Humanities & Social Sciences Reviews
eISSN: 2395-6518, Vol 8, No 4, 2020, pp 1083-1093
https://doi.org/10.18510/hssr.2020.84103

ANALYSIS OF THE CONSEQUENCES OF THE TRANSITION TO ONLINE LEARNING ON THE EXAMPLE OF MOOC PHILOSOPHY DURING THE COVID-19 PANDEMIC

Daria Bylieva[1*], Zafer Bekirogullari[2], Victoria Lobatyuk[3], Tatiana Nam[4]
[1*,3]Department of Social Science, Peter the Great St. Petersburg Polytechnic University, Russia; [2]Department of Psychology, Faculty of Arts and Sciences, Near East University, Cyprus; [4]Graduate School of Engineering Education, Psychology and Applied Linguistics, Peter the Great St. Petersburg Polytechnic University, Russia.
Email: [*]bylieva_ds@spbstu.ru

Article History: Received on 16th July 2020, Revised on 19th August 2020, Published on 11th September 2020

Abstract

Purpose of the study: The situation of a mass transition of Universities to online education in the period of the COVID-19 pandemic allowed us to see the challenges of distance e-learning in practice. In this unique situation, the same students studying the same course changed only the form of education, which allows us to see the consequences of such a transition. The purpose of the study is the analysis of changes in students' educational activities in the transition to online learning.

Methodology: The article provides a quantitative statistical analysis of changes in the behaviour of first-year students of Peter the Great St. Petersburg Polytechnic University (N=3122) in the framework of studying the mass open online course "Philosophy" on the platform open.edu when switching to fully e-learning in March 2020. The authors have applied data mining MOOCs from students' learning portfolios.

Main Findings: Existing technological solutions and educational technologies made it possible to quickly adapt the education system to the distance format. However, the transition to fully e-learning has led to a sharp increase (by 16-17%) in the number of students who do not participate in intermediate tests and not doing homework in the e-course and later did not return to normal learning.

Applications of this study: Since modern higher education is increasingly using e-learning, it is necessary to anticipate the consequences of the implementation of e-learning. The study helps to see general trends in this area.

Novelty/Originality of this study: The study provides an analysis of students' learning when switching to online education based on data taken directly from students' learning portfolios, which allows us to see a completely objective picture of changes in students' behaviour.

Keywords: *Online Learning, E-learning, MOOC, COVID-19, Higher Education.*

INTRODUCTION

The measures taken by different governments during the COVID-19 pandemic have dramatically changed the social life of people in all its aspects. There should be noted the increased role of information and communication technologies during the lockdown period, which on the one hand allowed many people to continue their normal activities, work, study, shopping, etc., on the other hand, served as a source of constant anxiety (Pan et al., 2020; Xie et al., 2020). The closure of schools has exacerbated problems of social inequality in society. Parents faced the problem of having to actively participate in the educational process and spend more time on home childcare. It is also worth noting that there is insufficient access to distance learning due to the difficulties related to the technical support of the process. (Armitage & Nellums, 2020; Dunn et al., 2020). There are also difficulties due to the lack of suitable courses, the need to train teachers, interaction with children with special educational needs, etc. (Petretto et al., 2020; Zhang et al., 2020). However, despite the above-mentioned facts, it turned down that education is among the most prepared fields.

Higher education turned out to be in a better position as the platforms of mass open courses and LMS of universities have already collected a vast library of various classes (Evseeva et al., 2020; Odinokaya et al., 2019; Pokrovskaia et al., 2018; Pozdeeva et al., 2019; Razinkina et al., 2019). Also, social networks play an essential role in communication between teachers and students (Al-Bahrani et al., 2017; Al-Musawi et al., 2020; Hamid et al., 2015; Narayan et al., 2019; Quansah et al., 2016; Sobaih et al., 2016). Ant technologies for involving students in the electronic educational process have been developed (Berisha et al., 2019; Hong et al., 2020; Moccozet et al., 2014; Nasser & Musawi, 2020). The most problematic courses are those that require direct physical participation, but there has been a recent development in this area that allows them to create virtual laboratories, simulators, etc. (Moskaliuk et al., 2013; Ng & Or, 2020). However, there are problems with high-stake assessments and graduation (Alawamleh, 2020).

Today we have the opportunity to assess in general terms some of the consequences of changing the form of education. In particular, this article presents data demonstrating what exactly changed in the educational activities of students of Peter the Great St.Petersburg Polytechnic University (SPbPU) in the framework of the MOOC course of philosophy, which at the beginning of the spring semester was supplemented by face-to-face classes, which cancelled on March 16. Thus, in the middle of the semester, there was a transition from the blended form of teaching philosophy to online

learning. Migrating from traditional or blended learning to an entirely virtual and online delivery strategy can't happen overnight (Crawford et al., 2020, p. 11). Therefore, at SPbPU the transition took place in just a few days. Our university management staff had decided to use MS Teams along with the learning management system Moodle and MOOCs. These programs are already operating at the university to ensure direct communication between teachers and students in the absence of a developed virtual course. Research shows that over time, the attitude of students to online learning at SPbPU has become more positive, so the assessment of the effectiveness of online education has increased from 2.9 to 3.8 on a five-point scale, and the evaluation of the ease of using online learning has also grown from 3.29 to 4.11 (Baranova et al., 2020).

LITERATURE REVIEW

In recent years, online learning has become increasingly favoured both in the context of lifelong learning and in classical university education. The economic advantages and ease of use at any time and from anywhere make online courses increasingly popular in the higher education environment (Pokrovskaia et al, 2019). The use of MOOC is not just a new technological solution; it is a significant change in existing university educational practices (Griffiths et al., 2014; Jaggars & Xu, 2013; Knox, 2016). As a result, the application of this phenomenon requires a comprehensive study. Many studies indicate that the students' success in the online platform is not worse than using other forms of training (Lyke & Frank, 2012; Meder, 2013; Wallace & Clariana, 2020). At the same time, studies are indicating such problematic aspects of using MOOC at universities as a lack of monitoring, shortcomings of the assessment system, tradition, mass character, and others (López Meneses et al., 2020). Also, the use of e-education is the least successful for the subjects as social science and professional studies courses (Xu & Jaggars, 2014).

Today we can overcome the problem related to the traditional approach in education by implementing adaptive MOOC (a-MOOC) and adaptive hybrid MOOC (ah-MOOC). The first one takes into account the characteristics of the student and the preferred learning model, offers different options for the presentation of material, control, sequence, and speed of learning modules, etc. The second one provides an individual educational trajectory by combining learning resources, a system of adaptation (tailoring to the needs of a particular student), and social networks of students (García-Peñalvo et al., 2018). University teachers develop a variety of strategies to help students to overcome the disadvantages of higher education program through online courses in their turn (Andone et al., 2015; Bralić & Divjak, 2016; Mori & Ractliffe, 2016).

