



IMPACT OF COVID-19 PANDEMIC ON PILOT TRAINING

Yosef Butuk
Air Transport Department
University of Žilina
Univerzitná 8215/1
010 26 Žilina

Iveta Škvareková
Air Transport Department
University of Žilina
Univerzitná 8215/1
010 26 Žilina

Abstract

The COVID-19 pandemic had a negative impact on all areas of human development. The air transport industry has been forced to adopt virtually all of its activities to meet rapidly changing travel regulations and requirements. The main goal of this paper was to identify the impact of the pandemic on pilot training. For this purpose, an analysis of many aspects were carried out, such as, for example, the impact of the pandemic and related restrictions on the psychological state, physical health, and the very quality of education in these difficult times. The paper also contains information about the pandemic's impact on aviation in general and active pilots, and about how the pandemic affected them.

Keywords

Pandemic, Training, COVID-19, Impact, Pilot.

1. INTRODUCTION

The coronavirus pandemic, named "COVID-19" can be called a serious global problem. This pandemic has become one of the most significant challenges of the 21st century. The consequences of a coronavirus pandemic are a phenomenon that has many aspects. In addition to affecting almost all areas of human life, the pandemic has affected complex social, economic, cultural, organizational, and managerial aspects of society as a whole.

Air traffic fell to record levels worldwide during the pandemic. This type of transport was most affected during the pandemic. The crisis has also affected airline employees - pilots, flight attendants, technicians, and so on.

Education has also undergone several changes during the pandemic period. Secondary, general, vocational, higher, and supplementary education systems have moved to an online format using distance learning technologies.

The transition to the distance form requires all participants in this process the ability to adapt quickly, to find suitable ways and approaches in teaching, to work on the efficient use of time, and increased responsibility for their results. The difficult pandemic situation and the constant changes in the form of education could worsen the mental state of the students.

2. IMPACT OF THE PANDEMIC ON PILOT TRAINING

The year 2020 brought surprises and challenges around the world. Many countries have begun to implement strict anti-pandemic measures, including lockdowns and the temporary closure of borders.

Due to the COVID-19 pandemic, we all had to change our usual approach to work, study, and everyday life, to relationships with colleagues, friends, and loved ones. For this reason, most educational institutions have begun to implement a safe model of organizing the educational process for students and teachers following the necessary hygienic and pandemic requirements. It

was also necessary to adapt the educational process and scientific activities, limit personal communication between students and teachers, and prevent the spread of the virus. It was necessary to increase the use of digital technologies, develop new methods of distance learning, and at the same time maintain high quality, in the shortest possible time.

With the transition of universities to online education, most of them have strengthened cooperation between themselves, national education authorities, educational platforms, and international organizations.

As it is very important to monitor physical health, mental health and the consequences of the coronavirus crisis, universities and research organizations have conducted studies around the world, analysing the impact of the COVID-19 pandemic on the population. The results of studies focused on students of universities of various disciplines will be presented, as there is very little information concerning only pilots. The first step for a large part of future pilots starting their path into the world of aviation and a professional pilot is integrated training, which is often completed at the university that offers the field, which means that the information provided will also cover pilot training.

Can we claim the modular course students were not affected? This is not entirely true. Due to strict anti-pandemic measures, such as the temporary closure of businesses, shops, but also educational institutions, the lockdown has also been applied in most countries, which severely restricts mobility and leads to self-study or distance learning and may lead to the consequences mentioned below. When the government of the countries started to ease the anti-pandemic measures, the situation changed for the better, but the pandemic left traces and the probability that we will return to the period before the pandemic and forget about the virus is quite small.

According to FlightLogger, at the beginning of the pandemic, a significant decrease (above 40%) in the average activity of pilots in training was recorded (see Fig. 1). This decline shows the impact of pandemics and anti-pandemic measures on pilot

training. As already mentioned, aviation schools were forced to adapt to new conditions and situations, to implement a new approach to the organization of the educational process. After the release of some measures and the organization of all training processes, the activity of students also increased. We can see an improvement in the situation at the time, but the data show that the average number of active pilots per training organization is still lower than before the pandemic. [1] [2]

