

Impact of Four Coronavirus Waves on Higher Education: Comparative study

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Abstract

The comparative study focuses on the comparison of education during the corona crisis at the Constantine the Philosopher University in Nitra (UKF). Specifically, it will compare the four waves of the coronavirus and their impact on students of the UKF Faculty of Education in Nitra from the point of view of education. It also focuses on the development and sustainability of education at the faculty. The research was carried out using the questionnaire method after each semester during the two years of the pandemic. The research was attended by 523 respondents who studied at the Faculty of Education of Constantine the Philosopher University in Nitra.

Keywords: Educational research, Education, Corona crisis, Comparative study

1 Introduction

The year 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 other education has remained largely unnoticed. The fact is that we found ourselves in a new, specific situation that we were not prepared for. The actions 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

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information and also provide flexible professional support for teachers. 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 common population. For the University of Constantine the Philosopher in Nitra two platforms were strictly binding. 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 Mclsaac, 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. Something that was once considered a particular form of education using non-traditional systems now is becoming an essential 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 so, that online education platforms were not provided in the first months of distance education and 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 personal, 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-providing systems has been greatly enhanced through the development of Internet-based information technology. In order to meet the needs of a changing world, future distance learning must be time-flexible, without geographical barriers, competitive and student-centred.

2 The Research Sample and Methodology

The research was carried out in the academic year 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 the Philosopher in Nitra, specifically at the Faculty of Education.

The study was prepared based on the findings that emerged from four questionnaire surveys. All questionnaires were identical and contained 29 questions. The questionnaire initially focused on categorising 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 analysed 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.

Besides the questionnaire, we also used the literary method of observation and interview to verify our goals.

523 university students (respondents) took part in the research over the course of four semesters. Of the 523 respondents, 19% were men (100), and 81% were women (423).

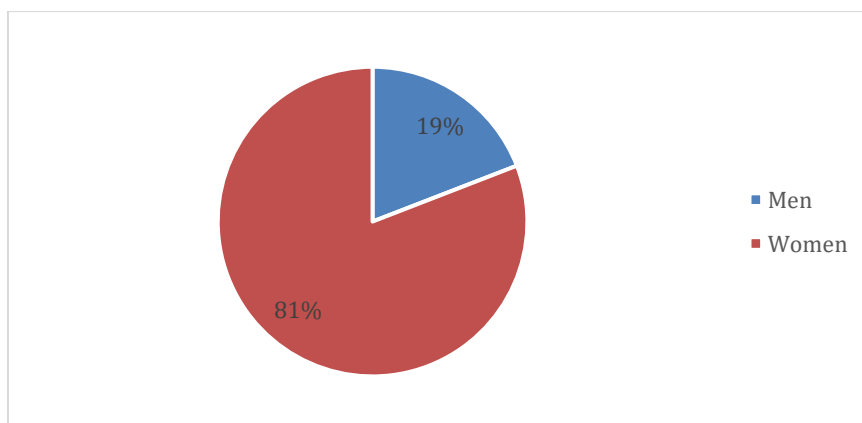


Fig. 1 Gender of the respondents

We were also interested in what form the respondents' study. From the respondents' answers in the questionnaire, it follows that most respondents studied, up to 80%, in the full-time form of study. Only 20% of the respondents who filled out the questionnaire reviewed in an external study form.

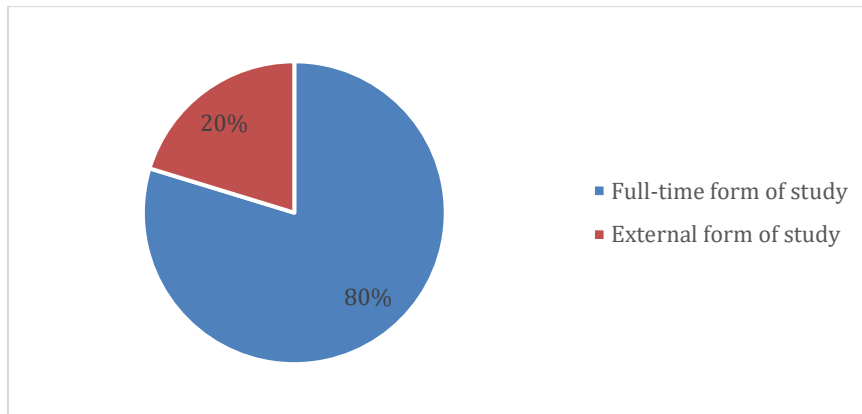


Fig. 2 Form of studies

We also investigated the representation of different years of study of students. According to the graph below, all study years, including PhD. and extension studies, were involved in the research. Most respondents were from the first year of bachelor's studies (38.2%), followed by respondents from the first year of master's studies (19.9%), the second year of bachelor's studies (18.5%), the third year of bachelor's studies (10.5%), the second year of master's studies (7.5%). Respondents from extension studies and respondents from the fourth year of bachelor's studies were 2.5%. The respondents of PhD studies had the smallest representation (0.4%).

