

THE IMPACT OF THE PANDEMIC ON TECHNICAL EDUCATION: A COMPARATIVE STUDY

^aERIK KRAJINČÁK, ^bMIROSLAV ŠEBO, ^cJANA DEPEŠOVÁ

Constantine the Philosopher University in Nitra, Tr. A. Hlinku 1, 949 01, Nitra, email: ^aerik.krajincak@ukf.sk, ^bmsebo@ukf.sk, ^cjdepesova@ukf.sk

Abstract: The period of the pandemic was clearly stressful for almost all areas of daily life. While the area of the school education system, primary, secondary and higher education, is in the media's crosshairs almost every day, the extensive area of further education has mostly gone unnoticed. The fact is that we found ourselves in a new, specific situation that we were not prepared for. As far as it was possible, school education switched to another form (e-learning, distance learning, etc.), but this option was not always possible for material reasons. The introduction of online teaching was not only for schools and teachers, but also for students. There was a need for contact between teachers and students, access to information and additionally flexible professional support for the teacher. The aim of the contribution is to supplement the comparison of the individual waves of the pandemic from the point of view of education at the Department of Technology and Information Technologies, Faculty of Pedagogy of the Constantine the Philosopher University in Nitra.

Keywords: education, pandemic, technology, e-learning

Introduction

2020 was clearly a stressful year for almost all areas of daily life, not excluding education. While the area of the full-time school education system, primary, secondary, and higher education, is in the media spotlight almost daily, the vast area of continuing education has remained largely unnoticed. The fact is that we found ourselves in a new, specific situation that we were not prepared for. The measures to combat the pandemic, consisting of the restriction of mobility, which went hand in hand with the restriction of face-to-face actions, significantly limited educational activity in this area and in most cases made it completely impossible. As far as it was possible, school education switched to another form (e-learning, distance learning, etc.), but this option was not always possible for material reasons. The introduction of online teaching was a challenge not only for schools and teachers, but also for students. It was necessary to ensure contact between teachers and students, access to information and provide professional support to teachers flexibly. Despite the fact that no computer screen can replace personal contact with a teacher, digital education during the pandemic made it possible to move to other new forms of education, making extensive use of information and communication technologies, which also contributed to the acceleration of the digital transformation of education. It can be stated that there are several distance learning platforms that are available to the general population. Two platforms that were strictly binding for the Constantine the Philosopher University in Nitra. The first platform was the EDU Educational Portal and the video conference system Meet.UKF. A big problem was the lack of technical equipment. For this reason, individual teachers were looking for ways to be in contact with students and provide them with at least basic support.

According to Marina Stock McIsaac, distance education is education in which the student and teacher are separated by time and place. It is currently the fastest growing form at the international level. What was once considered a special form of education using non-traditional systems is now becoming an important concept in mainstream education. In the traditional teaching model, teachers and students meet in the same place and at the same time. During the pandemic, however, the participants could not be in one place, so the possibility of a different place at the same time or a different place at a different time was used. Teaching in which participants meet at the same time, typically using communication services, on a common platform from different places, is also referred to as synchronous. This is, for example, a lecture that the teacher presents in real time with the online participation of students. However, the teacher can also choose another way and can pre-record his lecture and provide this recording to the students. Then we talk about asynchronous distance learning. The

situation marked by the Covid-19 pandemic caught the Ministry of Education of the Slovak Republic, and although online education platforms were not provided in the first months of distance education, digital technologies were primarily used for the purpose of communication and mediation of curriculum content between teaching staff, pupils and students at their place of residence. The time frame of the teaching units was flexible, parallel teaching took place according to needs and possibilities in the morning and afternoon hours, which caused increased demands on personnel, technical, communication and time management and on the adaptation of individuals.

The aim of this paper is to examine distance education in the context of the pandemic, technologies, concepts and benefits as it becomes an essential part of education systems in both developed and developing countries. Thanks to new technologies, the ways of teaching and acquiring new knowledge are no longer limited by space and time. New technologies offer great flexibility in when, where and how to distribute teaching and learning and offer flexible learning opportunities for individuals and groups of learners. Distance learning is one of the fastest growing areas of education and its potential impact on all education delivery systems has been greatly enhanced through the development of Internet-based information technology. To meet the needs of a changing world, future distance learning must be time-flexible, without geographical barriers, competitive and student-centered.