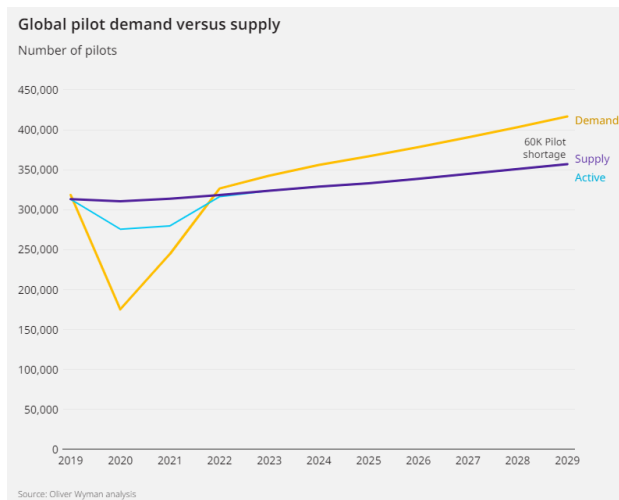


Fig. 1. Average active students per Pilot Academy

2.1. Implementation of distance education and its impact

The field of higher education can easily be called one of those on which the pandemic has had the greatest impact worldwide. In addition, the education sector has become one less ready to move most of its processes online. Many students initially like to switch to this form of education because in this case, they can spend more time at home, but in fact, it's not everything as good as it might seem at first glance. Of course, there are benefits. For example, it saves time, which is reflected in the absence of the need to go to university, including travel time, which means that the morning routine ends at the computer, but also the use of multiple Internet resources to study better and more thoroughly study information and much more. It should be noted that almost all resources are aimed at improving the quality of education and assimilation of information, but their excessive amount can adversely affect the state of students.

The psychological burden on students and teachers is increasing in connection with the transfer of many educational and administrative realities online. Due to the close dependence on tackling the problems of effective education, many universities are experiencing problems faced by educational organizations in the transition to the distance format of work. This challenge requires adequate preventive measures of a regulatory and organizational nature on the part of universities. [3]

During the first wave of the COVID-19 pandemic, the quality of distance education depended on services related to administration (speed of response of management of educational facilities to problems), technical support (speed of provision of all necessary technical means and especially services that would be suitable for online education), the active role of teachers in the online learning process and their response and timely feedback, and the overall quality of the

system with the way it is procured by IT infrastructure. Students' digital competencies and online interactions with colleagues and teachers are slightly less important factors, but they are still statistically significant. The influence of quality on students' performance also depends on the students themselves it depends on their satisfaction with online teaching, so it is important to monitor and analyse their satisfaction and the factors that affected student performance after the rapid introduction of e-learning. This can be important for decision-makers and anyone involved in implementing any new measures in the future. Investment in the development of digital competencies for both students and academics should also be supported, together with initiatives to support research and interdisciplinary innovation collaboration in various aspects of higher education online to increase its quality. [3]

The process of distance education depends on the attitude of teachers and students. Students' attitudes towards distance education are twofold and ambiguous. On the one hand, they understand its advantages and, on the other hand, they are still a little worried that the quality of the acquired knowledge will be lost, influenced by the lack of personal contact with the teacher. At the same time, it is clear that the right explanatory and marketing activities of educational institutions, as well as a well-established distance learning system (using the latest technological advances, sophisticated methodological basis, interactive interaction, etc.), can significantly increase the weight of distance learning.

Until two years ago, no one could have imagined that for almost two years, students around the world would study distance learning. In any case, the current situation in the world has given us a lot of experience. And now we can be sure that no matter the circumstances, there will always be an opportunity to gain quality education and skills, even at home. It can also be assumed that in the future it is possible to expect the introduction of a distance or combined method of education instead of the traditional one.

2.2. Impact of the COVID-19 pandemic on mental health

During the COVID-19 crisis, there was no direct contact between students. Communication was possible mostly through social networks, or via other applications and platforms that were designed for the exchange of information. As students in almost every country in the world have spent most of their time in isolation over the last two years, the pandemic has not only disrupted their normal way of life but also could endanger their mental health.

However, studying at university usually means a new chapter in life - the transition to adulthood and independence. In 2020, students did not experience this new life because they were deprived of social contacts, extracurricular activities, and brigades and many had to return home when they had previously been in dormitories, a place where student and social life is very active. The radical changes caused by the pandemic affected all students in some way. The most influenced were first-year students who had just started studying, the process of adapting to university life was especially challenging for them.