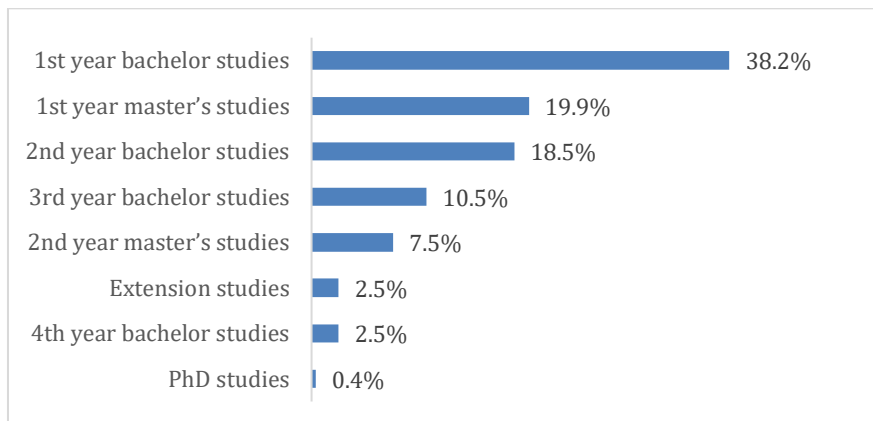


Fig. 3 Year of study

The last category we investigated is the affiliation of the respondents to a specific department. Respondents from all departments of the Faculty of Education of the University of Konstantin the Philosopher in Nitra participated in the research. The Department of pedagogy had the most significant representation at 56%, followed by the Department of Technics and Information Technologies at 22%. In third place was the Department of Language Didactics and Intercultural Studies with 10%. Other departments got a low percentage representation of 4% and less, more in the picture below. The lower representation of some departments is

caused by two factors. The first factor is the smaller number of students in the department compared to, for example, the Department of Pedagogy, and the second factor is the lack of interest in students' involvement in research by filling out a questionnaire.

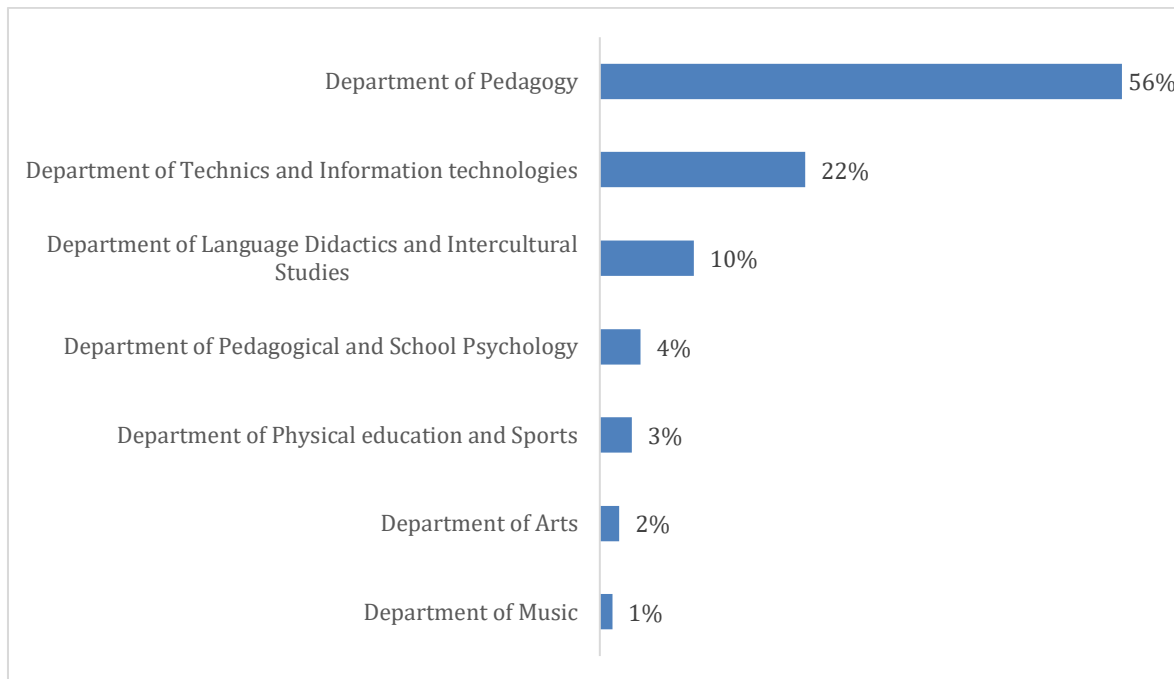


Fig. 4 The department of your studies

Based on the previous findings, we can conclude that all study years and all departments that educate students at the Faculty of Education are represented in the research. Due to the focus of the faculty, the respondents are predominantly women, and more than half of the respondents are from the Department of Pedagogy. The ratio of full-time and external forms of study is significantly in favour of full-time, from 80% to 20%. But in general, the representation of full-time students in regular education is also considerably higher. In terms of year of study, the first year of bachelor's studies has the highest representation. There are most of these students at the Faculty of Education, and therefore they have the highest representation in the research sample.