1 Research sample and research methodology

The research was carried out in the academic years 2019/2020 summer semester until the academic year 2021/2022 winter semester. In total, there are four semesters, which also represent four waves of the coronavirus. The entire research took place at the University of Konstantin Filozof in Nitra (UKF in Nitra), specifically at the Department of Technology and Information Technologies.

The study was prepared on the basis of the findings that emerged from four questionnaire surveys. All questionnaires were identical and contained 29 questions. The questionnaire initially focused on the precise categorization of respondents according to gender, year, type of study, faculty and department. The next part of the questionnaire focused on education during the corona crisis. This section contains 9 questions and is key to our comparative study. The next section of the questionnaire dealt with technical equipment and experiences with online education. This section also contained 9 questions. The last section focused on the environment in which teaching took place and its microclimatic conditions. There were 5 questions in this section.

The last two sections are not analyzed in this post and will be covered in future posts. All questionnaires were processed using the same statistical methods and then their results were compared and evaluated in a percentage display. In addition to the questionnaire, we also used the literary method, the method of observation and interview to verify our goals. 116 university students (hereafter only respondents) took part in the research over the course of four semesters. Of the total sample of 116 respondents, 59% were men (69) and 41% were women (47).

We were also interested in what form the respondents study. From the answers of the respondents in the questionnaire, it follows that the majority of the respondents, up to 78%, studied in the daily form of study. Only 22% of the respondents who filled out the questionnaire studied in an external form of study.

We also investigated the representation of students in individual grades. According to the graph below, all study years, including doctoral studies and extension studies, were involved in the research. The majority of respondents were from the first year of bachelor's studies (34), followed by respondents from the second year of bachelor's studies (21), first year of master's studies (14), then followed by students of extension studies (10), third year of

bachelor's studies (8 %) and students of the fourth year of bachelor's studies (8%). There were only (5%) respondents from the second year of master's studies. The respondents with doctoral studies had the smallest representation (1%).

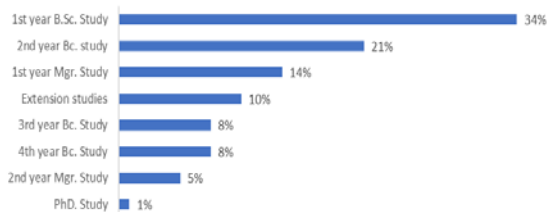


Figure 1 Year of study

Based on the previous findings, we can state that in the research, all grades that are educated at the Department of Technology and Information Technologies of the UKF in Nitra are represented. Due to the focus of the department, the respondents are mostly men. The ratio of full-time and external forms of study is significantly in favor of the full-time form, 78% to 22%. But in general, the representation of full-time students in regular education is significantly higher. From the point of view of years, the first year of bachelor's studies has the highest representation. There are the most of these students in the department and therefore they have the highest representation in the research sample.

2 Results

With the first question of the questionnaire, we found out how teaching was conducted during the corona crisis, led by teachers. Respondents had a choice of 8 answers (possibility of selecting multiple answers) plus the option to add another answer (figure 2).

During the first wave, the University of Constantine the Philosopher and the Department of Technology and Information Technologies were not yet ready for online education. Teaching therefore took place most often in the form of assigning seminar papers (theoretical papers) 85% and through e-learning courses 85%. Values above 35% were also exceeded by education via e-mail 54%, education via video-conference systems 38%. Among the less used forms of education with a value of 23% was the form of education through the assignment of projects (practical work). Education through social networks, education through online consultation and education through Microsoft Teams received 15% and were the least used forms of education in the first wave of the pandemic.

The university and the Department of Technology and Information Technology have already prepared for the second wave, and the forms of education have also changed significantly. Video-conference systems became the most used form of education by 92%, which increased by 54% compared to the first wave. They were followed by the assignment of seminar papers (theoretical papers) 43%, compared to the first wave they decreased by up to 42% and slightly above 30% received education through the assignment of projects (practical papers) 35%. Education through e-learning courses reached 29%, which is a decrease of up to 56% compared to the first wave. Education via e-mail also deteriorated significantly (decrease by 34%), which reached only 20%. Education using Microsoft Teams also fell, reaching a value of only 6% compared to 18% in the first wave. Education via social networks, on the other hand, increased by 10% compared to the first wave to a final value of 25%. Online consultations received 14% which are practically identical results to the first wave of the pandemic.