The psychological state of society is determined in terms of the mental and emotional well-being of people and is considered by taking into account objective indicators and subjective

evaluations. The World Health Organization has defined mental health as "a state of well-being in which an individual can exercise his or her abilities, cope with the stresses of everyday life, to be able to work productively, and can contribute to the life of society." [4]

Since the beginning of the pandemic, several studies have been conducted on its impact on society.

Researchers from the University of Applied Sciences in Zurich conducted a study where they monitored the mental health of university students. 2437 respondents took part in the survey. The average age of the participants was 25 years. The baseline survey was conducted from 3 to 14 April 2020. [5]

The most widely used measure of anxiety, which has also been used by Swiss researchers, used in clinical practice as well as in research to screen, diagnose and assess the severity of anxiety disorders is GAD-7 (Generalized Anxiety Disorder 7). GAD-7 is a personality questionnaire for assessing anxiety levels and screening for generalized anxiety disorder. In addition, it can be used to screen for panic disorder, social phobia, and post-traumatic stress disorder. The questionnaire consists of 7 test questions, each of which offers four possible answers. The points are awarded for each response, based on the sum of which concludes with the level of anxiety, the presence of symptoms of generalized anxiety disorder, and other anxiety disorders. Questions need to be answered based on the respondent's feelings over the past 14 days. [5] [6]

Analyses suggest that COVID-19 specific factors are related to student anxiety and anxiety prevalence. Depending on the latent group, some students perceived a strong impact on well-being and daily life and the level of anxiety approached the binding limit, but most students perceived a medium or even small impact of the pandemic. [5]

The research shows that students from the medical fields showed significantly less anxiety compared to students of management and law, biology, or linguistics. [5]

The data suggest that some students are better able to cope with the dramatic changes they have experienced, such as medical students, and younger and wealthier students. Others are doing worse and, with future measures in mind. Their needs should be addressed by public health and educational institutions. [5]

Researchers from Kazan Federal University together with colleagues from Moscow State University and the Psychological Institute of the Russian Academy of Sciences conducted a study on student mental health, which took place from April 9 to April 20, 2020. Students from several universities in Russia's eight federal districts took part in the online study. The total number of respondents was more than 3,000, students, most of whom were women. The average age of the respondents is 21 years. The results of studies conducted earlier by researchers during a large-scale research project on the study of students' mental health in the period 2018-2019 from 5 March to 23 March 2020 were compared. [7]

The main focus of the new study by Russian scientists is to identify stress levels in three different periods: long before the start of the pandemic (period 1); in the first days of the spread of COVID-19 in Russia, but before the introduction of measures

(period 2); in taking tough measures to curb the first wave of the pandemic (period 3). The researchers were interested in how anxiety increased and what factors contributed to increasing or decreasing the level of anxiety. [7]

In general, the available data allowed the researchers to conclude that no differences in mental well-being were found in the first period. The second and third periods were characterized by the highest rates of depression, anxiety, and stress. [7]

The results of the study also show that in a situation where the uncertainty caused by the pandemic was high, there was a significant deterioration in the mental health of male students. Thus, it can be assumed that pandemics, restrictions, and lifestyle changes had a stronger impact on men than on women. [7]

In this study, students' mental health indicators are significantly better than before the COVID-19 pandemic. The deterioration occurred when the pandemic was reported and the epidemiological situation in Russia and the world continued to deteriorate. And after weeks of anti-pandemic measures, the level of stress and anxiety began to decline. The data suggest that Russian students have been able to adapt quickly to change and the level of uncertainty in the situation has decreased. [7]

A study involving 3,490 respondents in Slovakia showed that "a combination of social isolation, insecure news and confusing information from school often led to states of anxiety, stress, and loneliness". 74% of respondents did not have a problem with a lack of communication and socialization within the possibility caused by the situation. Less than half of the students had excessive stress from school, almost 40% felt little to do anything and about 27% of students felt lonely. More serious manifestations, such as depression and anxiety, were felt by fewer people, 29% and 33%, still being a disproportionate part of the population. [8]

From the point of view of future pilots, the crisis in aviation caused by a pandemic can also cause feelings of anxiety and depression. There could be less interest in new pilots and thus less probability of employment after training and obtaining the necessary licenses and qualifications.

The increased anxiety observed among students at the onset of the pandemic subsided over time. Anxiety declined as people got used to the new way of life and the virus itself was no longer acute. However, depressive disorder is not so much related to general concerns as to feelings of isolation, lack of support, and drastic lifestyle changes. The psychological support offered by universities also helped the students.