The forced transition to distance learning due to the COVID-19 pandemic has given researchers around the world new opportunities to study online education. The first articles published on this topic had the purpose to share practices of e-learning implementation at all levels of education and the experience of using online tools that facilitate communication between teachers and students (Basilaia, 2020; Daniel, 2020; Zaharah & Kirilova, 2020). Chinese education experts were the first to face the problem of switching to online education in March 2020. So they have released a guide to help educational institutions in other countries to ensure reliable communication infrastructure, the adaptation of suitable digital learning resources, facilitation of effective online teaching and learning, by using flexible learning (Huang et al., 2020).

More recent studies reveal specific challenges associated with online education: the primary barrier levels, a teacher, a school, a curriculum, a student (Mailizar et al., 2020), and a jump in the load on the campus network traffic (Favale et al., 2020). The results of surveys of direct participants of the educational process began to appear in the public domain, for example, there are data on the degree of technical readiness and availability of necessary computer skills for online learning (Espino-Díaz et al., 2020; Händel et al., 2020). There are also results showing changes in the workload, satisfaction, as well as students' (Dwidienawati et al., 2020; Trung et al., 2020) and teachers' attitudes to studies (Mailizar et al., 2020). The most significant factors that hinder online learning identified as unavailability and accessibility issues, poor digital skills (Onyema et al., 2020), and lack of 'focus and restraint' (Sun et al., 2020).

Problems of a technical nature and interaction between a computer and a person came to the fore when there was a need to switch quickly to online training for the entire contingent of teachers and students. Nevertheless, the most acute problems in the first period of adaptation should not obscure the existence of a large layer of other challenges related to the use of online learning in university education. The rich experience gained over the years of studying questions devoted to e-learning allows us to determine its most significant characteristics and the existing problems. In numerous studies of factors that influence the success of online courses, researchers have focused on the characteristics of students (Rodriguez, 2011), course design (Glance et al., 2013; Jaggars & Xu, 2013), set learning goals, organization of the communication process (Gaytan, 2015; Tawafak et al., 2020) and other factors. One of the significant challenges discovered in online learning is low completion rates (Xu & Jaggars, 2011). That may occur due to the lack of social and teacher presence (Bowers & Kumar, 2015) and increased requirements for self-organization (Chen & Jang, 2019; Kizilcec et al., 2017). Some authors seek to identify similarities between students who drop out (Aragon & Johnson, 2008). Today, research methods for online courses are not limited to social surveys of all interested parties or expert evaluation of courses. In particular, data obtained directly from the learner's learning portfolio presents great opportunities for researchers. Data mining allows you to analyze all the features of a student's behaviour in an electronic course. It shows how often, in what sequence, and how much time the student accessed each of the available resources

(Romero et al., 2013). It allows us the opportunity to use this data at various levels from helping specific students in evaluating e-learning problems in general.

One of the most promising methods for identifying the most significant factors of learning in an electronic environment is an analytical comparison of face-to-face, blended, and online learning. However, when comparing courses conducted in different formats, either various courses (Bylieva et al., 2019; Ntourmas et al., 2018) or different groups of students (Al-Qahtani & Higgins, 2013) have been studied. This can have a significant effect on the results. The current situation has created opportunities to compare the learning situation before and after switching to fully online learning. This study examines a single stream of students in the same MOOC course, which reduces the impact of extraneous factors.

Nevertheless, the impact of the pandemic situation itself is a significant psychological factor and we should not ignore it. Data on student stress levels are mixed. Some studies show comparatively low levels of student anxiety caused by COVID-19, three-quarters of medical students reported minimal stress (Al-Rabiaah et al., 2020). Other studies show higher levels of stress among students about 42.4% (Acharya, 2020). This difference is not surprising. Even though the whole world has a common disease, different countries and universities had initially different living conditions, educational programs, and ways to adapt the learning process to new conditions. The situation of the pandemic is more unpleasant for some groups of students than for others. International students, especially those who are from countries where the virus started earlier, are in the most vulnerable and psychologically tricky situation, because, on the one hand, they are worried about their relatives at home, and on the other, they are ostracized and, or isolated in the country of study (Zhai & Du, 2020). Students with poor financial situations and those, who are far from home, also had a lot of problems such as losing their place in the hostel, having to spend money on tickets home, or rent an apartment and bear other expenses.

MATERIALS AND METHODS

We used data mining from the logs of the Russian portal of mass open courses (MOOC) "Open education" to evaluate the work of students on the electronic part of the course http:openedu.ru, offering more than 500 courses at the moment.

With the help of data mining taken from "Philosophy" MOOC, we got data on the passing of intermediate control by SPbPU students. We evaluated the topics of the whole spring semester of 2020 (from the beginning of the learning process on February 10 up to May 18). Taking into account that in March there was a complete cancellation of full-time classes. We analysed data on the course results in terms of demographics and the represented institutions' data.

The course is available to everyone who wants to study it. However, for this study, we considered only students of SPbPU, who signed up for the course, totalling 3,122 people. The majority of students are male (1956), 969 are female, and 197 chose not to reveal their gender.

The philosophy course in the blended learning format is mandatory for the first-year students of SPbPU, but some students take it in the fall semester, while others consider it in the spring semester. According to official data, the course was taken by students of the Institutes of Metallurgy, Mechanical Engineering and Transport, Civil Engineering, Energy and Transport Systems, Applied Mathematics and Mechanics and Physics, Nanotechnology and Telecommunications in the spring semester. Students of other Institutes are either re-engaged (at their request or did not pass the course), or transferred from different Universities, and have an academic difference.

Table 1: Distribution of students by Institution in the philosophy course in spring 2020

Institute of SPbPU of students (people)	Number
Institute of Metallurgy, Mechanical Engineering, and Transport (IMMET)	**794**
Institute of Civil Engineering (ICE)	**572**
Institute of Energy and Transport Systems (IETS)	**489**
Institute of Applied Mathematics and Mechanics (IAMM)	**450**
Institute of Physics, Nanotechnology, and Telecommunications (IPNT)	**404**
Institute of Humanities (IH)	**131**
Institute of Computer Science and Technology (ICST)	**102**
Institute of Industrial Management, Economics, and Trade (IIMET)	**91**
Institute of Biomedical Systems and Technologies (IBST)	**89**
Total	**3122**

MOOC "Philosophy" lasts fifteen weeks. During this period, a new course part is opened every week, consisting of video lectures on each topic (from 1 to 3 in the section), lecture notes, and presentations. Each chapter contains three assignments. The first task is a test, which consists of 10 questions related to the materials of the lecture. The second one is a practical lesson with seven test questions. The last assignment is an independent work aimed at the analysis of a philosophical text, where the answer is in the form of a word or a phrase, which students provide themselves. At the end

of the course, students have a final test with a time limit. Where within an hour students answer 50 test questions. On the schedule, each section is available for a period of two up to 4 weeks. The limits depend on course complexity. As a rule, there are two open topics at the same time. Also, the portal has a forum for interaction between teachers and students, it is possible to see your current rating, and there is an additional information section.

