The Impact of Covid-19 on the Field of Education and Science

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Abstract: The spread of the coronavirus infection COVID-19 has affected all sectors of the economy. The pandemic has had a tangible impact on the sphere of higher education, including graduate school. A radical restructuring of the educational process of universities: lectures and practical classes, laboratory work through distance technologies were transferred to the online environment. At this stage, the leading role is assigned to the most diverse aspects of natural science research, which are a catalyst for such disciplines as: mathematics, physics, biology, chemistry, as well as nanotechnology - the exponentially growing powers of these processes occupy dominant positions.

1 INTRODUCTION

Quoting Dr. Jeremy Farrar, Director of the 'Wellcome' fund and Chairman of the WHO Research and Development Program Advisory Group - "There is only one way to end the global pandemic which is through science." (https://www.who.int/ru/coronavirus-2019, 2019).

40 councils and associations participate in the research on COVID-19, including research councils and academies of the Russian Academy of Sciences, the International Science Council - a non-governmental structure, etc. In this regard, many countries have allocated funding which is visually represented in figure 1. Italy has allocated 140 million euros; France - 500 million euros; Germany - 525 million euros; Finland - 36 million euros; Belgium - 27 million euros; Spain -125 million euros; the Visegrad group (Hungary, Poland, Slovakia, Czech Republic) - 3 million Euro; Great Britain - more than 780 million euros; Norway - more than 850 euros; Canada - 720 million euros. EU, - 1 billion euros. Russia – 35 million euros.

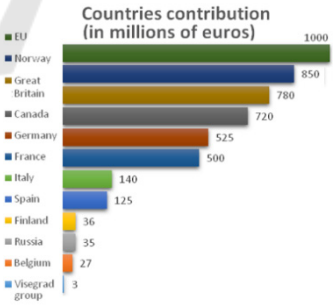

Figure 1: Diagram of various countries financial contribution (ach.gov.ru/upload/pdf/Covid-19-science.pdf, 2021).

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2 HIGHER EDUCATION CHALLENGES

COVID-19 has put high school teachers in a difficult environment that has had to accelerate the transformation of the way their universities operate. Experimental and scientific laboratories of chemistry, physics, and others felt a particularly strong influence of the pandemic:

- programs of student exchanges and attracting foreign students were suspended, international scientific conferences were postponed;
- the programs for the training of scientific and pedagogical personnel were interrupted;
- long-term experiments are thwarted;
- pause or reduction of hours in research work;
- the number of targeted educational programs and some courses is decreasing;
- weakening of partnerships.

The management of the university, when organizing the educational process based on various methods of delivering electronic content, in the context of the coronavirus, considers a number of tasks:

- strengthening cooperation of partner universities to provide methodological support for the use of digital tools;
- volume of attracted extra-budgetary funds (external content providers);
- use of crowdfunding platforms;
- market coverage (competitiveness).

During a pandemic, there is a reduction in academic mobility, a weakening of partnerships necessary for the development of new master's programs, new research projects (www.un.org/ru/120159, 2021).

A serious problem for the leadership of higher education, in the current situation, is the reduction in funding, which will negatively affect all aspects of the university's activities. Visual representation of the major difficulties caused by Covid-19 is given in figure 2.

Universities are focused on the most efficient use of financial resources to maintain their stable work, realizing that in the near future the number of foreign students will decrease, funding from the state will decrease, and it will become impossible to receive income from other activities of universities: the income of the population has decreased for accessing paid educational services, During the crisis, many non-academic organizations suspended orders for research and development (www.csee-etuce.org/ru/novosti/etuce/4401-posledstviya-pandemii-covid-19-dlya-vysshego-obrazovaniya-v-evropejskom-prostranstve-vysshego-obrazovaniya, 2021).