3 RESULTS

With the first question of the questionnaire, we were finding out how teaching, led by teachers, was conducted during the corona crisis. Respondents had a choice of 8 answers (the possibility of selecting multiple answers) plus the option to add another solution (figure 5). During the first wave, the University of Constantine the Philosopher and the Faculty of Education were not ready for online education. Teaching, therefore, took place most often in

the form of assigning seminar papers (theoretical papers) (81%). Values above 40% were also exceeded by education through e-learning courses (46%), education through email (46%) and assignment of projects (practical work) (41%). Education through the video-conference system (32%) also achieved a relatively high percentage. Among the least used forms of education, with a value of 14%, was the form of education through social networks, followed by education through online consultation, with a value of 12% and the Microsoft Teams system was used the least, only 5%.

Both the university and the Faculty of Education were better prepared for the second wave, and the forms of education have also changed significantly. The most used form of education became video-conference systems (88%), which grew by 56% compared to the first wave. They were followed by the assignment of seminar papers (theoretical papers) (46%); these decreased by up to 35% compared to the first wave, and slightly more than 30% received education through e-learning courses (32%) and the assignment of projects (practical papers) (31%). Compared to the first wave, education via e-mail significantly worsened (decreased by 25%), which reached only 25%. On the contrary, education with the help of Microsoft Teams increased significantly, rising from 5% to 18%. Education through a social network and online consultation received 10%. Compared to the first wave, there was no significant decrease in these two forms of education.

The third wave was very similar to the second wave, and the forms of education reached similar values. Although education through video-conferencing systems decreased by 4% to 84% compared to the second wave, we do not consider this decrease to be statistically significant. On the contrary, the form of education in assigning seminar papers (theoretical papers) increased compared to the second wave by 18% to a value of 64%. A slight increase (15%) was recorded in education through the assignment of projects (practical work), which reached a value of 46% in the third wave. Education via email has stabilised at 30%, which is only 2% less than in the second wave. Forms of education through Microsoft Teams (increase by 5%), social networks (decrease by 3%), and online consultations achieved the same values as in the second wave (10%). A decrease of 11% compared to the second wave was recorded by e-mail education.

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 82%, which is only 2% less than in the third wave, and we do not consider this a statistically significant difference. Education in the form of assigning seminar papers (theoretical papers) decreased by 7% compared to the third wave but increased by 11% compared to the second wave. It settled at 57%. Compared to the second and third waves, the form of education through the assignment of projects (practical work) decreased and stabilised at 23%. The decrease compared to the third wave was up to 23% and compared to the second wave only by 8%. We explain this decrease by the fact that the teachers found a suitable ratio between the use of the video-conference system (82%) and the assignment of theoretical (57%) and practical papers (23%), a total of 80%. The discussed material that the pedagogues explained through the video-conference system, gave the students the task of working out with the help of seminar papers

or projects. For e-learning courses, there was a slight decrease of 7% compared to the third wave, and the resulting value of this form of education stabilised at 23%. Practically no change has occurred in education through Microsoft Teams. Compared to the third wave, there was a decrease of only 1% to the resulting 22%. Compared to the second wave, there was an increase of 4%. With this form of education, we can state that it achieves the same values in the long term. Education via email is very similar. This has stabilised at a value of 20%. This is an increase of 6% compared to the third wave and a decrease of 5% compared to the second wave. Online consultations and education through social networks have maintained values of around 10% since the first wave. In the fourth wave, education through social networks received 9% and online consultations 12%.