Table 2: Schedule for opening access to the "Philosophy" topics for the spring semester of 2020

Course section	Opening/closing dates for topic materials	Theme
1	February 10 - March 2	Topic 1.1. Introduction to Philosophy
		Topic 2.1. Philosophy of the Ancient world
2	February 17 - March 2	Topic 2.2. Philosophy of the Middle Ages and Renaissance
3	February 24 - March 9	Topic 2.3. The philosophy of the New Time
4	March 2 - March 16	Topic 2.4. German classical philosophy
5	March 9 - March 23	Topic 2.5. Non-classical philosophy of the nineteenth century
6	March 16 - March 30	Topic 2.6. The main directions and trends of the philosophy of the XX century
7	March 23 - April 6	Topic 2.7. Russian philosophy
8	March 30 - April 13	Topic 3.1. The problem of being. Philosophical understanding of matter
		Topic 3.2. Philosophy of development
9	April 6 - April 20	Topic 3.3. Philosophy of knowledge
10	April 13 - April 27	Topic 4.1. Epistemological problems
11	April 20 – May 11	Topic 5.1. Philosophy of science
		Topic 5.2. Positivist and postpositivist concepts in the methodology of science
12	April 27 - May 18	Topic 6.1. Social philosophy
		Topic 6.2 Dynamics and typology of historical development
13	May 4 - May 25	Topic 7.1 Philosophical anthropology
14	May 11 - May 25	Topic 8.1. Philosophy of language and philosophy of technology
15	May 18 – June 1	Final test

On March 16, 2020, Peter the Great St. Petersburg Polytechnic University became one of the first universities in Saint-Petersburg to switch to a fully electronic distance learning format by order of the rector. This was when the fifth section of the "Philosophy" course was in progress (see tab.2), i.e. many students have already completed the tasks, while others had not. Starting from the sixth section opened on March 16, the philosophy course lost its face-to-face component.

To identify changes in the students' behaviour during the process of switching to the online format, we conducted the quantitative statistical analysis and visualization of the obtained data.

FINDING

To assess the impact of the transition to a full e-learning medium, we studied the results of mid-term assessments from the first week to the twelfth week. The most exciting indicator, in this case, is the number of students who refused to complete the tasks.

Figure 1 shows the number of students who did not attempt to complete the tasks for the lecture material (yellow), practice (orange), and independent work (green). In the first part of assignments 1007 students (32.2%) had not completed the lecture tasks, practical assignments – 833 students (26.7%) and independent work – 774 (23.8%). Up to the fourth part of tasks, a slight increase in all indicators is visible, in the fifth part, there is a small jump in the number of not attempted: 1118 students (35.8%) on lectures, 980 students (31.3%) at practice and 962 students (30.8%) during the independent work. But a big jump is observed in the sixth week when there was a transition to a completely remote form: 1519 (48.6%) students did not participate in testing based on the materials of lectures, 1334 students (42.7%) – based on practical classes, 1323 students (42.4%) - upon the result of the independent work. Further, the level of indicators remains approximately the same, decreasing slightly by week 12 for lecture testing (1427 students– 45.7%), but increasing – for independent work (1409 – 45.1%). Therefore, it is not possible to say that the loss of students is due to temporary reasons (for example, moving home from St. Petersburg for students from other cities). So, compared with the level in the first week, it can be noted that by the end of the sixth week the number of "lost" students was from 501

Humanities & Social Sciences Reviews
eISSN: 2395-6518, Vol 8, No 4, 2020, pp 1083-1093
https://doi.org/10.18510/hssr.2020.84103

students when performing practical assignments (16.0% of the total contingent) up to the number of 549 people (17.5%) when performing their independent work.

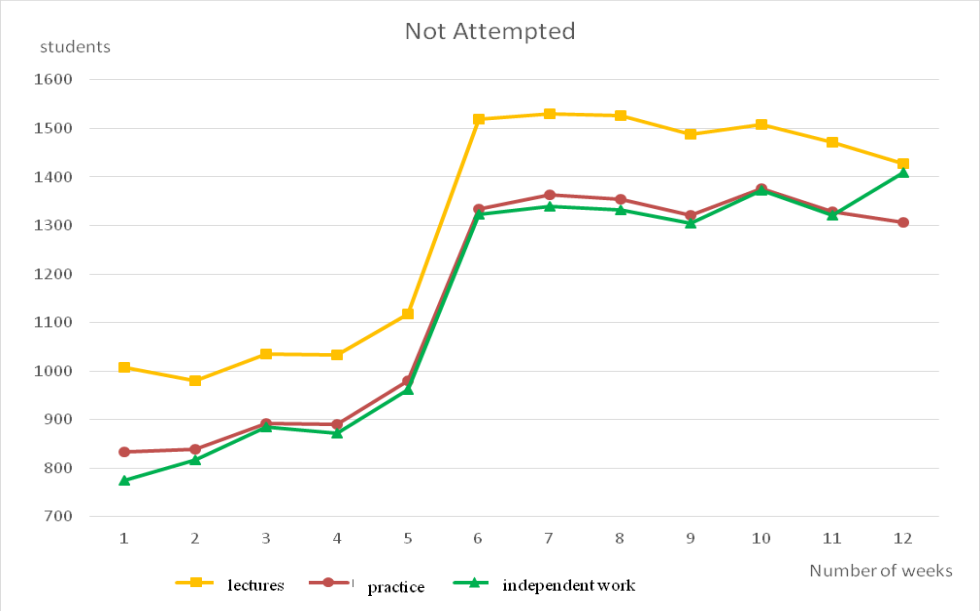

Figure 1: The number of students who did not attempt to complete tasks of the course sections

We considered two control points in time to compare different categories of students. The first was the beginning of the semester from February 10, the second - the sixth week from March 16, when students of SPbPU switched to the distance-learning format.