2.3. Impact of the COVID-19 pandemic on physical health

Coronavirus has a detrimental effect not only on the lungs but also on other human organs. Attempts to systematize this process based on data obtained from physicians have been made by the American edition of Science.

Upon entering the human body through the nasopharynx, the virus begins to multiply and spread in new cells. If the immune system cannot stop it, the virus enters the trachea and lungs, which is especially dangerous. As a result of the immune system's fight against it, the body's oxygen supply is disrupted.

Infection with pneumonia and acute respiratory distress syndrome is also possible with the infection. People infected with the virus are seriously ill and do not even die from the coronavirus but from the action of their immune system. The immune system sometimes works so fast and hard, trying to fight the virus that in some cases it destroys its own body. [9]

Experts believe that COVID-19 poses a threat to the brain and central nervous system. According to experts, patients may lose consciousness. A symptom such as olfactory loss is quite common. A cytokine storm can lead to brain edema and stroke due to increased blood clotting. The publication says that an objective picture of the effect of coronavirus on the human body can be obtained only after serious long-term studies. [9]

In addition to the impact of the virus itself on the human body, the impact of distance learning and anti-pandemic measures should also be taken into account.

Sight is one of the five major human senses that needs to be protected. While studying at university, eyesight was less stressed: during lectures, students look at the teacher, the notebook, the blackboard, and the moment they move their eyes and focus on other subjects, they relieve eye strain. Working at a computer all day, and during breaks monitoring social networks, which means minimal eye movement from the computer screen to the screen of a mobile phone or tablet can cause visual impairment. To prevent this, it is necessary to shorten the time spent at the computer screen and it is also useful to do exercises or gymnastics for the eyes. The pandemic had a strong impact on human activity, significantly limiting it. The student was still on the move: a trip to the university and back, relocation to other classes between classes, short walks during breaks, and so on. [10]

The new measures have encouraged people around the world not only to reduce physical activity but also to consume more junk food that can be ordered quickly through various services and applications. Remarkably, eating junk food is closely related to a mental condition that worsened for many during the quarantine period, and could have changed sleep patterns. Therefore, even those who have never experienced anything like this before had problems with overeating and being overweight. The pandemic has forced us to look at the problem of overweight (obese people are more at risk and harder to bear the virus). [10]

Distance learning also affects students' postures. Students often sit in poor postures, which can cause serious illnesses, such as scoliosis, osteochondritis, and other diseases. [10]

It is important for pilots, whether in training or already working, to monitor their health. This is because their state of health depends on the possibility to work. At least once a year, the transport pilot should have a medical examination and, upon successful completion, obtain a medical certificate. In case of any deviation of their medical condition that could affect air safety, the medical officer shall no longer issue a medical certificate and the applicant should undergo further examination and treatment, but there may be a possibility that the problem will not be resolved what can mean the end of a career.

We can therefore conclude that this form of education, like any other, has its advantages, but also significant disadvantages. In

addition, they significantly affect the health of students, but with a little effort and it would be possible to minimize the damage of a pandemic. However, it should be noted that during a pandemic, distance learning is to some extent a lucrative solution.

2.4. Degradation of pilot skills

The pandemic could also have a negative impact on aviation safety. Civil aviation pilots could make mistakes at work due to a lack of experience, fears, lack of professional skills, self-confidence, or simply forgetfulness which can lead to tragedy. Some airlines provide pilots with adequate refresher training after a break. Others, however, offer only the bare minimum or offer nothing. According to a publication in the *Global Journal of Engineering and Technology Advances*, the aerospace industry, as a highly technical and inherently risky area, is largely dependent on the ability of pilots to reduce operational risks to the lowest possible level. However, the competence of the pilot depends to a large extent on how often pilots train the most important skills associated with safe flight. [11]

The paper describes an experiment conducted by Ammons et al. to evaluate pilots' ability to retain skills due to a long period of lack of expertise, and a general decline or trend in declining practical knowledge was observed. [11]

The experiment involved training participants eight hours a day to gain the necessary knowledge and perform a specific flight task. The training was stopped at intervals of 24 hours to two years and then the skills were reassessed. The result of this experiment showed that the longer the skill was not practiced, the lower the corresponding skill. [11]