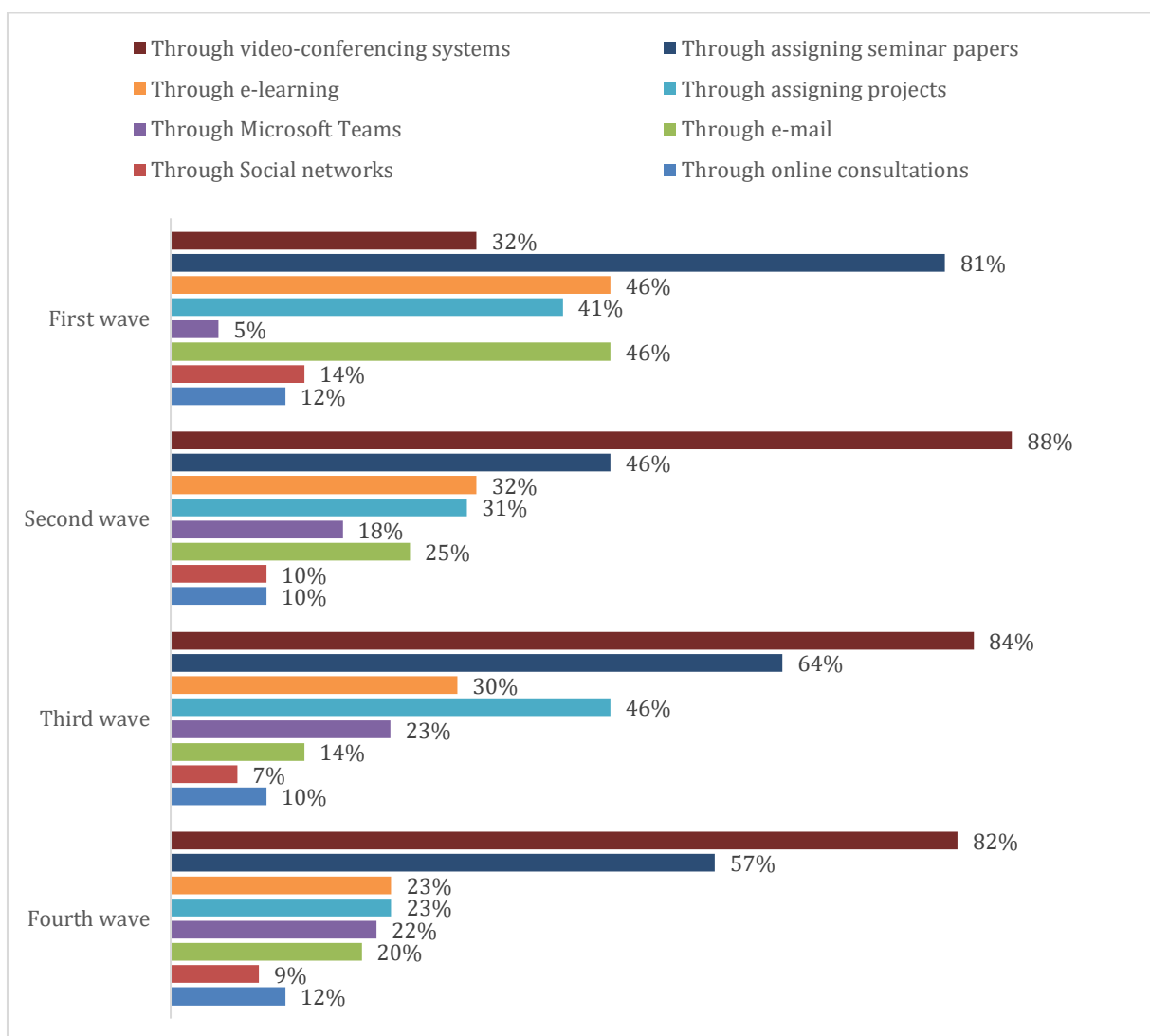


Fig. 5 Education process

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 Faculty of Education of the University of Constantine the Philosopher in Nitra needed to

be sufficiently prepared for distance education. During the next three waves, education at the Faculty of Pedagogy stabilised, thanks to deploying new technologies such as its own Meet.UKF video-conferencing system and Microsoft Teams team collaboration software. In the same way, pedagogues also went through training to work with new technologies and found their system for using these technologies effectively in education.

With the second question, we investigated the most frequently used video-conference systems at the Faculty of Education of the UKF in Nitra (figure 6).

In the first wave, teachers used various video-conferencing systems only when the university deployed its own Meet.UKF video-conferencing system, the teachers gradually started using this video-conferencing system. The deployment of the university video conference system was also reflected in the achieved results. The university video-conferencing system Meet.UKF received 75%, which is significantly more than other video-conferencing systems. Skype (22%) and Zoom (20%) were used considerably less. Values below 10% were obtained by Messenger (8%), Whatsapp (5%) and Microsoft Team only 3%.

In the second wave, Meet.UKF was dominantly used (100%). Compared to the first wave, its use increased by 20%. Educators got used to this video-conference system, and students also appreciated it. Its control is simple, clear and allows easy sharing of presentations and desktops. Since teachers and students liked Meet UKF, the usability of other video-conferencing systems decreased significantly. The second most used system was Microsoft Teams (16%). Its popularity increased by 13% due to teachers' training to work with this system. The use of the Zoom application decreased by 8% compared to the first wave to a final value of 12%. The most significant decline occurred with the Skype application, which fell by 18% to a final 4%. Messenger was used by only 1% of respondents in the second wave. Messenger decreased by 7% compared to the first wave. No one used Whatsapp in the second wave.

In the third wave, the use of video-conference systems began to stabilise. Just like in the second wave, Meet.UKF achieved 100%. The use of the Microsoft Teams program increased slightly (by 7%), reaching 23%. Zoom (3%), Messenger (2%) and Whatsapp (0%) have practically stopped being used. However, the use of Skype has grown surprisingly. Compared to the second wave, the use of the Skype application increased by 33% to the final 37%. The increase in Skype was caused by teachers' frequent use of this application at the Department of Pedagogy. At the department of pedagogy, the Meet.UKF video-conference system was sometimes unstable due to many students logged on simultaneously (around 150). This is also why some teachers chose the Skype application as an alternative.

