



Student performance: is there any difference between traditional and distance learning?

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Abstract: Traditionally, distance learning has to be effectively designed to ensure the achievement of learning outcomes. Many studies have examined student performance in a well-prepared distance learning environment, but just a few have addressed the situation that required fast transition from traditional way of study to distance learning (like that one caused by Covid-19). The purpose of this study is to compare student performance in the traditional and unprepared distance learning environment. Chi-square and correlation analysis were performed to answer if statistically significant there existed any difference in student performance between two modalities. The results of this study may contribute to present and future researches, legislation in the area of Higher Education, Higher Education Institutions and teachers when creating distance courses.

Keywords: distance learning, student performance, higher education

JEL: I21, I23

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DOI 10.32015/JIBM.2021.13.2.8

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Journal of Innovative Business and Management
ISSN 1855-6175

Uspešnost študentov: ali obstaja razlika med tradicionalnim učenjem in učenjem na daljavo?

Povzetek: Tako kot tradicionalno učenje, mora biti tudi učenje na daljavo učinkovito zasnovano, da zagotovi doseganje učnih rezultatov. Številne raziskave so preučevale uspešnost študentov v kakovostno pripravljenem učnem okolju na daljavo, a le nekaj jih je namenjenih situaciji, ki je zahtevala hiter prehod s tradicionalne oblike učenja na učenje na daljavo (kot je bila tista, ki jo je povzročila pandemija Covid-19). Namen te raziskave je primerjati uspešnost študentov v tradicionalno pripravljenem učnem okolju z uspešnostjo v nepripravljenem učnem okolju na daljavo. Hi-kvadrat in korelacijska analiza sta bila izvedena z namenom pridobivanja odgovora o tem, ali obstaja statistično pomembna razlika v uspešnosti študentov med dvema modalitetama. Rezultati te raziskave lahko prispevajo k sedanjim in prihodnjim raziskavam, zakonodaji na področju visokega šolstva, delovanju visokošolskih zavodov in delu profesorjev pri oblikovanju tečajev na daljavo.

Ključne besede: učenje na daljavo, uspešnost študentov, visoko šolstvo

1 INTRODUCTION

The dramatic growth and development of information technology have made a significant contribution to business, politics, economy and society, to any organisation and human lives. Consequently, the potentials have been noticed in the educational sector, especially in the sense of increasing flexibility at all levels, such as reinforcing accessibility, reducing the cost of education. This also means applying the distance/online/e-learning and different ICT tools, in order to facilitate student-teacher communication, different opportunities for lifelong learning with their professional development, etc. (Mesfin, et al., 2018). According to these possibilities, over the last decade, a great number of Higher Education Institutions (HEIs) around the world have introduced the distance learning system in the area of formal, as well as informal education. Additionally, the latest surveys refer to the increase in the number of people who have participated in some kind of distance learning (Eurostat, 2020; Yu and Hu, 2016; Kenzig, 2015). In European Union, 8% of people aged 16 to 74 attended an online course in the last three months prior to the survey conducted in 2019. In 2010, that percentage was 4% (Eurostat, 2020).

Regarding the data from the National Entity for Accreditation and Quality Assurance in Higher Education of Serbia (NEAQA, 2021), 12 academic and six professional HEIs have (accredited) study programmes for distance learning (the total number of accredited institutions is 206). However, new circumstances caused by the Covid-19 pandemic have forced most HEIs, including those in Serbia, to perform transition from traditional (classroom) education to online education without any previous preparation activities. In that situation, HEIs, as well as teachers and students, have faced many challenges: (un)availability of technical equipment, the levels of specific ICT skills among teachers and students, adaptability of course content and teaching methods, efficiency and effectiveness of teaching and learning, student motivation and perseverance, student internet access etc. (Gaebel, et al., 2021). Responses and experiences are different among countries and HEIs (Gaebel, et al., 2021; Li and Lalani, 2020).

This paper examines the first-year students' performance indicated by efficiency and final course grade (below: FCG) in different learning environments - traditional (classroom) and distance learning. It is known that the first-year students have faced many challenges in traditional learning that could have affected their performance. Therefore, the authors found it interesting to examine first-year student performance in the situation of prompt transition to distance learning, in the circumstances of lockdown: they did not know well each other, their teachers or surroundings; the institution was closed, and all activities were performed online without previous preparation. The survey was conducted according to the data obtained at the Academy of Applied Technical Studies Belgrade, Department of Belgrade Polytechnic. That institution, like many others, was forced to introduce online learning because of the situation caused by the Covid-19.