The third wave was very similar to the second wave and the forms of education reached similar values. Education through video-conferencing systems decreased by only 1% to 91% compared to the second wave, but we do not consider this decrease to be statistically significant. On the contrary, the form of education in the form of assigning seminar papers (theoretical papers) increased by 25% to a value of 68% compared to the

second wave. An increase of 20% was recorded by education through assignment of projects (practical work), which reached a value of 55% in the third wave. Education via email rose to 45%, which is 16% more than in the second wave. Similar values as in the second wave were recorded by the form of education via e-mail, which received only 3% more in the third wave than in the second, a total of 23%, and education via online consultations, which rose by 4% compared to the second wave to the final 18%. Microsoft Teams, on the other hand, recorded an increase of 12%, and its use in education reached an 18% share during the third wave. Education through social networks was used the least in the third wave of the pandemic, in only 9% of cases. This form of education decreased by up to 16% compared to the second wave.

The fourth wave continues the trend of the previous two waves and its values are very similar. Education through video-conferencing systems reached a value of 87%, which is only 4% less than in the third wave and we do not consider this to be a statistically significant difference. Education in the form of assigning seminar papers (theoretical papers) decreased by 11% compared to the third wave but increased by 14% compared to the second wave. It settled at 57%. Compared to the second and third waves, the form of education through assignment of projects (practical work) decreased and stabilized at 23%. The decrease compared to the third wave was up to 32%, and the values did not change compared to the second wave. We explain this decrease by the fact that the teachers found a suitable ratio between the use of the video-conference system (87%) and the assignment of theoretical (57%) and practical papers (23%), a total of 80%. What the pedagogues explained through the video-conference system, they gave the students the task of working out with the help of seminar papers or projects. For e-learning courses, there was a decrease of 18% compared to the third wave, and the resulting value of this form of education stabilized at 27%, similar to the second wave. In education through Microsoft Teams, there was a decrease of 11% and the value stabilized, similar to the second wave, at 7%. Education via email is very similar. This has stabilized at a value of 20%. E-mail education dropped by 13% from the first wave to the final 10%, and this form of education had a downward trend practically from the second wave. Education through online consultation maintained stable values of around 15% in the first three waves, but in the fourth wave there was a drop to a total of 7%. This is due to the fact that the students already had enough resources (videoconferences, e-learning systems and e-mail communication) for education and online consultations were therefore not used so often. The form of education through the social network decreased by only 2% compared to the third wave to a total of 7%. This value gradually decreased and stabilized at the resulting value.

Based on the analysis, we conclude that during the four waves of the pandemic, the most significant changes in the form of education occurred after the first wave. In the first wave, the University of Constantine the Philosopher in Nitra and the Department of Technology and Information Technologies were not sufficiently prepared for distance education. During the next three waves, education at the department stabilized, thanks to the deployment of new technologies, such as its own Meet.UKF video-conference system, which was the most frequently used resource at the department. In the same way, pedagogues went through training to work with new technologies and found their own system of how to use these technologies effectively in education.

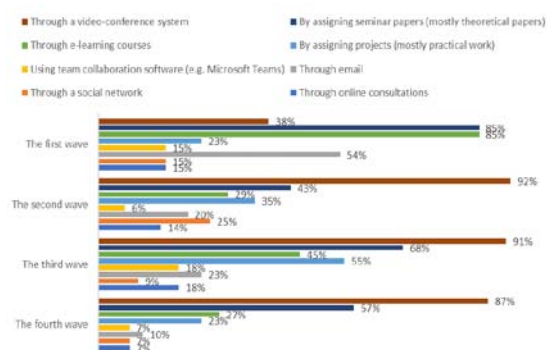


Figure 2 Course of teaching

With the second question, we investigated the most frequently used video-conference systems at the Department of Technology and Information Technologies of the UKF in Nitra (figure 3).

In the first wave, educators used various video-conferencing systems, and only later, when the university deployed its own Meet.UKF video-conferencing system, educators gradually began to use this video-conferencing system. The deployment of the university video-conference system was also reflected in the achieved results. The Meet.UKF university video-conferencing system scored 85%, which is significantly more than other video-conferencing systems. Messenger had a significantly smaller representation at 15% and WhatsApp also at 15%. Microsoft Team was used the least, only 8%.

In the second wave, Meet.UKF was dominantly used (100%). Compared to the first wave, its use increased by 15%. Educators got used to this video-conference system and the students also appreciated it. Its operation is simple, clear and enables easy sharing of presentations and the desktop. Since teachers and students liked Meet.UKF, the usability of other video-conferencing systems decreased significantly. Microsoft Teams became the second most used system. However, this only reached 2%. Messenger and even WhatsApp were not used by any of the educators in the second wave.