In terms of gender, there is some difference in the initial level of not attempted: there were fewer female students (from 18.2% to 23.4%) than among male representatives (from 20.3% to 28.0%), but the percentage of "lost" (the difference between 1 and 6 weeks) differs much less: female students (15.1-16.1%), and male students (15.5-17.2%).

A significant change in the percentage of not attempted students in the period between week one and week six occurs in all institutions regardless of the specialty received (Table 3). We observed the lowest losses for all types of tasks in the Institute of Civil Engineering (from 10.7% to 12%); the highest ones are in the Institute of Applied Mathematics and Mechanics (from 17% to 18.7%).

Students of institutes that did not have the “philosophy” course on the schedule of the spring semester 2020 showed a higher percentage of not attempted from the very first lesson. The reason is that many of them signed up without really planning to study it (22.5% to 56.5% compared to 17.6% to 36.3% of students that have this discipline in the program). However, we are interested in the change that occurred between the first and sixth weeks. It turned out that the percentage of students who stopped completing tasks was higher in this particular group.

However, there are some exceptions, namely students of the Institute of Computer Science and Technology, who studied independently, showed losses less than in the average for students who studied according to the program (from 10.8% to 13.8%).

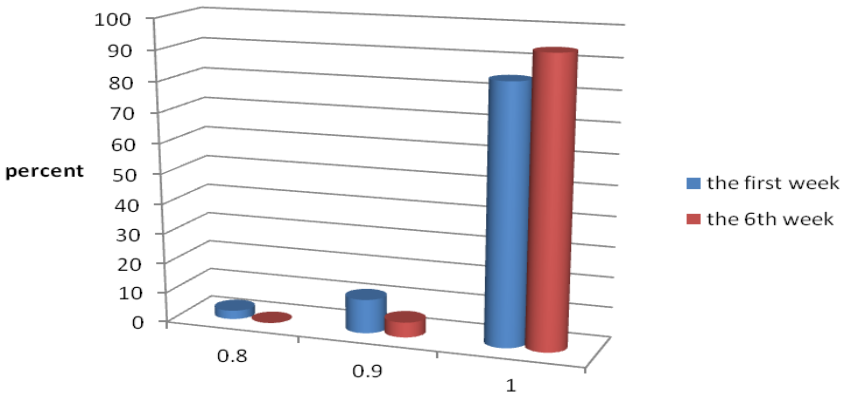

Figure 2: Changes in the percentage of test scores for lectures in the first and sixth weeks of learning

Comparing the percentage of correctly completed tasks during the first and sixth weeks, we can conclude that it increases. This change is especially noticeable in the example of tests based on lecture materials. For the first week, the number of students who answered completely correctly was 84.6%, and in the sixth week – 93.8% (Figure 2). As for other tasks, the changes are smaller but have the same tendency to increase the number of correct answers (for practical classes 92.3% and 93.8%; for independent work 86.3% and 88.5% in the first and sixth weeks)

Table 3: The number of not attempted depending on the Institution in the first and sixth week

Institutes of SPbPU	Kind of work	Not attempted in the first week (students)	% of the total number of students studied in the course of the Institute	Not attempted in the sixth week (students)	% of the total number of students enrolled in the course of the Institute	Loss from the number of students (%)
IMMET	lectures	288	36,3%	411	51,8%	15,5%
	practice	236	29,8%	372	46,9%	17,2%
	independent work	229	28,8%	374	47,1%	18,3%
ICE	lectures	168	29,4%	237	41,4%	12%
	practice	145	25,3%	206	36,0%	10,7%
	independent work	129	22,6%	193	33,7%	11,1%
IETS	lectures	123	25,2%	196	40,1%	14,9%
	practice	101	20,7%	168	34,4%	13,7%
	independent work	91	18,6%	167	34,2%	15,6%
IAMM	lectures	115	25,6%	197	43,8%	18,2%
	practice	87	19,3%	167	37,1%	17,8%
	independent work	82	18,2%	166	36,9%	18,7%
IPNT	lectures	119	29,5%	186	46,0%	16,5%
	practice	82	20,3%	145	35,9%	15,6%
	independent work	71	17,6%	144	35,6%	18,0%
IH	lectures	74	56,5%	116	88,5%	32,0%
	practice	71	54,2%	111	84,7%	30,5%
	independent work	67	51,1%	113	86,3%	35,2%
ICST	lectures	54	52,9%	68	66,7%	13,8%
	practice	51	50,0%	62	60,8%	10,8%
	independent work	49	48,0%	62	60,8%	12,8%
IIMET	lectures	41	45,1%	61	67,0%	21,9%
	practice	39	42,9%	58	63,7%	20,8%
	independent work	36	39,6%	58	63,7%	24,1%
IBST	lectures	25	28,1%	46	51,7%	23,6%
	practice	21	23,6%	44	49,4%	25,8%
	independent work	20	22,5%	45	50,6%	28,1%

DISCUSSION

Data on the assessments of students' progress on the topics studied during the 2020 spring semester in the MOOC "Philosophy" course showed that after switching to the fully online learning format, about one-sixth of the students stopped completing the course tasks. These changes were not temporary as there were no significant changes in the number of "not attempted" students after the jump in March when fully e-learning was announced.

It seems that the transition to online education was relatively easy due to a decent level of preparedness of the higher education system and the overall level of dissemination of information and communication technologies in society. Moreover, the currently available results of surveys of teachers and students show that the existing problems, both technical and psychological, are not strongly pronounced (Mailizar et al., 2020; Trung et al., 2020; Baranova et al., 2020). At the same time, it should be noted that although student surveys provide important information when evaluating the transition to fully e-learning, it is likely that such surveys cover to a much lesser extent the category of students that we have called "lost". There is a need for having research that shows objective indicators of the consequences of switching to online learning. One example of such kind of investigation is the performance of students in an electronic environment. The research shows that it is difficult for students to continue their studies in the form of e-learning, which is confirmed by one of the main challenges of online education, which is low completion rates (Xu & Jaggars, 2011).

Scientists attribute the main reasons for both existing technical problems (Onyema et al., 2020) and the lack of self-organization of students (Sun et al., 2020).

In this article we used the main indicator "not attempted" (no attempts to complete the task) to analyze changes that have occurred because of switching to entirely online learning. We consider that it does not directly depend on the performance or engagement indicators. Nevertheless, some of the students end up the course with gaps in understanding and have severe problems with the assessment if they do not complete the tasks required, which most often means that they do not prioritize this course, and also if they skip not all, but part of the assignments. Studies based on data mining (Romero et al., 2008) indicate that the number of quizzes completed during learning is an excellent predictor of the final score.