2 DEFINITION, ADVANTAGES AND EFFECTIVENESS OF DISTANCE LEARNING

Regarding the literature, online learning can be traced back to the beginning of the 20th century (Sadeghi, 2019; Meyer, 2002; Hanson, et al., 1997). It was linked with the communication process where the message could be transferred in the form of a lesson, and sender could use various devices from different eras of communication technologies that were characteristic for a certain period of time (Sadeghi, 2019). Today, the overall growth of ICT has given a new direction to online learning, "allowing distance learning to occur in real time" (Valentine, 2002). Some contemporary definitions explain online learning as "virtual school", as well as the "process of education by the use of technology without the need for the instructor and the learner to be in the same location, or for them to be communicating at the same time" (Simonson, Zvacek and Smaldino, 2015, pp.36). The term of distance learning is used to point out limitations related to "distance" - location and time (Newby, Stepich, Lehman, & Russell, 2000; Guilar & Loring, 2008 cited in Moore, 2010); as a way of reaching learners in the distance (Greenberg, 1998); as a "result concerning the technological separation of teacher and student which frees the student from the necessity of travelling to a fixed place, at a fixed time, to meet a fixed person, in order to be trained" (Keegan, 1995, pp.7 cited in Valentine, 2002). Regarding these definitions, they have one thing in common - online learning is a process of education that does not require classroom presence of students.

There is no doubt that online learning has many of advantages. For HEIs, it is an opportunity to increase access to learning and training to a wider audience, thus providing lifelong learning,

reducing the cost of education, improving the quality of teaching methods, enhancing flexibility for employed students and/or those who have family commitments, and attracting international students. From the students' point of view, online learning enables overcoming the distance in location and time, improving digital skills, it includes the reduction of learning costs, immediate feedback, harmonization between learning and working, avoiding social influences, etc. (Sadeghi, 2019; Moore & Kearsley, 2011 cited in Firat, 2017; Kenzig, 2015; Xu and Jaggars, 2011).

Beside these advantages, the question that occupied many scholars was related to student performance (academic achievement) regarding different course delivery modalities (traditional and online). The student performance can be measured in different ways - through pre-exam activities, FCG, total engagement, retention, as well as added knowledge and skills (Ni, 2013). Findings in this area of study are quite different. Some results show that when online courses are well prepared, there is no significant difference in student results between traditional and online learning (Gagne & Shepherd, 2001 cited in Sadeghi, 2019; U.S. Department of Education, 2009 cited in Kenzig, 2015; Ni, 2013; Figlio, Rush & Yin, 2010 cited in Xu and Jaggars, 2011; Friday, et al., 2006 cited in Daymont & Blau, 2008; McCleary and Egan, 1989; Souder, 1993 cited in Campbell, Floyd and Sheridan, 2002), or distance students performed significantly better (Campbell, Floyd and Sheridan, 2002). On the other hand, the findings support the thesis that students achieved better results through traditional learning (Nelson, 2006; Brady, 2001; Faux & Black-Hughes, 2000; Carr, 2000 cited in Atchley, Wingenbach & Akers, 2013).

Additionally, most studies underlined that effectiveness of online learning depended on different factors. Elumalai, et al. (2020) found that administrative support, course content, course design, instructor characteristics, learner characteristics, social support and technical support had a positive relationship on the quality of online learning. Same authors indicated significant differences in the quality of e-learning regarding gender and course level. Opposite results in terms of relationship between gender and online student performance were found by Papageorgiou and Halabi (2014). They proved that academic aptitude had great contribution to student performance. Based on the number of researches, Atchley, Wingenbach & Akers (2013, pp.113) in their study concluded that "some disciplines may not be well-suited to online delivery". Some other studies linked online student performance with their characteristics like prior knowledge, motivation, preferences, culture, self-confidence, level of responsibility, etc., as well as with teachers' efficiency and effectiveness. Hence, the number of factors have influence on online student performance.

All mentioned studies examined student performance in a well-prepared and designed online learning environment. But, what is happening with student performance when the online learning environment is unprepared, in the circumstances of sudden transition to distance learning? Guided by the issue mentioned, the authors formulated the following research questions:

- Q1: Is there a significant difference between traditional and online student performance?
- Q2: Is there a relationship between traditional and online student performance regarding subject area?