As in the second and third waves, the Meet.UKF system was used by 100% of respondents in the fourth wave as well. Microsoft Teams decreased compared to the third wave by 11% to the resulting 12%. Zoom was only used in 2%, about the same as in the third wave. Usage of Skype dropped just by 1% after considering the performance of Meet. UKF's video conferencing system servers. Other applications 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 was appreciated by teachers and students. Skype became the second most used video-conferencing system. Its frequent use was the insufficient performance of the servers for Meet.UKF, which, however, was resolved during the pandemic. Microsoft Teams has been used throughout the pandemic as a supplemental learning tool, with usage ranging from 12% to 23% over the last three waves. In the first wave, the university and teachers were still looking for a suitable video-conferencing system, reflected in the inconsistent use of video-conferencing systems.

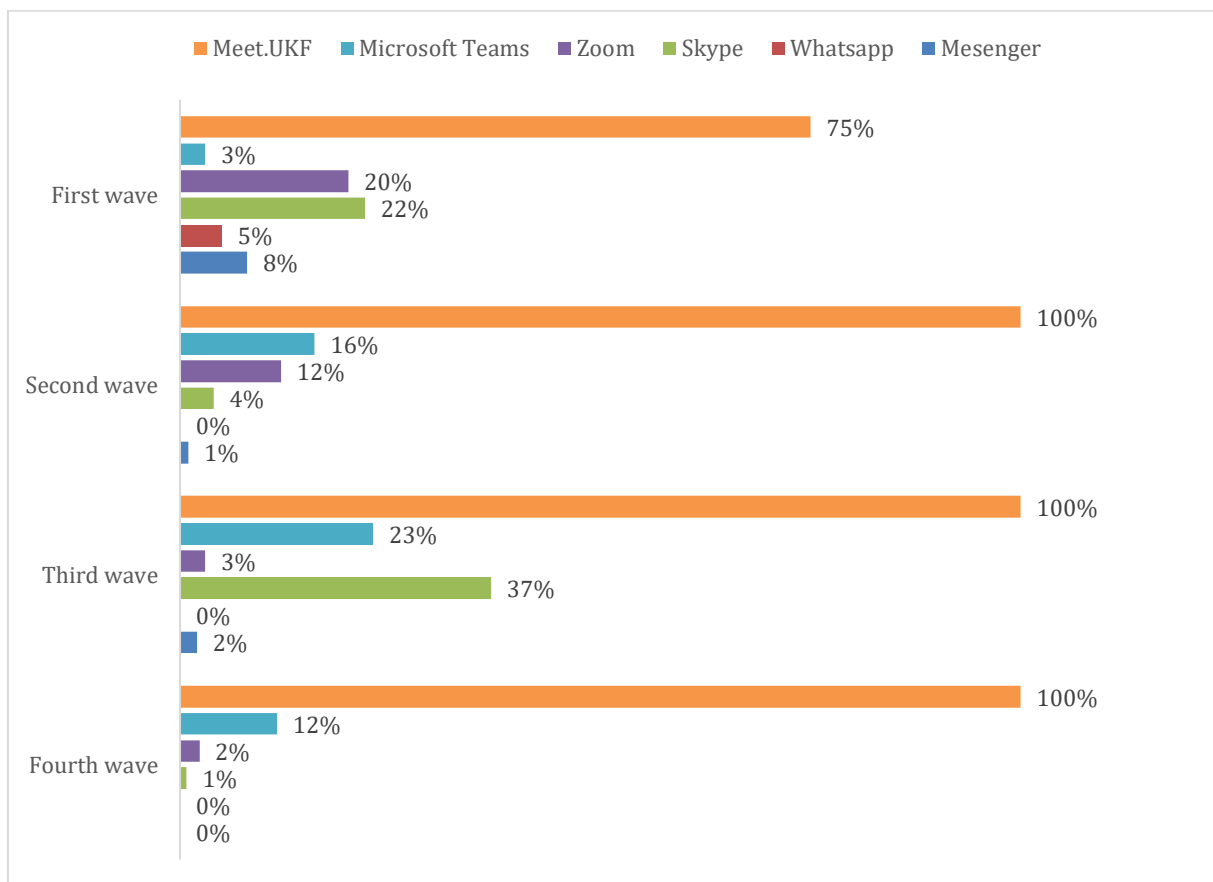


Fig. 6 Mainly used video-conference systems

As another question, we were finding out what were the most frequently used e-learning systems at the Faculty of Education (figure 7). For a long time, the university has been using and preferring its own UKF EDU e-learning system, which is built on the LMS Moodle. However, some educators also use other e-learning systems in the education process, such as Google Classroom, MS Teams, and so.

In the first wave, the dominant university education portal UKF EDU was used by 85% of respondents. LMS Moodle follows it with 10%. Since many respondents named UKF EDU's 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 questionnaire. We assume that only a small percentage of respondents used a different LMS Moodle than the university one called UKF EDU. Another e-learning system used in the first wave was Google Classroom, which only gained 3%. Only 2% was acquired by Gmail. However, here we assume that the respondents meant Google Classroom; they just used the wrong terminology.

In the second wave, the use of UKF EDU increased by 8% to a total of 93%. Respondents stated that they used LMS Moodle in 6%. It follows that Moodle in the form of UKF EDU or its modification was used by 99% in the second wave. Only 0.5% of respondents said they used Microsoft Teams, and 0.5% said they did not use any e-learning system.

