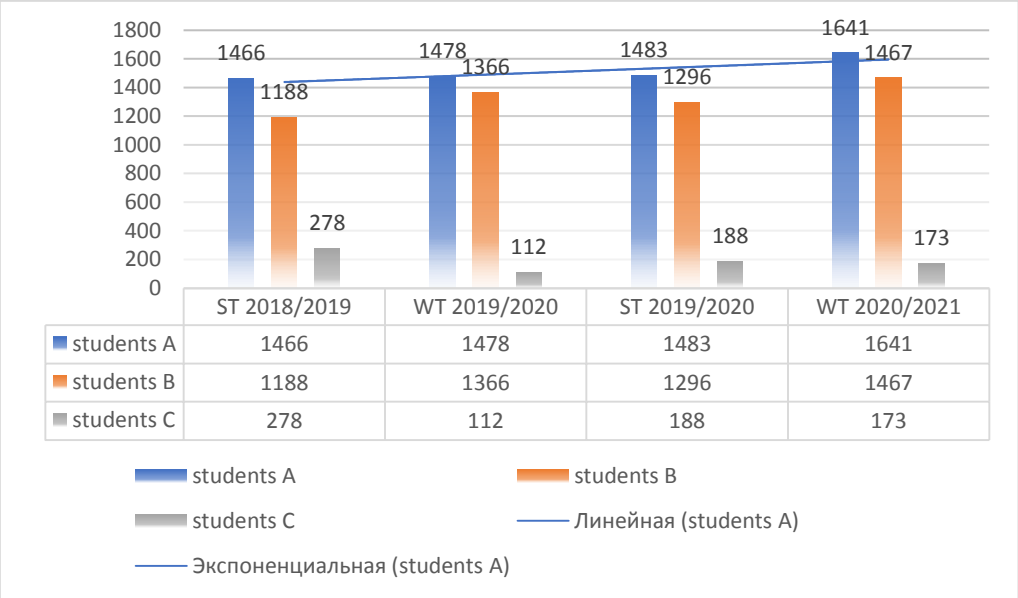
The standard deviation (s) in the number of points that students obtained during online testing is 23,855, i.e. the number of student points during online teaching differs by an average of 23.86 points.

$S^2 = \left(\frac{1}{n}\right) * \sum(x_i' - \bar{x})^2 * n_i$ $s = \sqrt{(s^2)}$

$S^2$=(1/2763)*1572325,901 = 569, 064 $s = \sqrt{(s^2)}$ = 23,855

In on-site and online testing, the average evaluation of students is mark D. The difference is in the average number of points that students achieved. In the on-site form of testing, students surprisingly achieved an average of 3.35 points more. There are also differences in other parameters. The standard deviation of the number of points achieved by students who took the test in person is 22.15. The standard deviation of the number of points achieved by students who took the test online is 23.86.

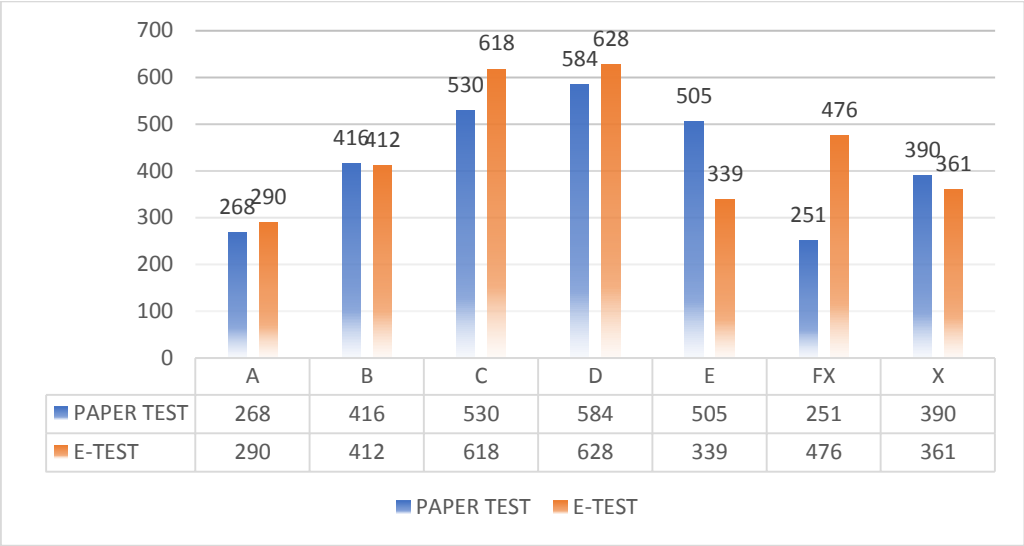
On bar graph no. 3 we see the numbers of students in each semester who were admitted to the university (Students A), the numbers of students who actively participated in the teaching (Students B), and the numbers of students who did not participate in the educational process (Students C). During the summer term, 2018/2019 and the winter term 2019/2020 students took exams on-site. During the summer term, 2019/2020 and the winter term 2020/2021 students took exams online. In bar graph no. 3 we can see the differences in individual categories.