In this paper, the distance learning was defined as process of education without the classroom presence of students, performed by the usage of available tools (Google classroom, Moodle, Canvas, Google Meet, Zoom, YouTube, e-mail, etc.). On the contrary, traditional learning was perceived as a process of education "with no online technology used where content is delivered in writing or orally" (Allen and Seaman, 2008, pp. 4). The other dimensions of the teaching process (teachers, course contents and requirements) were unchanged. For course classification into subject areas the authors used ISCED-F 2013 (UNESCO, 2015).

3 ANALYSIS OF STUDENT PERFORMANCE

3.1 Methodology

The study was based on the comparative analysis and included data of student examination results consisting of the courses studied in the first year of nine undergraduate programmes. The presented data joined student results of the first and second examination terms after autumn and spring

semesters in the 2018/2019, 2019/2020 and 2020/2021 academic years. In the 2018/2019 academic year, students were taught in traditional way; in the autumn semester of 2019/2020 students completed courses in traditional way and the spring semester in the online environment. Students enrolled in 2020/2021 participated in online learning environment only. All examinations were performed in the traditional way.

The student efficiency was measured through the percentage of passing the exams in each exam period, whereas FCG was calculated as the average course grade. To present the results by subject area, the average grade was calculated as the arithmetic mean of the grades in the given exam period, i.e. as the quotient of the sum of the obtained grades and the number of grades for each subject area.

Data were systematized by the SPSS and Excel programmes. Descriptive statistics is used to extract data by the course modality and to express mean values. To answer the research questions and to find (possible) connections between variables, we performed the Chi-square and correlation analysis. Kolmogorov-Smirnov test was used to examine the normality of the sample.

3.2 Result Analysis

The research question one was to determine the existence of significant difference between traditional and distance student performance. For this purpose, the authors extracted data that included the total number of registered exam applications, the number of students who took the exams and the number of students who passed the exams together with FCG (Table 1).

Table 1 Data extracted by course modality

<i>Subject area</i>	<i>Course modality</i>	<i>No of registered for the exam</i>	<i>No of took the exam</i>	<i>No of passed the exam</i>	<i>% of passed the exam</i>	<i>FCG*</i>
Mathematics and Statistics	traditional	85	81	40	49.38	6.23
Engineering and Engineering trade		1106	954	608	63.73	6.84
Business and Administration		242	190	113	59.47	5.87
ICT		420	405	388	95.80	8.20
Physical Sciences		133	109	56	51.37	6.28
Social and Behavioural sciences		117	74	53	71.62	7.13
Languages		371	327	281	85.93	7.89
Arts		1590	1467	1465	99.86	8.61
SUM/AVERAGE		4064	3607	3004	83.28	7.95
Mathematics and Statistics	distance	58	57	27	47.37	5.87
Engineering and Engineering trade		694	611	399	65.30	7.02
Business and Administration		169	140	75	53.57	6.59
ICT		350	311	254	81.67	8.01
Physical Sciences		224	93	60	64.52	6.45
Social and Behavioural sciences		149	99	99	100.00	8.37
Languages		254	235	201	85.53	7.46
Arts		1069	895	880	98.32	8.86
SUM/ AVERAGE		2967	2441	1995	81.73	8.02

*Column FCG - the rank of grades is from 5 (fail) to 10 (excellent)

(Source: own calculations, based on data collected in the Department of Belgrade Polytechnic)

The results obtained by applying descriptive statistics (Table 1) indicate several significant differences among student results regarding modalities and subject areas. The results of student efficiency are better in traditional modality particularly in the following two areas: Business and Administration and ICT. Otherwise, online student efficiency is higher in those two areas: Physical Sciences and Social - Behavioural Sciences. The average grade of the students who completed the courses in online environment is generally higher, except for three subject areas: Mathematics and Statistics, ICT and Languages. This could be explained by the fact that these subject areas require more detailed prior knowledge that takes more time related to the preparation and learning than other areas of study.

With respect to the previous data, the next step in the analysis was to examine the associativity between student performance (measured through efficiency and FCG), and course modality. For this purpose, Chi-square test was conducted. Table 2 shows that student efficiency is not associated with the course modality, $\chi^2(4999) = 146.747$, $p < 0.05$.

Table 2 Chi-Square Tests (student efficiency and course modality)

	<i>Value</i>	<i>df</i>	<i>Asymptotic Significance (2-sided)</i>
Pearson Chi-Square	146.747 ^a	18	.000
Likelihood Ratio	157.378	18	.000
Linear-by-Linear Association	1.274	1	.259
N of Valid Cases	4999		
a. 4 cells (10,5%) have expected count less than 5. The minimum expected count is 1,27.			