We can draw the following conclusions by analyzing the factors at our disposal that can potentially affect the number of students who stop completing course assignments. The change in the number of continuing students on the course influenced both sexes equally. But there was a difference in institutions with different specialities. At the current time, we can only assume what caused the difference in a number of "lost" students depending on their affiliation to the Institute. According to our observations, the combined influence of factors relates to the contingent of students and to the course itself. For example, there is the number of non-resident and international students, for whom the transition to distance learning may have been more difficult due to technical, financial, and other problems. As we know the parameters of the online course have a significant impact on the educational activity of students (Paechter et al., 2010). Although the MOOC course itself was the same for all Institutions of SPbPU, teachers who previously conducted face-to-face classes continued to communicate with students when dealing with distance education on the forums of the educational portal, as well as via other means of communication (social networks email, etc.). Teachers independently determined the frequency and form of communication, so that it could vary significantly for students of different institutes of the university. In particular, students of the Institute of Applied Mathematics and Mechanics were given a task in the form of writing essays on two topics in the period from April 9 to May 9. Students of the Institute of Civil Engineering had a diverse system of tasks with deadlines for different dates of March, April, and May. Besides once a week, interactive dialogues were held with these students on the forum of the educational portal by the topics of classes. Therefore, several studies indicate that the influence of greater support for the course from the teacher is an important factor in the success of e-learning (Gaytan, 2015; Tawafak et al., 2020; Wuellner, 2013). A separate fact that deserves further consideration is the behaviour of students. The Institute of Computer Science and Technology went through the process of switching to online learning more easily than other institutes. The high digital literacy skills of computer specialization students are obvious. That can play an important role in e-learning as shown in the study (Hamutoğlu et al., 2019). However, a great number of modern students can also have a high level of digital literacy skills (Händel et al., 2020). We can suppose that this is owing to students' close or professional acquaintance with information and communication technologies and their habit of constant work in a digital environment. This information is rather unusual but requires further study to identify the key factors that influence the behaviour of this group of students in online learning.

Among those students who took the course on their own, and not according to the curriculum of the semester, the losses were the largest - up to 35% of those enrolled in the course. These results show that the problem of e-learning is not just a question of the form of classes, which has not changed for students who took the course independently. Moreover, this is the matter of the atmosphere of studying at university, which encourages them to learn. Those students who needed or wanted to take the course on their own due to various circumstances, the termination of the face-to-face study had a more significant negative effect.

As for the results of passing the tasks, most students do an excellent job with the course tasks based on the available material. However, even here, we can draw some conclusions if we compare the sum of assessments in the first and the sixth weeks. As discussed above, the number of students fell. At the same time concerning all three options of tasks the percentage of those students who answered correctly increased, starting from the sixth week. Although the changes are not very significant, they show that weaker students who have to deal with increasingly complex sections or topics are lost during the transition period to electronic format.

CONCLUSION

The experience gained as a result of the forced transition to online education allowed us to immediately move several steps forward in the field of electronic technologies application. Those changes in the curriculum, requirements for teachers and students, in the use of information and communication technologies passed during a few weeks due to the situation of emergency that would normally take several years. The results of this experience allow the management of higher education institutions to consolidate new emerging practices, use the created and developed learning materials and practices.

Owing to the availability of educational portals with online courses from many leading universities and having the universities' own learning management system, various communication platforms (MS Teams, Zoom, Google Class, and others), and despite the situation of forced isolation students were able to continue their education, even in a modified format.

However, the transition to entire online learning still caused damage to the educational process. This study points out to such a component as the refusal of some students to continue performing assignments required in the course. The biggest losses were among those students who were engaged in the course on their own, and not on a schedule.

This leads to the conclusion that we need to consider the advantages and obstacles to e-learning more broadly than just analyzing the form of course submission. Full-time education at the university is a certain lifestyle that motivates students to study, which they have to refuse to be entirely involved in e-learning.

LIMITATION AND STUDY FORWARD

This study is limited to one University and one subject, while an investigation of a combination of studies at universities in different countries, which also faced the need to quickly switch to fully online classes, can provide a more complete picture of the opportunities and challenges of e-education in the higher education system.

In addition, at the time of writing this article, the Philosophy course under the study had not been completed. So, it is not known exactly how great a negative impact on the assimilation of the course and the final assessment of students' progress a sharp transition to fully e-learning had. This article examines the behaviour of the same students on the same course in the blended and online learning situation, which allows us to observe the most obvious consequences. At the same time, we cannot ignore the fact that the transition situation itself could be accompanied by stress due to the pandemic, and in some cases, the deterioration of the Internet connection, which could have affected the students' decision to not participate in the intermediate tasks. In this article, we have focused on the most obvious indicator, which is the non-participation of students in the tasks related to the assessment of their performance. In the future, more detailed studies of students' behaviour in the online environment using data mining are needed to allow us to understand how the fully online learning environment impacts students' educational strategies.

Data mining has made it possible to assess in detail the changes in students' learning behaviour after switching to an exclusively online format. It includes the assessment of time spent on different parts of the course, the sequence of elements, the distribution, and management of study time during the day and week, etc. In turn, this allows stakeholders, especially educational policymakers, curriculum experts, and management of higher education institutions to understand the changes that are taking place and to plan their strategies to optimize students' academic achievement.

ACKNOWLEDGEMENT

This paper was financially supported by the Ministry of Education and Science of the Russian Federation on the program to improve the competitiveness of Peter the Great St. Petersburg Polytechnic University (SPbPU) among the world's leading research and education centres in 2016-2020.

The authors are grateful to the organizers of the conference "Professional Culture of the Specialist of the Future" (Peter the Great St. Petersburg Polytechnic University).

AUTHORS' CONTRIBUTION

Conceptualization, D.B. and Z.B.; Data curation, V.L.; Formal analysis, D.B., and V.L.; Investigation, D.B., V.L. and T.N.; Methodology, V.L.; Software, T. N..; Supervision, D.B.; Visualization, T.N..; Writing—original draft, D.B., and V.L.; Writing—review & editing, T.N., and Z.B.