The third wave saw a negligible decrease in respondents' responses to the use of UKF EDU. This decreased by 4% to a total of 89%. Conversely, LMS Moodle rose by 2% to a final 8%. The university education system received 97%, which is a statistically insignificant difference compared to the second wave. Google Classroom and Gmail gained a combined 4%. In the third wave, other e-learning systems were not used at the Faculty of Education. 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 stabilised, and the respondents stated that up to 97% used the UKF EDU e-learning system, and only 3% indicated LMS Moodle. 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. This indicates the long-term sustainability of the use of this e-learning system in education.

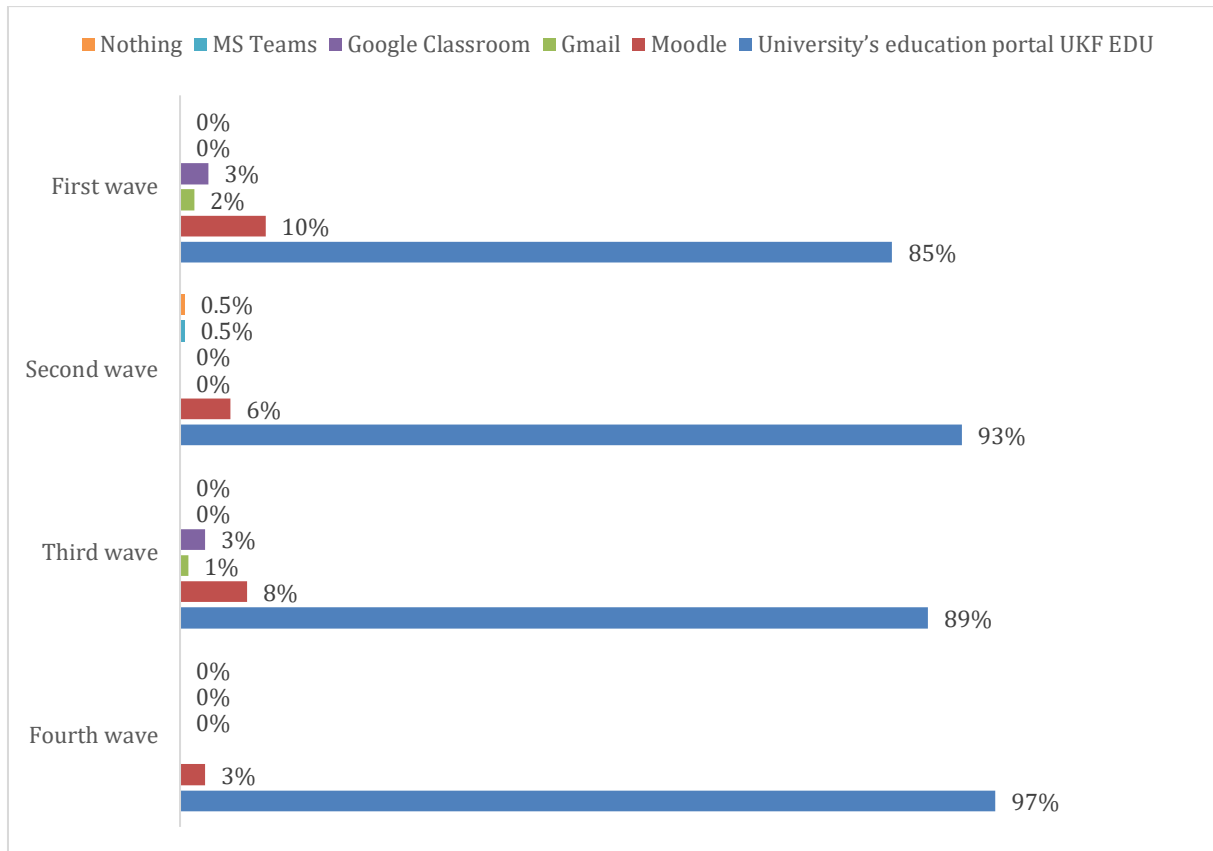


Fig. 7 Mainly used e-learning systems

The following question was used to determine the quality of the educational materials teachers at the Faculty of Education provided students during the pandemic (Figure 8).

In the first wave, the respondents stated that 2% of the materials were poor quality and 25% were average. Up to 53% of respondents considered the provided materials high quality. 20% of respondents chose the answer as very high-quality material. We note that 73% 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 only 2% of poor-quality materials. Average materials fell by 3% to a total of 22%. Similarly, high-quality materials fell by 3% to 50%. At the same time, however, very high-quality educational materials rose to 25%. In total, 75% of the 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 27%, 5% more than in the second wave. The number of high-quality educational materials also increased by 8% to 58% compared to the second wave. However, high-quality educational materials fell by up to 11% compared to the second wave. In total, however, quality educational materials received 72%.