In the third wave, the situation in the use of video-conferencing systems began to stabilize. Just like in the second wave, Meet.UKF reached 100%. The use of the Microsoft Teams program increased slightly (by 7%), reaching a total of 9% and thus approaching the values from the first wave of the pandemic. Messenger and WhatsApp have practically ceased to be used in the educational process.

The Meet.UKF system was used by 100% of respondents in the fourth wave as well as in the second and third waves. Microsoft Teams, Messenger and even WhatsApp were no longer used in the fourth wave.

After analyzing the use of video-conferencing systems during the four waves of the pandemic, we conclude that the most frequently used video-conferencing system was Meet.UKF. Its simplicity of the user environment and possibilities of use in the educational process were appreciated not only by teachers, but also by students. Microsoft Teams became the second most used video-conferencing system. Microsoft Teams during the first three waves of the pandemic and its use was in the range of 2% to 9%. In the first wave, the university and teachers were still looking for a suitable video-conferencing system, which was reflected in the inconsistent use of video-conferencing systems.

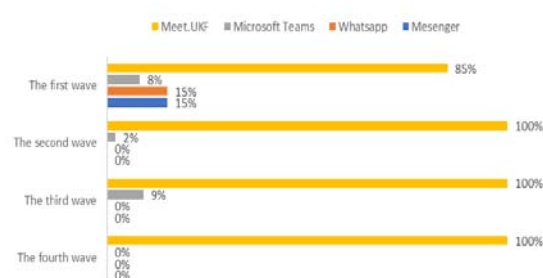


Figure 3 The most frequently used video-conference systems

As another question, we found out what the most frequently used e-learning systems at the Department of Technology and Information Technologies (figure 4) were. The university has been using and prefers its own e-learning system UKF EDU for a long time, which is built on LMS Moodle. However, some educators also use other e-learning systems in the educational process, such as LMS Moodle.

In the first wave, the dominant university educational portal UKF EDU reached 77% usage among respondents. It is followed by LMS Moodle with 23%. Since many respondents name the UKF EDU e-learning system as Moodle and vice versa, it is very likely that if they marked Moodle in the question, they actually meant UKF EDU. Therefore, this option to choose Moodle or UKF EDU was purposefully included in the question of the questionnaire. We assume that only a small percentage of respondents really used a different LMS Moodle than the university one called UKF EDU. Other e-learning systems were not used at the department.

In the second wave, the use of UKF EDU increased by 21% to a total of 98%. Respondents stated that they used LMS Moodle only in 2%. It follows that Moodle in the form of UKF EDU, or its modification, was used 100% in the second wave. No other e-learning system was used at the department even during the second wave.

The third wave saw a negligible increase in respondents' responses to the use of UKF EDU. This rose by 2% to a total of 100%. Compared to the first wave, this is an increase of 23%. On the other hand, LMS Moodle decreased by 2% compared to the second wave and stopped being used. Other e-learning systems were not used at the Faculty of Education in the third wave. The data obtained from the respondents indicate a trend of teachers focusing on using only the university e-learning system UKF EDU.

In the fourth wave, the situation with the use of e-learning systems stabilized and the respondents stated that the UKF EDU e-learning system was used up to 100%. No other e-learning systems were used.

During all four waves of the pandemic, the UKF EDU e-learning system was the most used. Gradually, all teaching staff got used to it, and in the fourth wave they practically only used this e-learning system. Which indicates the long-term sustainability of the use of this e-learning system in education.

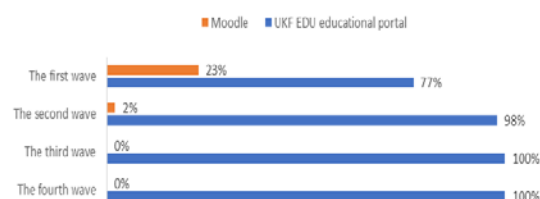


Figure 4 The most frequently used e-learning systems

The next question we asked was the quality of the educational materials that teachers at the Department of Technology and

Information Technologies provided to students during the pandemic (figure 5).

In the first wave, the respondents stated that 15% of the materials were average. Up to 77% of respondents considered the provided materials to be of high quality. 8% of respondents chose the answer very high-quality material. None of the respondents chose the option low-quality or very low-quality materials. We note that 85% of the educational materials were of a high-quality level (the sum of high-quality and very high-quality materials).