REFERENCES

1. Acharya, S. (2020). Stress in the students after lockdown due to outbreak of Corona Virus (COVID-19). *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3627022
2. Al-Bahrani, A., Patel, D., & Sheridan, B. J. (2017). Evaluating Twitter and its impact on student learning in principles of economics courses. *The Journal of Economic Education*, *48*(4), 243–253. https://doi.org/10.1080/00220485.2017.1353934
3. Al-Musawi, A. S., El Shourbagi, S. A., & Al Saddi, B. K. (2020). Effects of software on gifted students achievement and activities in elementary education. In *Handbook of Research on Software for Gifted and Talented School Activities in K-12 Classrooms* (pp. 65–93). IGI Global. https://doi.org/10.4018/978-1-7998-1400-9.ch004
4. Al-Qahtani, A. A. Y., & Higgins, S. E. (2013). Effects of traditional, blended and e-learning on students' achievement in higher education. *Journal of Computer Assisted Learning*, *29*(3), 220–234. https://doi.org/10.1111/j.1365-2729.2012.00490.x
5. Al-Rabiaah, A., Temsah, M.-H., Al-Eyadhy, A. A., Hasan, G. M., Al-Zamil, F., Al-Subaie, S., Alsohime, F., Jamal, A., Alhaboob, A., Al-Saadi, B., & Somily, A. M. (2020). Middle East Respiratory Syndrome-Corona Virus (MERS-CoV) associated stress among medical students at a university teaching hospital in Saudi Arabia. *Journal of Infection and Public Health*, *13*(5), 687–691. https://doi.org/10.1016/J.JIPH.2020.01.005
6. Alawamleh, M. (2020). COVID-19 and higher education economics. *Journal of Economics and Economic Education Research*, *21*(2), 1–2.
7. Andone, D., Mihaescu, V., Ternauciuc, A., & Vasiu, R. (2015). Integrating MOOCs in traditional higher

education. *European Stakeholder Summit on Experiences and Best Practices in and around MOOCs, EMOOCs*. https://www.researchgate.net/publication/289991756_Integrating_MOOCs_in_Traditional_Higher_Education
8. Aragon, S. R., & Johnson, E. S. (2008). Factors Influencing Completion and Noncompletion of Community College Online Courses. *American Journal of Distance Education*, *22*(3), 146–158. https://doi.org/10.1080/08923640802239962
9. Armitage, R., & Nellums, L. B. (2020). Considering inequalities in the school closure response to COVID-19. *The Lancet Global Health*, *8*(5), e644. https://doi.org/10.1016/S2214-109X(20)30116-9
10. Baranova, T., Kobicheva, A., & Tokareva, E. (2020). Total transition to online learning at St. Petersburg Polytechnic University: students' and teachers' motivation and attitudes. In A. Nordmann, O. Shipunova, & V. Volkova (Eds.), *Knowledge in the Information Society. Lecture Notes in Networks and Systems* (p. in press). Springer.
11. Basilaia, G. (2020). Replacing the classic learning form at universities as an immediate response to the COVID-19 virus infection in Georgia. *International Journal for Research in Applied Science and Engineering Technology*, *8*(3), 101–108. https://doi.org/10.22214/ijraset.2020.3021
12. Berisha, E., Trindade, R. T., Bürgi, P. Y., Benkacem, O., & Moccozet, L. (2019). A versatile and flexible e-assessment framework towards more authentic summative examinations in Higher-Education. *International Journal of Continuing Engineering Education and Life-Long Learning*, *29*(1), 1. https://doi.org/10.1504/IJCEELL.2019.10019538
13. Bowers, J., & Kumar, P. (2015). Students' Perceptions of Teaching and Social Presence. *International Journal of Web-Based Learning and Teaching Technologies*, *10*(1), 27–44. https://doi.org/10.4018/ijwltt.2015010103
14. Bralić, A., & Divjak, B. (2016). Use of MOOCs in traditional classroom: blended learning approach. *Forging New Pathways of Research and Innovation in Open and Distance Learning: Reaching from the Roots*, 250–259.
15. Bylieva, D., Lobatyuk, V., Safonova, A., & Rubtsova, A. (2019). Correlation between the Practical Aspect of the Course and the E-Learning Progress. *Education Sciences*, *9*(3), 167. https://doi.org/https://doi.org/10.3390/educsci9030167
16. Chen, K., & Jang, S. (2019). Motivation in online learning: Testing a model of self-determination theory. *Computers in Human Behavior*, *26*(4), 741–752.
17. Crawford, J., Butler-Henderson, K., Rudolph, J., & Glowatz, M. et al. (2020). COVID-19: 20 countries' higher education intra-period digital pedagogy responses. *Journal of Applied Learning & Teaching*, *3*(1). https://doi.org/10.37074/jalt.2020.3.1.7
18. Daniel, S. J. (2020). Education and the COVID-19 pandemic. *PROSPECTS*, 1–6. https://doi.org/10.1007/s11125-020-09464-3
19. Dunn, C. G., Kenney, E., Fleischhacker, S. E., & Bleich, S. N. (2020). Feeding low-income children during the Covid-19 pandemic. *New England Journal of Medicine*, *382*(18), e40. https://doi.org/10.1056/NEJMp2005638
20. Dwidienawati, D., Abdinagoro, S. B., Tjahjana, D., Gandasari, D., & Munawarohd. (2020). Forced shifting to e-learning during the covid-19 outbreak: Information quality, system quality, service quality, and goal orientation influence to e-learning satisfaction and perceived performance. *International Journal of Advanced Trends in Computer Science and Engineering*, *9*(2), 1518–1525. https://doi.org/10.30534/ijatcse/2020/93922020
21. Espino-Díaz, L., Fernandez-Caminero, G., Hernandez-Lloret, C.-M., Gonzalez-Gonzalez, H., & Alvarez-Castillo, J.-L. (2020). Analyzing the impact of COVID-19 on education professionals. Toward a paradigm shift: ICT and neuroeducation as a binomial of action. *Sustainability*, *12*(14), 5646. https://doi.org/10.3390/su12145646
22. Evseeva, L. I., Shipunova, O. D., Pozdeeva, E. G., Trostinskaya, I. R., & Evseev, V. V. (2020). Digital learning as a factor of professional competitive growth. In T. Antipova & Á. Rocha (Eds.), *Digital Science 2019. DSIC 2019. Advances in Intelligent Systems and Computing, vol 1114* (pp. 241–251). Springer. https://doi.org/10.1007/978-3-030-37737-3_22
23. Favale, T., Soro, F., Trevisan, M., Drago, I., & Mellia, M. (2020). Campus traffic and e-Learning during COVID-19 pandemic. *Computer Networks*, *176*, 107290. https://doi.org/10.1016/j.comnet.2020.107290
24. García-Peñalvo, F. J., Fidalgo-Blanco, Á., & Sein-Echaluce, M. L. (2018). An adaptive hybrid MOOC model: Disrupting the MOOC concept in higher education. *Telematics and Informatics*, *35*(4), 1018–1030. https://doi.org/10.1016/j.tele.2017.09.012
25. Gaytan, J. (2015). Comparing Faculty and Student Perceptions Regarding Factors That Affect Student Retention in Online Education. *American Journal of Distance Education*, *29*(1), 56–66. https://doi.org/10.1080/08923647.2015.994365
26. Glance, D. G., Forsey, M., & Riley, M. (2013). The pedagogical foundations of massive open online courses. *First Monday*, *18*(5). https://doi.org/10.5210/fm.v18i5.4350
27. Griffiths, R. J., Chingos, M. M., Spies, R., & Mulhern, C. (2014). Adopting MOOCs on campus: a collaborative effort to test MOOCs on campuses of the university system of Maryland. *Online Learning*, *19*(2). https://doi.org/10.24059/olj.v19i2.523
28. Hamid, S., Waycott, J., Kurnia, S., & Chang, S. (2015). Understanding students' perceptions of the benefits of