In the fourth wave, the educational materials were evaluated very similarly to the previous waves. Very poor- quality materials gained 1%. Low-quality educational materials reached a value of 2%. The sum of these low-quality materials is only 3%, which is a very low value. The average educational materials' value decreased slightly (by 5%) to the final 22%. High-quality educational materials decreased by 3%, which is a statistically insignificant decrease to a total of 55%. Very high-quality materials, on the other hand, rose by 6% to a final 20%. In total, however, quality educational materials received 75%.

Based on the analysis, we conclude that students were provided with quality materials during all four waves of the pandemic. Respondents stated that, in total, three-fourths of the educational materials provided were of high quality. Slightly more than 20% of the educational materials were average during all waves of the pandemic, and only about 2% of the respondents included them in the group of low-quality materials. Based on these data, we conclude that UKF Faculty of Education in Nitra teachers provided quality educational materials throughout the pandemic.

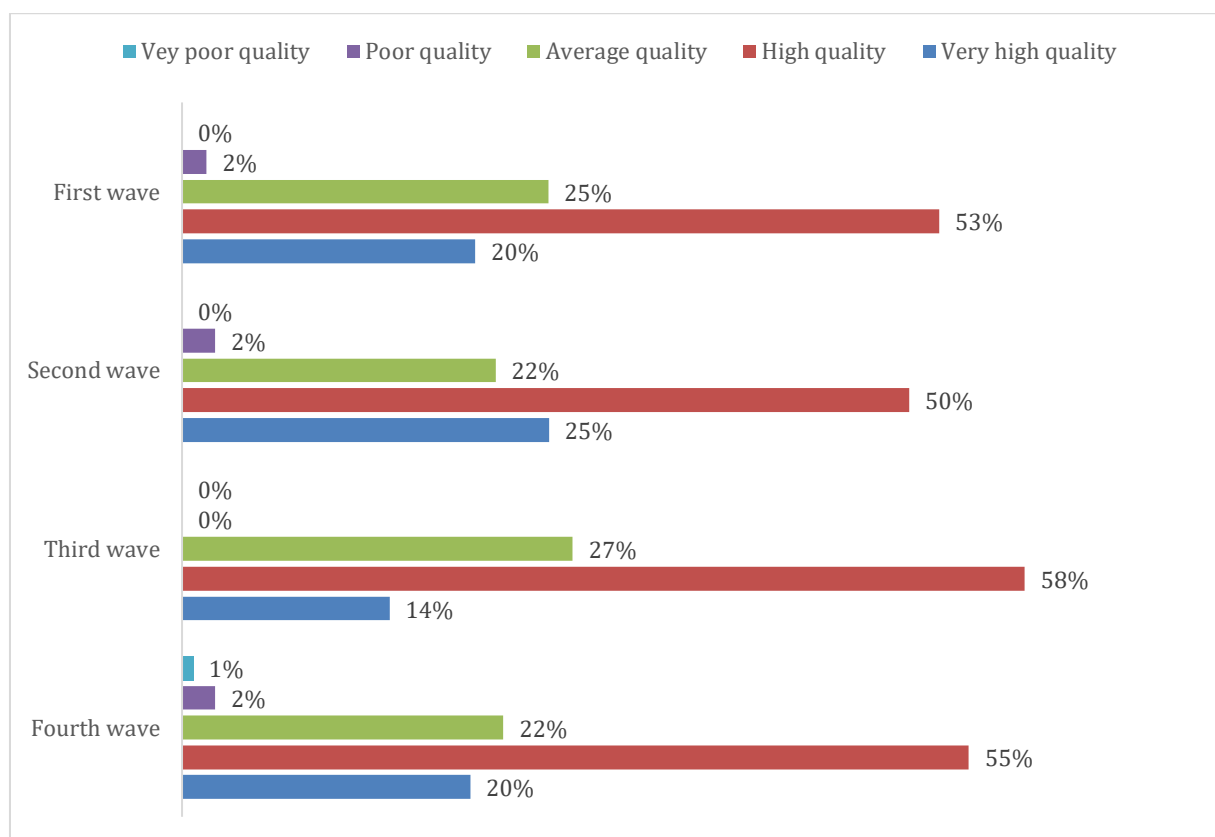


Fig. 8 The quality of the provided materials

With the last question, we found out how students would evaluate teachers and their education during the pandemic. The students had the task of assessing all the teachers who taught them during the given wave of the pandemic with one average grade (figure 9).

In the first wave of the pandemic, even if teachers were not prepared for online education, they received positive or average rating. 17% of teachers were rated excellent with grade 1. Up to 32% of teachers were rated 2 Very good. A maximum of 36% of teachers received a grade of 3 – good. Grade 4 – sufficiently – obtained 10% of teachers. Only 5% of 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 the evaluation of teachers. Compared to the first wave, there was an 11% increase in the best rating 1 – excellent, which rose to 28%. The rating went up even more for 2 – very good. This evaluation of teachers increased by 13% to the final 45%. The rating dropped by 12% for 3 – good. Educators received a 24% share from this evaluation. Only 3% of teachers were evaluated with grade 4 – sufficient. No teacher received a rating of 5 – insufficient.