In the second wave, the situation with the quality of educational materials was very similar to the first wave. There were 0% of low-quality materials and very low-quality materials. Average materials rose by 9% to a total of 24%. Quality materials fell by 22% to a value of 55%. At the same time, high-quality educational materials rose to 22%, which represents a 14% increase compared to the first wave. In total, 77% of educational materials were of high quality.

In the third wave, none of the respondents stated that the educational materials were of poor quality or very poor quality. Average educational materials reached 14%, which is 10% less than in the second wave and practically identical to the first wave. The number of high-quality educational materials also increased by 22% to a final 77% compared to the second wave. However, very high-quality educational materials fell by 13% compared to the second wave to the resulting 9%. In total, however, 86% received quality educational materials. The third and first waves were practically identical in terms of the quality of the materials. The same winter semester and thus the use of the same materials from the previous period (first wave) also played a role in this.

In the fourth wave, the educational materials were rated very similarly to the second wave. This is due to education in the same semester (summer) as education during the second wave. Very poor-quality materials received only 3%. Low-quality educational materials reached a value of 0%. The value of average educational materials rose slightly (by 3%) to the final 17% compared to the third wave. Quality educational materials fell by 24%, to a total of 53%. Very high-quality materials, on the other hand, rose by 18% to a final 27%. In total, however, quality educational materials received 80%.

Based on the analysis, we conclude that students were provided with quality materials during all four waves of the pandemic. Respondents stated that on average for all four waves, 82% of the educational materials provided were of high quality. Slightly over 17% of educational materials were mediocre during all waves of the pandemic. Respondents classified less than 1% of the educational materials for the four waves of the pandemic in the group of very poor-quality materials. Based on these data, we conclude that the teachers at the Department of Technology and Information Technologies of the UKF in Nitra provided quality educational materials throughout the pandemic.



Figure 5 Quality of educational materials provided

With the last question, we found out how students would evaluate teachers and their education during the pandemic. The

students had the task of evaluating all the teachers who taught them during the given wave of the pandemic with one average grade (figure 6).

In the first wave of the pandemic, even if teachers were not ready for online education, they received positive or average rating. 15% of teachers were rated 1-excellent. Up to 31% of teachers were rated 2-Very good. A maximum of 38% of teachers received a grade of 3-Good. 15% of teachers received grade 4-adequate. None of the teachers received a rating of 5-Insufficient.

In the second wave, teaching staff gained more experience with online education, and the material and technical equipment necessary for teaching was also improved. All this had a positive impact on the educational process and on the evaluation of teachers. Compared to the first wave, there was a 3% increase in the best rating 1-Excellent, which rose to 18%. The 2-Very good rating rose even more. This evaluation of teachers increased by 22% to the final 53%. The 3-Good rating dropped by 11%. Educators received a 27% share in this evaluation. Only 2% of teachers were rated as 4-adequate. No teacher received a rating of 5 Inadequate.

In the third wave of the pandemic, there was a slight shift in the assessment. 9% fewer teachers received the best rating of 1-Excellent. In total, teachers received only 9% in this evaluation. In the rated 2-Very good there was an 11% increase compared to the second wave and the final score was 64%. The 3-Good rating did not change compared to the second wave and remained at 27%. No teacher received a grade of 4-Sufficient and a grade of 5-Insufficient. Compared to the second wave, there was therefore a slight deterioration of the results in the best-rated category, but a significant increase in the rating of 2-Very good. This may also be due to the difficulty of the subjects that were taught during this wave and semester.

In the fourth wave, there was a significant shift towards a better evaluation of teachers. In this wave, educators were rated the best of all four waves of the pandemic. 30% of teachers received the rating 1-Excellent, which is 21% more than in the third wave. The second-best rating was 2-Very good, achieved by 53% of educators, which is 11% less than in the previous wave. Only 13% of teachers received the grade 3-Good. It is 14% less than in the second and third waves. Three percent more than in the third wave and only 1% more than in the second wave, a total of 3% of teachers received a grade of 4-Sufficient. No one got a grade 5 Inadequate.

From the analysis of the results of the respondents' answers to this question, it follows that pedagogical workers were evaluated the worst during the first wave of the pandemic. In each subsequent wave, they scored better than in the previous wave. This was due to gaining experience with online education, training teachers to work with new digital resources, but also better material and technical security than in the first wave.