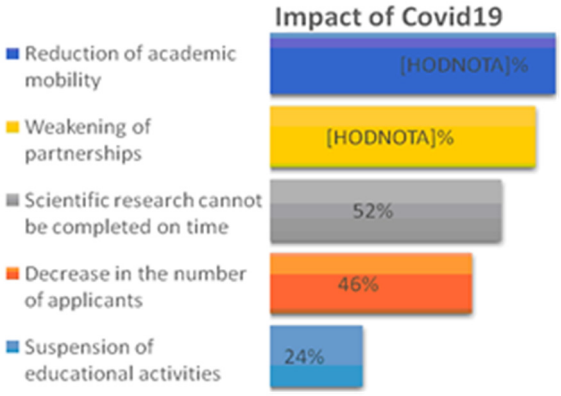


Figure 2: Challenges for Universities in a Pandemic. (according to a survey by the International Association of Universities) (ntf.ru/sites/default/files/ Vliyanie% 20pandemii%20COVID-19%20na%20sektor%20vysshego%20obrazovaniya%20i%20magistraturu.pdf, 2021).

The distance learning used by universities is not inferior to the offline format. Many universities, in case of academic disciplines and specialties that require a laboratory research workshop, are adopting a hybrid form of education (Crawford et al., 2020; Almaiah et al., 2020; Țălu and Nazarov, 2020).

Numerous studies in the field of educational technologies agree that the basis of online learning is the educational material which is carefully designed, planned and supported by a methodologically sound and purposeful sequence. Such material ensures the achievement of learning outcomes in the format of exclusively e-learning (Means et al., 2014).

The provision of educational services through online learning reflects the cognitive and social process. Correctly selected course materials will provide students with an educational result, and a positive connection for the teacher.

The crisis also revealed positive aspects: intensive work of universities to form new formats of interaction with partners, the development of crisis plans together with partner organizations, an increase in virtual mobility and the strengthening of the third role of universities (iau-aiu.net/Covid-19-Higher-Education-challenges-and-responses, 2021).

In the shortest possible time, universities had to adapt to new forms of "open science" in all its aspects: digitalization was accelerated (unified platforms for collecting observational and experimental data); internationalization (association of scientists (crowdfunding)); transition to online cooperation on current and new projects; allocation of funding priorities (main scientific areas - mathematics,

chemistry, physics, nanotechnology, IT and Data Science).

The introduction of quarantine paralyzed work in laboratories around the world due to the self-isolation regime. Experiments were suspended in scientific centers or, if possible, the research of biologists and chemists was reoriented. Master's programs requiring laboratory practice, hardware research, production trials / approbation, consider the activation of virtual research networks, the redistribution of experimental work, etc. as solutions.

The programmatic approach to the development of the master's studies and the introduction of online technologies turned out to be a timely response to the challenge. The universities that were preparing this transition, or acting in this way long before that, "amortized" the sharp slowdown in most of the life processes of universities around the world. The world's leading universities offer 'micromasters' programs on the Edx platform https://www.edx.org/micromasters and on the Coursera platform https://www.coursera.org/mastertrack.

According to a Key stone academic study, applicants prefer different social networks for communication. The preferences of applicants when it comes to social networks is given in figure 3.

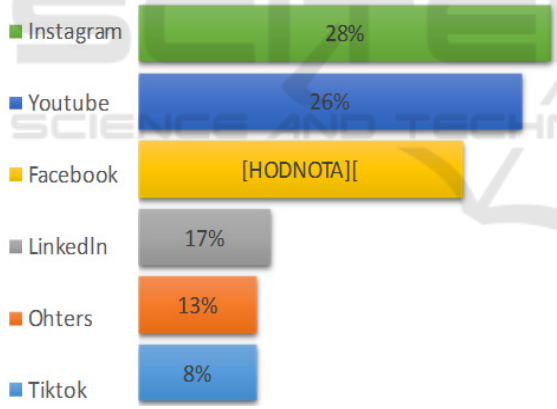
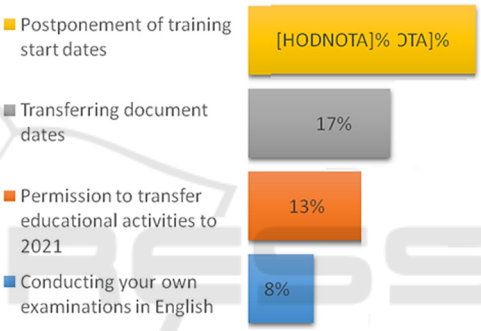


Figure 3: The popularity of various social networks (ntf.ru/sites/default/files/Vliyanie%20pandemii%20COVID-19%20na%20sektor%20vysshego%20 obrazovaniya%20i%20magistraturu.pdf, 2021).