online social networking use for teaching and learning. *The Internet and Higher Education*, *26*, 1–9. https://doi.org/10.1016/J.IHEDUC.2015.02.004
29. Hamutoğlu, N. B., Savaşçı, M., & Sezen-Gültekin, G. (2019). Digital literacy skills and attitudes towards e-learning. *Journal of Education and Future*, *16*, 93–107. https://doi.org/10.30786/jef.509293
30. Händel, M., Bedenlier, S., Gläser-Zikuda, M., Kammerl, R., Kopp, B., & Ziegler, A. (2020). Do students have the means to learn during the Coronavirus pandemic? Student demands for distance learning in a suddenly digital landscape. *PsyArXiv*. https://doi.org/https://doi.org/10.31234/osf.io/5ngm9
31. Hong, J.-C., Hwang, M.-Y., Tsai, C.-M., Liu, M.-C., & Lee, Y.-F. (2020). Exploring teachers' attitudes toward implementing new ICT educational policies. *Interactive Learning Environments*, 1–15. https://doi.org/10.1080/10494820.2020.1752740
32. Huang, R. H., Liu, D. J., Tlili, A., Yang, J. F., & Wang, H.H., et al. (2020). *Handbook on Facilitating Flexible Learning During Educational Disruption: The Chinese Experience in Maintaining Undisrupted Learning in COVID-19 Outbreak*. Smart Learning Institute of Beijing Normal University. https://iite.unesco.org/wp-content/uploads/2020/03/Handbook-on-Facilitating-Flexible-Learning-in-COVID-19-Outbreak-SLIBNU-V1.2-20200315.pdf
33. Jaggars, S. S., & Xu, D. (2013). *Adaptability to online learning: Differences across types of students and academic subject areas* (No. 54; CCRC). https://ccrc.tc.columbia.edu/media/k2/attachments/adaptability-to-online-learning.pdf
34. Kizilcec, R. F., Pérez-Sanagustín, M., & Maldonado, J. J. (2017). Self-regulated learning strategies predict learner behavior and goal attainment in Massive Open Online Courses. *Computers & Education*, *104*, 18–33. https://doi.org/10.1016/j.compedu.2016.10.001
35. Knox, J. (2016). Posthumanism and the MOOC: opening the subject of digital education. *Studies in Philosophy and Education*, *35*(3), 305–320. https://doi.org/10.1007/s11217-016-9516-5
36. López Meneses, E., Vázquez Cano, E., & Mac Fadden, I. (2020). MOOC in higher education from the students' perspective. A sustainable model? In J. Sarasola Sánchez-Serrano, F. Maturo, & Š. Hošková-Mayerová (Eds.), *Qualitative and Quantitative Models in Socio-Economic Systems and Social Work. Studies in Systems, Decision and Control, vol 208* (pp. 207–223). Springer. https://doi.org/10.1007/978-3-030-18593-0_17
37. Lyke, J., & Frank, M. (2012). Comparison of student learning outcomes in online and traditional classroom environments in a psychology course. *Journal of Instructional Psychology*, *39*, 245–250.
38. Mailizar, M., Almanthari, A., Maulina, S., & Bruce, S. (2020). Secondary school mathematics teachers views on e-learning implementation barriers during-the COVID-19 pandemic the case of Indonesia. *Eurasia Journal of Mathematics, Science and Technology Education*, *16*(7), em1860. https://doi.org/10.29333/ejmste/8240
39. Meder, C. (2013). *Counselor education delivery modalities: do they affect student learning outcomes database* (p. UMI Number: 357359). ProQuest Dissertations and Theses database.
40. Moccozet, L., Benkacem, O., Platteaux, H., & Foerster, M. (2014). Looking for a Platform That Can Be Proposed to Students as a PLE Enabler. *2014 Eighth International Conference on Complex, Intelligent and Software Intensive Systems*, 498–503. https://doi.org/10.1109/CISIS.2014.71
41. Mori, K., & Ractliffe, L. (2016). Evaluating the use of a MOOC within Higher Education Professional Development Training. *Proceedings of the 25th International Conference Companion on World Wide Web - WWW '16 Companion*, 831–833. https://doi.org/10.1145/2872518.2890577
42. Moskaliuk, J., Bertram, J., & Cress, U. (2013). Training in virtual environments: putting theory into practice. *Ergonomics*, *56*(2), 195–204. https://doi.org/10.1080/00140139.2012.745623
43. Narayan, V., Herrington, J., & Cochrane, T. (2019). Design principles for heutagogical learning: Implementing student-determined learning with mobile and social media tools. *Australasian Journal of Educational Technology*, *35*(3). https://doi.org/10.14742/ajet.3941
44. Nasser, I., & Musawi, A. S. Al. (2020). Engineering education trends in the digital era. In Ş. SerdarAsan & E. Işıklı (Eds.), *Advances in Higher Education and Professional Development* (pp. 26–52). IGI Global. https://doi.org/10.4018/978-1-7998-2562-3
45. Ng, Y.-M., & Or, P. L. P. (2020). Coronavirus disease (COVID-19) prevention: Virtual classroom education for hand hygiene. *Nurse Education in Practice*, *45*, 102782. https://doi.org/10.1016/j.nepr.2020.102782
46. Ntourmas, A., Avouris, N., Daskalaki, S., & Dimitriadis, Y. A. (2018). Comparative study of MOOC forums: Does course subject matter? *17th Panhellenic and International Conference, ICT in Education (HCICTE 2018)*. http://uvadoc.uva.es/handle/10324/31410
47. Odinokaya, M., Krepkaia, T., Karpovich, I., & Ivanova, T. (2019). Self-Regulation as a Basic Element of the Professional Culture of Engineers. *Education Sciences*, *9*(3), 200. https://doi.org/10.3390/educsci9030200
48. Onyema, E. M., Eucheria, N. C., Obafemi, F. A., Sen, S., Atonye, F. G., Sharma, A., & Alsayed, A. O. (2020). Impact of Coronavirus pandemic on education. *Journal of Education and Practice*, *11*(13). https://doi.org/10.7176/JEP/11-13-12
49. Paechter, M., Maier, B., & Macher, D. (2010). Students' expectations of, and experiences in e-learning: Their relation to learning achievements and course satisfaction. *Computers & Education*, *54*(1), 222–229. https://doi.org/10.1016/j.compedu.2009.08.005
50. Pan, S. L., Cui, M., & Qian, J. (2020). Information resource orchestration during the COVID-19 pandemic: A

study of community lockdowns in China. *International Journal of Information Management*, *54*, 102143. https://doi.org/10.1016/j.ijinfomgt.2020.102143