In the third wave of the pandemic, there was a slight shift in evaluation. 13% fewer educators received the best rating of 1 – excellent. In total, educators received only 15% in this evaluation. In grade 2 – very good, there was a 7% increase compared to the second wave and the final score was 52%. It increased slightly (by 7%) compared to the second wave of the pandemic, rating 3 – good. Educators received 31% in this evaluation. Two per cent of teachers had a grade of 4 – sufficient, and one per cent a grade of 5 – inadequate. Compared to the second wave, there was a slight deterioration in the results, and the teachers got worse grades. This may also be due to the difficult subjects taught during this wave and semester.

In the fourth wave, there was a significant shift towards a better evaluation of teachers. In this wave, teachers were rated the best of all four pandemic waves. 28% of teachers received a rating of 1 – excellent, which is 13% more than in the third wave. Second-best rating 2 – very good, achieved by 51% of educators, which is only 1% less than in the previous wave. Only 17% of teachers received a grade 3 – good. It is 14% less than in the third wave. Two per cent more, a total of 4% of teachers received a grade of 4 – sufficient. No one got a grade of 5 – insufficient.

From the analysis 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 the acquisition of experience with online education, the training of teachers to work with new digital resources by the Faculty of Education, and better material and technical provision than in the first wave. Teachers in the third wave received a slightly worse rating than the second and fourth waves, possibly due to the composition of the educational subjects and their difficulty.

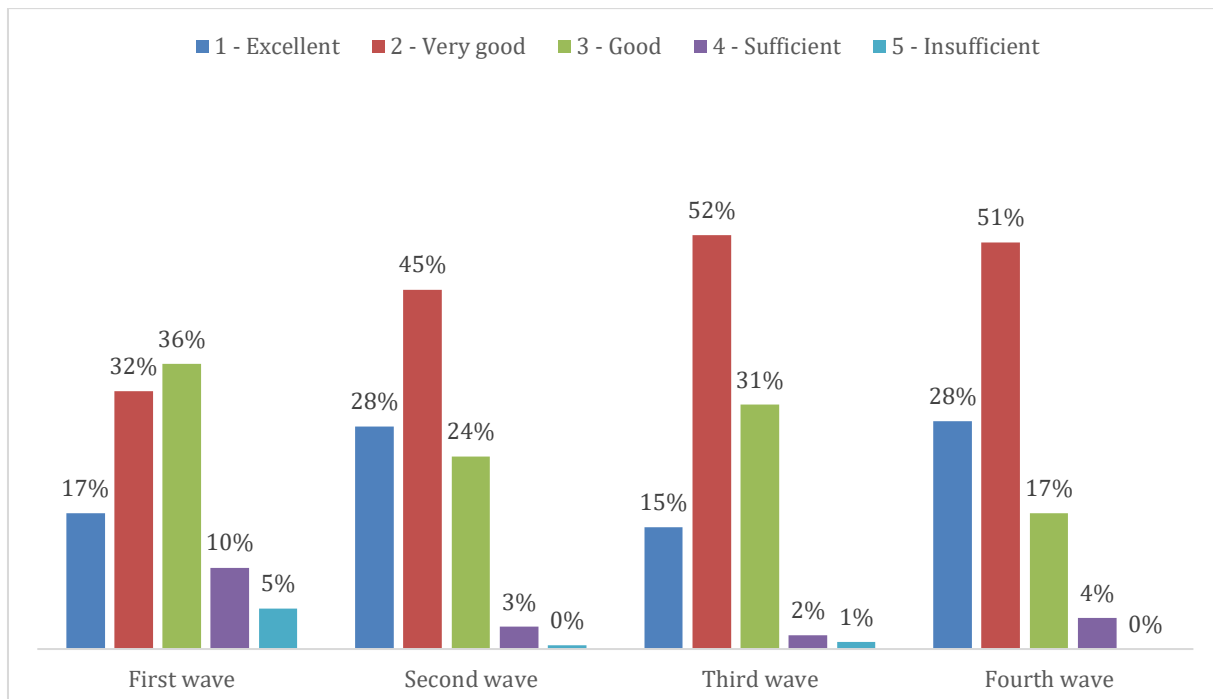


Fig. 9 Evaluation of teachers

4 CONCLUSIONS

During the pandemic, between the first and second wave of the corona crisis, there was a significant shift in the quality of education in education at the Faculty of Education of the University of Constantine the Philosopher 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 training was 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. It was also reflected in its stability and ability to work with a more significant number of students without the application crashing. All these improvements were also reflected in the next waves.

At the Faculty of Education of the UKF in Nitra, a fixed schedule was introduced during 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 improving the educational process at the Faculty of Education.

All these improvements resulted in a more stable educational process in the second, third and fourth waves of the pandemic and a greater use of new technologies in education at the Faculty of Education. 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 Faculty of Education throughout the pandemic was set up in such a way that education could continue without major problems. From the research it is obvious that 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 not only came from the technical side – hardware, software, but also from the improvement of the experience of the teachers of the Faculty of Education.

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