In a similar experiment conducted by Fleisman and Parker, were also reported similar observations, and there was also a reduction in pilot skills because of the lack of practice during pauses. When the refresher course or training was completed, the skill level returned to 75%. The same problem prevailed among private pilots who did not regularly perform critical flight maneuvers and emergency procedures after an eight-month test flight. [11]

A significant increase in the number of major accidents has not yet been observed. According to the Aviation Safety Network, there were eight major commercial aircraft accidents in the world in 2020, 20 in 2021, which is not a very high difference compared to previous years, for example in 2019 there were 23 and in 2018 there were 18. So it means that the pandemic has not had a major impact on flight safety, but it is still always better if pilots have the opportunity to undergo not only basic training to maintain a license during major breaks [12]

During the period of quarantine and suspension of air traffic, the issue of the validity of the pilot's license became topical. Airplanes and pilots do not fly. As a result of the COVID-19 pandemic, airlines around the world have sharply reduced flights since March 2020.

Most of the aircraft remained on the ground, and the pilots who were forced to leave the cockpit only have to come to terms with the rare simulator training needed to maintain their professional skills. At the same time, according to the rules in force in the EU, civil aviation pilots must complete at least three

take-offs and landings in 90 days in order not to lose their type rating.

Full Flight Simulator became almost the only opportunity to practice the professional skills of a pilot when there was no opportunity to be in the cockpit of a real aircraft. Training on such a simulator is equal to the actual flight and is calculated when the license is renewed. The problem is that due to the coronavirus pandemic, many centres with simulators have been closed. Another problem was maintaining the validity of licenses and clauses for pilots who had not yet worked before the pandemic or lost their jobs because of it. Maintaining valid qualifications is an expensive affair, considering that it is sufficient to complete the necessary tasks on the simulator, not to mention flying on an airplane. The airline could pay the employed pilots or at least help with it financially, but the unemployed must pay for everything themselves. And, despite the financial difficulties of many airlines, it was clear that firing pilots would not be the best decision.

2.5. Forecasts

The aviation and aerospace industries have already experienced historical turbulence and major impacts, such as the aftermath of 11 September 2001 in America, the SARS pandemic of 2002-2004, and the disruption of air traffic caused by the eruption of Eyjafjallajökull in Iceland in 2010 and others. However, the consequences of the COVID-19 pandemic were very different.

At the beginning of the pandemic, the aviation industry saw a record decline in the number of flights, now, as the pandemic situation around the world improves, we see a recovery in demand. With the opening of borders and the lifting of travel restrictions in most countries in Europe and other parts of the world, airlines are moving closer to pre-pandemic flight indicators. History shows that after all the crises, the aviation industry as well as other industries are returning to pre-crisis indicators and increasing over time, and only the speed of the process differed. [13]

According to the IATA forecast, the Aviation industry should return to pre-pandemic indicators by 2020. Despite the rapid spread of the omikron variant, people want to travel. In 2021, the total number of passengers was 47% of passengers carried in 2019. It is expected to improve to 83% in 2022, 94% in 2023, 103% in 2024 and 111% in 2025. However, these optimistic prognoses may be influenced again by the spread of SARS-CoV-2, its most widely used variant, omicron. But the possibility of virus mutation cannot be ruled out. The growth of the civil aviation market may also be affected by the ongoing military conflict between Russia and Ukraine. As a result of the war, significant increases in the prices of fuel and raw materials used in the manufacture of aircraft and others can be expected, which may be reflected in ticket prices. [14]

The big question facing the aviation industry is when demand will return. Regarding the resumption of passenger transport, estimates range from early 2022 to 2024 and beyond. In the case of pilots, however, demand depends on the use of aircraft, which in turn depends on the number of potential passengers. As the civil aviation market recovers from the effects of the pandemic, recruitment and quality training continue to play a key role in ensuring flight safety. Before the pandemic, airlines offered more options and benefits for pilot training, mainly to

help with training funding. When the rapid spread of the virus began and the costs outweighed the profits, these benefits and assistance were limited or cancelled. Some banks, which offered loans to students to pay for training, also reassessed the risks involved and severely limited the process.