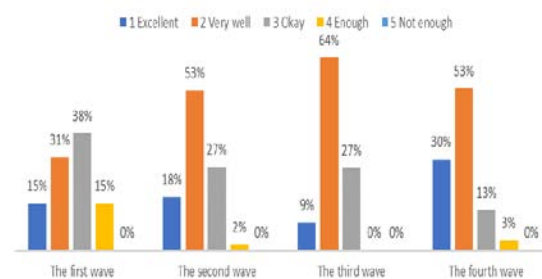


Figure 6 Evaluation of teachers

3 Conclusion

During the pandemic, between the first and second waves of the corona crisis, there was a significant shift in the quality of education at the Department of Technology and Information

Technologies of the University of Konstantin Filozof in Nitra. The management of the university and the faculty of education introduced several changes and improvements to the educational process before the second wave of the pandemic. Several series of trainings were held to work with the e-learning system, the MS Teams application, and the university video-conference system Meet.UKF. The Meet.UKF video conference system was improved in terms of both hardware and software, which in subsequent waves worked on better servers, which was also reflected in its stability and ability to work with a larger number of students without the application crashing. All these improvements were also reflected in the next waves.

At UKF in Nitra, a fixed schedule was introduced since the second wave of the pandemic, so that distance learning took place exactly at the same time as if it were applied face-to-face. This also contributed to the improvement of the educational process at the Faculty of Education. All these improvements resulted in a more stable educational process in the second, third and fourth wave of the pandemic, but also a greater degree of use of new technologies in education at the Department of Technology and Information Technologies. This contributed to a positive perception of the educational process by students and a positive assessment of the work of teachers by students.

From the point of view of sustainability, we note that the education system at the Department of Technology and Information Technologies throughout the pandemic was set up so that education could continue without major problems. As can be seen from the research, distance education gradually improved in the context of the corona crisis. The improvement was noticeable in each wave from the point of view of qualitative and quantitative indicators. Improving the quality of education came not only from the technical side - hardware, software, but also from improving the experience of the teachers of the Department of Technology and Information Technologies.

Literature:

1. Anderson, M. & Jiang, J. Teens, Social Media & Technology. Report of the Pew Research Center. [online]. [quoted 2019-09-18]. Retrieved from: <https://www.pewresearch.org/internet/2018/05/31/teens-social-media-technology-2018/>.
2. Dirgasová, S. (2022). Online vzdelávanie očami študentov VŠ, Univerzita Karlova Praha [quoted 2022-10-08]. Retrieved from: <https://dspace.cuni.cz/handle/20.500.11956/175623>
3. Espuny, C. & Gonzalez, J. & Lleixà, M. & Gisbert, M. University Students Attitudes Towards and Expectations of the Educational Use of Social Networks. In RUSC. Universities and Knowledge Society Journal, 8, 186–199. 2011.
4. Gunawardena, C. N. & McIsaac, M. S.(2002) Distance education [quoted 2022-10-08]. Retrieved from: <https://members.aect.org/edtech/ed1/pdf/13.pdf>
5. Manca, S. & Ranieri, M. (2013). Is it a tool suitable for learning? A critical review of the literature on Facebook as a technology-enhanced learning environment. Journal of Computer Assisted Learning, 29(6), 487-504.
6. Niklová, M., & Šimšáková, A. (2022) Vybrané dopady pandémie na vzdelávanie a žiakov v podmienkach slovenských škôl. Školská a profesijná orientácia, 59.
7. Šebo, M.(2016). Comparison of LMS and Facebook in Terms of Education Support. In Proceedings from 3rd International Multidisciplinary Scientific Conference on Social Sciences and Arts. Psychology and Psychiatry, Sociology and Healthcare, Education(Vol. 3, pp. 125-135). Sofia, Bulgaria: STEF92 Technology. doi:10.5593/sgemsocial2016B13
8. Šebo, M. & Depešová, J. (2019) The use of facebook and lms moodle in university education, ICERI2019 Proceedings, pp. 11702-11708
9. Šebo, M. & Hašková, A. (2020). How students perceive educational support through Facebook. Education and Self Development, 15(3), 67-75. DOI: 10.26907/esd15.3.06.
10. Teclehaimanot, B. & Hickman, T. (2011). Student-teacher interaction of Facebook: What students find appropriate. TechTrends, 55(3), 19-30. United Nations. (2020). Policy Brief: Education during COVIC-19 and beyond

Primary Paper Section: A

Secondary Paper Section: AM