(Source: own calculations, based on data collected in the Department of Belgrade Polytechnic)

Concerning the associativity between the FCG and the course modality, Table 3 shows that, although the high value of $\chi^2(4999) = 323.061$ indicates that the association exists, and the p-value is less than 0.001, so consequently the FCG is not associated with the course modality.

Table 3 Chi-Square Tests (FCG and course modality)

	<i>Value</i>	<i>df</i>	<i>Asymptotic Significance (2-sided)</i>
Pearson Chi-Square	323.061 ^a	5	.000
Likelihood Ratio	342.904	5	.000
Linear-by-Linear Association	41.688	1	.000
N of Valid Cases	4999		
a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 27,14.			

(Source: own calculations, based on data collected in the Department of Belgrade Polytechnic)

The research question two was to determine a relationship between traditional and online student performance, regarding subject area. In this regard, the correlation analysis was applied. In the traditional modality, results given in Table 4 indicate positive and strong correlations in both cases - between student efficiency and subject area (0.608, with significance at the 0.01 level), and between FCG and subject area (0.593, with significance at the 0.01 level).

Table 4 Correlations in the traditional modality

		<i>Subject area</i>	<i>FCG</i>	<i>Student efficiency</i>
Subject area	Pearson Correlation	1	.593**	.608**
	Sig. (2-tailed)		.000	.000
FCG	Pearson Correlation	.593**	1	.758**
	Sig. (2-tailed)	.000		.000
Student efficiency	Pearson Correlation	.608**	.758**	1
	Sig. (2-tailed)	.000	.000	

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

(Source: own calculations, based on data collected in the Department of Belgrade Polytechnic)

Similar results were obtained for students who completed courses in online modality. Table 5 shows positive and strong correlations between student efficiency and subject area (0.575, with significance at the 0.01 level) and between FCG and subject area (0.615, with significance at the 0.01 level).

Table 5 Correlations in the distance modality

		<i>Subject area</i>	<i>FCG</i>	<i>Student efficiency</i>
Subject area	Pearson Correlation	1	.615**	.575**
	Sig. (2-tailed)		.000	.000
FCG	Pearson Correlation	.615**	1	.763**
	Sig. (2-tailed)	.000		.000
Student efficiency	Pearson Correlation	.575**	.763**	1
	Sig. (2-tailed)	.000	.000	

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

(Source: own calculations, based on data collected in the Department of Belgrade Polytechnic)

Comparing the results of two modalities (Table 4 and Table 5), it can be concluded that the relation between subject area and FCG is slightly higher in online than in traditional way of learning. However, the relation between subject area and the student efficiency is smaller online than in traditional modality.

4 DISCUSSION AND CONCLUSIONS

As the online learning is not a new phenomenon, in the literature review we found many studies investigated the efficiency and effectiveness of distance learning regarding different factors, as well as differences in student performance between online and distance learning. Most of these studies examined mentioned parameters in a well-prepared online learning environment. The findings varied - from online learning advantages and disadvantages to different factors that affect the efficiency and effectiveness of online learning. Concerning student performance, one group of authors found that there was no significant difference between traditional and online learning, another group pointed out that online students performed significantly better, and the third group

stated that students obtained better results by traditional learning.

The findings of this study support the authors who claimed that there is no significant difference in student performance between online and traditional learning. The descriptive statistics indicates an increase in student average efficiency related to traditional modality, but the average of the final course grade is slightly higher in online modality. However, performed Chi-square test indicates that a statistically significant difference does not exist in the student performance between distance and traditional modalities.

Concerning the relation among student performance, subject area and course modality, the descriptive statistics shows varied results. In some subject areas, students performed better in traditional modality, but in the other areas, results were better in online modality. The relation among these parameters was examined by correlation analysis. Obtained results indicate positive and strong correlation between student efficiency/final course grade and subject area in both modalities. Consequently, it can be concluded that student performance depends on the subject area, but this relationship does not depend on the course modality.

Although the online learning modality was unprepared - caused by circumstances of the Covid-19 pandemic, the student performance has been satisfactory, and in some subject areas even better than in traditional learning modality. These findings support previous findings and can be a good basis for future research. They may contribute to national legislation in the sense of changing the actual standards and eligibility criteria for introducing online learning in HEIs. Finally, the results of this study may be helpful at the institutional level with respect to making decisions about introduction of online learning.

Acknowledgments

Some parts of this paper have been presented at the 5th International Scientific Conference on Economics & Management - EMAN 2021 (<https://eman-conference.org/>)

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