Situational complexity in the higher education sector has developed for the following reasons:

- lack of material and technical base;
- not all universities are provided with sufficient infrastructure for organizing online learning (Internet networks);
- reduction of the teaching staff working with universities on a contract basis;
- not enough experience of some teachers to study online;
- suspension of research in scientific experimental laboratories;
- psychological overload of teachers and students;
- low standard of living of the population, etc.

The divergence between universities in the European zone will increase: countries such as Germany, Denmark, Switzerland are increasing funding for universities, whereas the Czech Republic, Romania, Slovakia and Ireland are decreasing funding. Due to the lack of public funding, there may be a tendency to merge universities. Many international programs aimed at academic exchange and research have adjusted their activities (ec.europa.eu/programmes/erasmus-plus/news/coronavirus-outbreak-deadlines-applications-extended_en, 2021). The percentage of measures taken by universities to increase the admission of foreign applicants is represented in figure 4.



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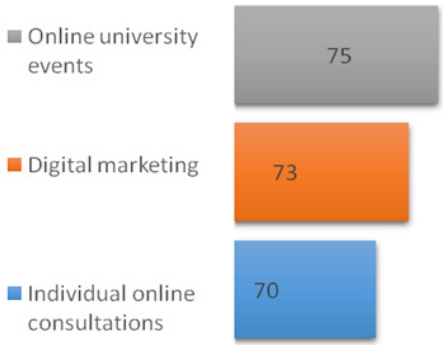
Quantification of online formats that are important for communication with applicants and their attraction is given in figure 5.



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3 THE ROLE OF SCIENCE

Medical research addressing the etiology, epidemiology, mechanism of pathogenesis, and the body's immune response to the virus must have a holistic approach to developing effective treatment protocols to combat the epidemic (Waris et al., 2020; Lurie et al., 2020).

A wide range of areas of science and technology, such as nanotechnology, have great potential in the prevention, diagnosis and treatment of COVID-19 (Huang et al., 2020). Of course, nanotechnology will determine the world's approaches and tools for treatment (Cheng et al., 2009). There are a variety of tools to create numerous materials for the research, identification and surveillance of viruses.

On the other hand, the therapeutic nanotechnology seeks to provide specific factors that may reduce morbidity and mortality by a minimally invasive therapy, high density functions, and concentration in very small volumes.

Nanotechnology makes it possible to address the fight against COVID-19 through various approaches: (a) the execution of highly effective personal protective equipment (PPE) against infections, in order to increase the safety of healthcare professionals and the creation of high-performance products of antiviral disinfectants and surface coatings, capable of blocking the replication of the virus and its spread; (b) the execution of nano-specific sensors with a high sensitivity for the efficient identification of the infection or the immune response; (c) the development of new drugs that allow rapid activity with low toxicity to affected tissues, for example in the lungs; and (d) the development of a nano-based vaccination to trigger humoral and cellular immune responses (Campos et al., 2020). In addition, the use of nanoparticle markers in various nanostructures can study the mechanism of infection of host cells by viruses.

Nanomaterials can be used in combination with active antiviral substances that allow their interaction with viruses. If we refer to the antiviral activity of specific biocompatible nanomaterials (eg silver and gold nanoparticles), the general antiviral action can be effectively blocked (Draz and Shafiee, 2018; Lung et al., 2020; Shin et al., 2020; Singh et al., 2021).

Nanoparticles can be adapted by specific geometry and controlled properties (such as surface functionalization with various ligands) to make them adaptable vehicles for vaccines (Chauhan et al., 2020).

The applied application of innovative developments in the field of nanotechnology and the formation of advanced research areas in the field of biochemistry, mathematics, physics (AFM device) can help in the fight against Covid-19.

In conclusion, nanotechnology can revolutionize the fight against COVID-19 by providing efficient working methods, materials and tools with immediate benefits in medical research and practice.

4 CONCLUSIONS

The most successful universities, in addition to using modern approaches to online education, have created an online community of students, teachers, administrators, which contributed to improving the quality of education and reducing the stress of social isolation.

Under these conditions, universities will develop new forms of cooperation, the following primary tasks will be solved:

- Development of measures to support teachers and students;
- Strategic planning, taking into account the associated risks to predict the short-term and long-term consequences of the pandemic;
- Finding ways to effectively transition to online learning;
- Development of distance learning assessment methods;
- High quality educational services.

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