**Graph 3. Number of Students**

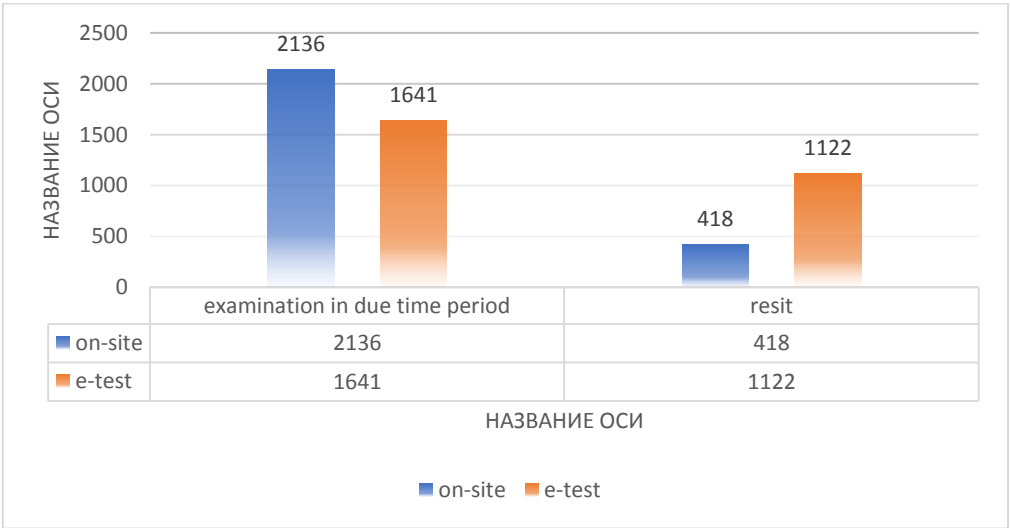
Bar graph no. 4 shows marks achieved in on-site and online testing. The most commonly used rating is D in both types of testing. The most surprising finding is that the FX rating is significantly higher in online

testing. 476 students were rated FX in online testing compared to 251 students who were rated FX in on-site evaluation, i.e. the difference in rating FX between on-site and online is 225 students that count against online testing.




**Graph 4. Marking**

In table 5, we see a comparison of the number of students who successfully passed the test for the first time with the number of students who had to resit the exam again. The result is surprising. 84% of students who took the on-site test successfully passed the test for the first time, and only 16% of all students who took the test had to take the test again. The situation is significantly different in online testing, where only 59% of students successfully passed the test for the first time and 41% of students had to resit the test again.




**Graph 5. Examination in due time period versus resit**

**Discussion**

The European Parliament resolution on the future of European education in the context of the COVID-19 pandemic (2020/2760 (RSP)) states that the COVID-19 pandemic has perhaps caused the most serious disruption to global education and training systems in history, with a whole generation of students at risk of losing areas of study, and whereas a pandemic could reverse the progress made over several decades. These losses are likely to lead to lower future incomes for the generation concerned and may also have a negative impact on labour productivity growth and the competitiveness of the European Union as a whole because the same generation is facing labour market entry, which is significantly affected by the economic crisis caused by the COVID-19 pandemic.

The research of online teaching during the pandemic revealed the unpreparedness of universities and teachers for a sudden change in the teaching environment. At the beginning of the pandemic, most university teachers submitted assignments via email and were looking for ways to implement the teaching in the online environment. By the end of the summer term 2019/2020, teachers were better oriented in the online environment and were preparing for the final online testing of students' knowledge. The testing was carried out in a significantly different environment from the traditional classroom environment. The task of the research team was to find the most suitable way of testing knowledge in the online environment, to analyse the achieved results, and compare them with the results achieved by students whose knowledge was tested on the university premises in the period just before the covid-19 pandemic.

In the research, we decided to use quantitative analysis and descriptive statistics, which would allow us to compare the results of testing achieved by the students that sat for the examination, as we mentioned before, in two different environments, on-site at the university premises and online at home. The aim of the research was to determine in which environment the students achieved better results.