51. Petretto, D. R., Masala, I., & Masala, C. (2020). Special educational needs, distance learning, inclusiond COVID-19. *Education Sciences*, *10*(6), 154. https://doi.org/https://doi.org/10.3390/educsci10060154
52. Pokrovskaia, N. N., Ababkova, M. Y., & Fedorov, D. A. (2019). Educational Services for Intellectual Capital Growth or Transmission of Culture for Transfer of Knowledge—Consumer Satisfaction at St. Petersburg Universities. *Education Sciences*, *9*(3), 183. https://doi.org/10.3390/educsci9030183
53. Pokrovskaia, N. N., Petrov, M. A., & Gridneva, M. A. (2018). Diagnostics of professional competencies and motivation of the engineer in the knowledge economy. *2018 Third International Conference on Human Factors in Complex Technical Systems and Environments (ERGO)s and Environments (ERGO)*, 28–31. https://doi.org/10.1109/ERGO.2018.8443851
54. Pozdeeva, E. G., Shipunova, O. D., & Evseeva, L. I. (2019). Social assessment of innovations and professional responsibility of future engineers. *IOP Conference Series: Earth and Environmental Science*, *337*, 012049. https://doi.org/10.1088/1755-1315/337/1/012049
55. Quansah, J. Y. D., Fiadzawoo, J. K., & Kuunaagmen, C. K. (2016). Students' engagement in social media and its mainstay for teaching and learning. the case of the wa nursing training college. *American Journal of Educational Research*, *4*(13), 961–969. https://doi.org/10.12691/education-4-13-8
56. Razinkina, E., Pankova, L., Trostinskaya, I., Pozdeeva, E., Evseeva, L., & Tanova, A. (2019). Influence of the educational environment on students' managerial competence. *E3S Web of Conferences*, *110*, 02097. https://doi.org/10.1051/e3sconf/201911002097
57. Rodriguez, V. P. (2011). *Relationships between Student Characteristics and Student Persistence in Online Classes at a Community College (Order No. 3485377)*. University of California.
58. Romero, C., Espejo, P. G., Zafra, A., Romero, J. R., & Ventura, S. (2013). Web usage mining for predicting final marks of students that use Moodle courses. *Computer Applications in Engineering Education*, *21*(1), 135–146. https://doi.org/10.1002/cae.20456
59. Romero, C., Ventura, S., & García, E. (2008). Data mining in course management systems: Moodle case study and tutorial. *Computers & Education*, *51*(1), 368–384. https://doi.org/10.1016/j.compedu.2007.05.016
60. Sobaih, A. E. E., Moustafa, M. A., Ghandforoush, P., & Khan, M. (2016). To use or not to use? Social media in higher education in developing countries. *Computers in Human Behavior*, *58*, 296–305. https://doi.org/10.1016/j.chb.2016.01.002
61. Sun, L., Tang, Y., & Zuo, W. (2020). Coronavirus pushes education online. *Nature Materials*, *19*(6), 687–687. https://doi.org/10.1038/s41563-020-0678-8
62. Tawafak, R. M., Romli, A. B. T., Arshah, R. bin A., & Malik, S. I. (2020). Framework design of university communication model (UCOM) to enhance continuous intentions in teaching and e-learning process. *Education and Information Technologies*, *25*(2), 817–843. https://doi.org/10.1007/s10639-019-09984-2
63. Trung, T., Hoang, A.-D., Nguyen, T. T., Dinh, V.-H., Nguyen, Y.-C., & Pham, H.-H. (2020). Dataset of Vietnamese student's learning habits during COVID-19. *Data in Brief*, *30*, 105682. https://doi.org/10.1016/J.DIB.2020.105682
64. Wallace, P. E., & Clariana, R. B. (2020). Achievement predictors for a computer-applications module delivered online. *Journal of Information Systems Education*, *11*(1), 3.
65. Wuellner, M. R. (2013). Student learning and instructor investment in online and face-to-face natural resources courses. *Natural Sciences Education*, *42*(1), nse.2012.0023. https://doi.org/10.4195/nse.2012.0023
66. Xie, B., He, D., Mercer, T., Wang, Y., Wu, D., Fleischmann, K. R., Zhang, Y., Yoder, L. H., Stephens, K. K., Mackert, M., & Lee, M. K. (2020). Global health crises are also information crises: A call to action. *Journal of the Association for Information Science and Technology*, asi.24357. https://doi.org/10.1002/asi.24357
67. Xu, D., & Jaggars, S. S. (2011). The effectiveness of distance education across Virginia's community colleges: evidence from introductory college-level math and English courses. *Educational Evaluation and Policy Analysis*, *33*(3), 360–377. https://doi.org/10.3102/0162373711413814
68. Xu, D., & Jaggars, S. S. (2014). Performance gaps between online and face-to-face courses: differences across types of students and academic subject areas. *The Journal of Higher Education*, *85*(5), 633–659. https://doi.org/10.1080/00221546.2014.11777343
69. Zaharah, Z., & Kirilova, G. I. (2020). Impact of Corona Virus Outbreak outbreak towards teaching and learning activities in Indonesia. *SALAM: Jurnal Sosial Dan Budaya Syar-I*, *7*(3). https://doi.org/10.15408/sjsbs.v7i3.15104
70. Zhai, Y., & Du, X. (2020). Mental health care for international Chinese students affected by the COVID-19 outbreak. *The Lancet Psychiatry*, *7*(4), e22. https://doi.org/10.1016/S2215-0366(20)30089-4
71. Zhang, W., Wang, Y., Yang, L., & Wang, C. (2020). Suspending classes without stopping learning: China's education emergency management policy in the COVID-19 outbreak. *Journal of Risk and Financial Management*, *13*(3), 55. https://doi.org/10.3390/jrfm13030055