According to Oliver Wyman, 25,000 to 30,000 current and future pilots may choose alternative career paths due to the pandemic. According to a scenario by Oliver Wyman, there will be a shortage of pilots in some regions by 2023 at the latest, but a faster increase in demand must also be considered. According to the scenario, there will be a shortage of 34,000 pilots by 2025 and 60,000 by 2029 (see Figure 2). The recovery is not expected to be identical worldwide. According to the company's analysis, North America, the Asia-Pacific region and the Middle East are likely to face the largest deficits, while Europe, Africa, and Latin America will remain closer to balancing demand and supply. [15]

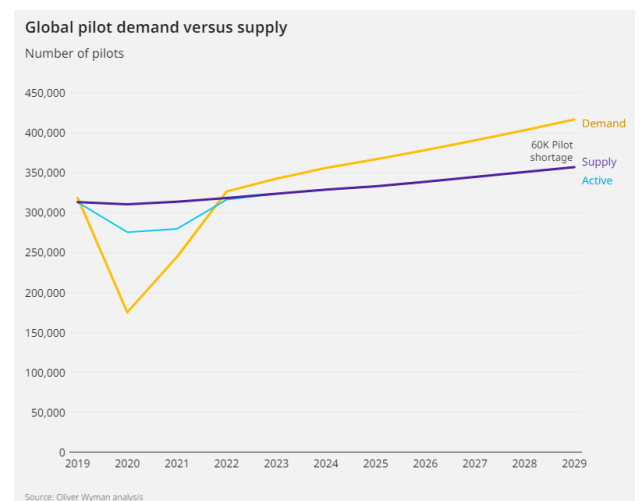


Fig. 2. Global pilot demand versus supply

Boeing analysts expect more than 2.1 million new aircraft and technicians to operate a global fleet of civilian aircraft over the next 20 years. Of which - 612 thousand pilots, 626 thousand mechanics, and 886 thousand flight attendants. Demand for 115,000 new pilots in Europe is expected over the next 20 years. [16]

3. EVALUATION OF RESULTS

Global crises always contribute not only to technological progress but also to their widespread implementation in society in ways that were previously considered impossible. The global pandemic has confirmed that online learning is essential in such crises, and all educational institutions should spend the necessary time and money on developing and improving it to be prepared for similar situations in the future.

Even before the pandemic, there were experiments with the introduction of distance education. More often only in the form of courses, but implementation was slow. COVID-19 has certainly brought a breakthrough, with most universities around the world making a relatively rapid shift towards distance learning.

Over time, a large number of analysts, university leaders, educators, and students themselves began to realize that the pandemic brought not only disasters for them and their

universities, but also unexpected positive effects. The main benefits of distance learning include reduced study costs, greater mobility, and the availability of a wealth of information and resources. The main disadvantage was the lack of socialization among students, they were forced to live in isolation for a long time and there was a lack of direct interaction with teachers and classmates and the problems associated with it. Problems can be called reduced physical activity, increased stress, and anxiety at the beginning of a pandemic, which subsided over time as students got used to the conditions.

In this article, we pointed out the effects of the COVID-19 pandemic on pilot training. We found that the pandemic had the greatest impact on pilots in training during the first waves of the SARS-CoV-2 virus when national governments introduced anti-pandemic measures and educational institutions switched to distance learning, according to the response of approved training organizations. However, the pandemic also had a major impact on active pilots, some of whom eventually had to find employment opportunities in other sectors. We can judge that thanks to the coordinated cooperation, the process of adaptation proceeded at a sufficiently fast pace, and over time, the students also got used to studying in the new conditions. The licensing authorities have also set up the aviation licensing process relatively quickly.

4. CONCLUSION

The pandemic has thus become a new serious challenge for civil aviation, which is radically changing established trends in the aviation industry. At present, there are no individual measures that could reduce all risks to air transport. However, the solution of all strategic tasks is possible only with the consolidation of the efforts of all parties and with the active involvement of the state, as its tasks also include the provision of comfortable business conditions.

The COVID-19 pandemic has also challenged the education sector, changed the lives of students and their families and creating wider societal challenges. Countries and universities that faced the same challenges responded to them at different speeds. The most sensitive was the provision of up-to-date information to students and applicants about the situation at universities. The impact of the COVID-19 pandemic on pilot training cannot be called long-term, thanks to the rapid adaptation of all training processes, and the impact also varies from region to region.

All countries will have to mitigate the effects of the pandemic, but based on the available materials, it can be concluded that the trend of digitalisation of education and academic exchanges will continue. Countries and universities will develop new forms of cooperation with academic and non-academic organizations. Countries and universities will review the experience gained and use it in further work.

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