The first step was to find the most appropriate way to implement the test. We looked at the 3 testing options we had available: Microsoft Forms, which is part of Office 365 Forms, Google Forms, which is part of the Google Account, and e-test in the Moodle platform. Different platforms offer different options for testing We evaluated Microsoft Forms as the weakest platform concerning testing. This platform offers very limited options that can be used as a supplement to teaching, or for simple testing of knowledge. Short answers can be used in the test, a choice of several options. Google Forms are similar to Microsoft Forms, but easier to use, it is possible to change the form in the test (this option is not in the Microsoft Forms, i.e. if you forget to set the form as a test you cannot change it in the Microsoft Forms). The Google Forms environment is more intuitive than Microsoft Forms, i.e. tests or exercises are easier to create, offer a wider range of options.

We evaluated the e-test in Moodle as the best platform. This platform met our requirements. It offers a wide range of testing exercises: multiple-choice, true/false, matching, short answer, numerical, essay, drag and drop into text, embedded answers (Cloze), random short-answer matching, select missing words. The advantage of this platform is a wide range of exercises. This e-learning platform can serve as teaching support, for example for handing over assignments, assessment, testing knowledge. Another advantage is that all teachers and students of the university have access to this platform. The disadvantage is that for creating some exercises the code is required.

During 4 terms, we tested a total of 6068 first-year full-time students for bachelor's studies. 2944 students wrote the test on-site and 3124 wrote the test online.

Based on the analysis of the data and their statistical evaluation, we can conclude that students who sat for the examination in person on the university premises achieved significantly better results than students who took the test online. If we compare their marks, only 9% of students who took the test in person received FX marks, i.e. the knowledge of 9% of students was insufficient and the students did not pass the exam. 15% of students who sat for the examination online fail the exam. As we can see the difference is 6%. There are also differences in the marks from A-E between the compared groups of students, but they are not as significant as in the FX evaluation.

By evaluating the data obtained from AIS, we refuted hypothesis H0 (null hypothesis): *Students whose language skills were tested online achieved better results than students whose language skills were tested on-site.*

We confirmed alternative hypothesis H1: *Students whose language skills were tested on-site achieved better results than students whose language skills were tested online.*

This result surprised us. We expected students to achieve better results in an online environment that is close to them. We assume that this result is significantly influenced by the fact that these students, who wrote the online test, also completed the online educational process. As we stated in the introduction, the educational process in the online environment does not have the same level as the on-site educational process, in which all participants in the educational process are present.

The situation in which we found ourselves, and in which the testing was carried out during the covid-19 pandemic at the University of Economics, is different from testing, which took place in person at the university premises. Examination during the covid-19 pandemic was performed under completely different conditions. Students carried out the exam from home. They had to use their computers. Slow, unsteady Internet or limited access to the Internet from home was often a problem during the educational process and also during taking the test, especially for students from villages where the Internet coverage was limited. Teachers were also confronted with similar problems. We assume that technical problems may have also affected the results achieved during the testing.

The research of online learning is nothing new and online course of instruction has already long been present in many universities, mostly as part of blended learning, at all academic levels and forms of education, being more manifestly used in the case of distance-learning programmes (Schiffman et al., 2019, Balula, Moreira, 2014, Maican, Cocorada, 2021). The issue of online testing, which would not take place in computer laboratories at university premises, has not received much attention so far, as no one expected a pandemic that would cause a long-term shift of on-site education to online education, which ends with online testing of knowledge from home. We believe that the covid-19 pandemic will change the way scientists look at this issue and that online testing will get more attention from the scientific community. We see a space for research into the methodology and didactics of not only online education, but also online testing. The results of such research would help teachers to better orient themselves in the possibilities of online education and testing of students' knowledge.

## Conclusions

In this article, we looked at the results of testing in two different environments. The first case involved testing the language skills of the students of the University of Economics in Bratislava on-site. Teaching that preceded testing was conducted in person, i.e. students in person attended classes. In the second case, students' language skills were tested in the online environment and the educational process was carried out online.

Based on the analysis of the achieved data, we can conclude that students whose teaching took place online and also carried out the online test, achieved worse results than students who participated in the course in person and completed the test on-site. This fact was also confirmed by the result of our research.

The covid-19 pandemic showed the state of education. The informatisation of schools is necessary, but in a covid-19 pandemic, it is clear that this is not enough. Education moved to a home environment where families faced the lack of adequate technical equipment. In addition to computers, they also had to secure the Internet, which was often unstable and slow. Teachers faced the same problem.

This state opens the door to further research, the aim of which would be to find out how students and teachers perceive online education. And how the Ministry of Education should help to secure the educational process in the event of a pandemic.

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