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SUSTAINABLE DEVELOPMENT AND THE DIGITAL TRANSFORMATION OF EDUCATIONAL SYSTEMS

Wadim STRIELKOWSKI*

Department of Agricultural and Resource Economics, 303 Giannini Hall, University of California, Berkeley, CA 94720 Berkeley, United States
Cambridge Institute for Advanced Studies, King str. 23, CB1 1AH Cambridge, United Kingdom
Department of Trade and Finance, Faculty of Economics and Management, Czech University of Life Sciences Prague, Kamýcká 129, 165 00 Prague, Czech Republic,
E-mails: strielkowski@berkeley.edu, strielkowski@cantab.net*, strielkowski@pef.czu.cz*

Elena KORNEEVA

Financial University under the Government of the Russian Federation, Leningradsky Prospekt 49, 125993 Moscow, Russian Federation
Togliatti State University, Belorusskaya str. 14, 445667 Togliatti, Russian Federation
E-mail: ENKorneeva@fa.ru

Larisa GORINA

Associate Professor, Institute of Engineering and Environmental Security, Togliatti State University, Togliatti 445020, Russian Federation
E-mail: gorina@tltsu.ru

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Abstract. *Aim: Our research concentrates on the sustainable development and digital transformation of educational systems. This topic has gained the special attention of researchers and policymakers in recent years due to the wide spread of information and communication technologies (ICT) and the digital surge that can be observed all around the world. This digital surge, which can also be called a digital revolution, was further deepened by the COVID-19 pandemic, which resulted in the massive closure of schools and universities and the deployment of online and home learning.*

Methods: We use data obtained from researchers and lecturers at universities and higher education institutions in the Czech Republic and Russia between September 2020 and March 2021 to perform ordinal regression analysis. This allows us to test the relationships between effectiveness as a key factor of creativity on one side and motivation to look for new ways of teaching and research during and after the COVID-19 pandemic on the other.

Results: Overall, it appears that there are still many obstacles to the digital transformation of educational systems that might be embedded in the structure and the scope of today's educational institutions. We demonstrate that, at present, universities and higher educational institutions are

** Corresponding author: Professor Wadim Strielkowski, strielkowski@berkeley.edu, strielkowski@cantab.net*

undergoing r`adical change driven by the need to digitize education and training processes in record time, and that many academics lack the innate technical skills for online education. Nevertheless, it appears that young and motivated academics and researchers are keen on embracing new technologies and support the digital transformation of educational systems.

Conclusions: Our results might be useful for decision-makers and stakeholders in universities and higher education institutions for designing their strategies for the digitalization of educational systems.

Keywords: *educational systems, sustainable development, digitalization, COVID-19, information systems*

JEL codes*: I23, I25, O33*

Introduction

In recent years, sustainable economic development and digital transformation have heavily impacted upon educational systems in virtually all countries around the world (ElMassah & Mohieldin, 2020). However, it is quite unfortunate that in today's fast-moving digital world, some countries have failed to take full advantage of technological change. One of the main reasons for the gap in technological innovation and adoption is the lack of digital skills and awareness (Nordhaus, 2019). For example, the Vietnam Digital Evolution Index (DEI), at 46.79, is low compared to other Southeast Asian countries such as Malaysia (69.03), Thailand (55.04), Singapore (90.82), and Indonesia (46.72). It is obvious that DEI insights can help us recognize the need to promote digital change in Vietnam's education sector (Knoema, 2021), but other researchers have concluded that the digitization of schools is a complicated process (Lindqvist & Pettersson, 2019)

As a key player in the national education system, higher education institutions (HEIs) play a role in helping to catch up in several dimensions associated with digital skills development among students, minors, and, to a certain extent, adults. HEIs must embrace digital technologies and become drivers of the growth and development of their own ecosystems. HEIs need to become engines of digital innovation, including the provision of the skills needed to navigate the paradigm shift (Nureev et al., 2020). Quality education is one of the pillars of the 2030 Agenda for Sustainable Development of the United Nations, which aims to promote inclusive and equitable quality education and lifelong learning opportunities. UNESCO has begun preparing the Declaration on Connectivity in Education to support learning and strengthen the resilience of education systems. Digital learning can reduce the cost of access to training and better meet individual needs (OECD, 2020).

The transition to virtual learning is the future of higher education. The current COVID-19 pandemic has changed the way work and life are interrelated on a global scale. University systems must strive to overcome this situation in order to be competitive and to provide high-quality education in a digital transition scenario, where disruptive technological innovations are accelerating change. To achieve this goal, this paper explains the obstacles and challenges that universities face, the technological resources and methods that they must deploy in the current scenario of the transformation of higher education, and the role of higher educational institutions (as well as other business enterprises and state institutions) in the face of COVID-19 upheavals (Pan & Zhang, 2020; Strielkowski et al., 2021; or Trachenko et al., 2021).

In summary, the conceptualization of digitization in small steps enables the analysis of gradual digitization, since it does not end with the complete transformation of the school. Learning involves the transformation of entire activities and systems, including qualitative changes in objects, practices, cultural patterns, and activities (Engeström & Sannino, 2010). This in turn should contribute to the picture of the different levels of learning and the steps of transformation in schools.

We have categorized climate knowledge, for example, as an environmental achievement, but it can also be appropriately considered an academic achievement in an environment where students study science-related materials in a curriculum that is developed based on government standards and standardized tests. However, the inclusion of non-academic achievements (e.g., in the environment, civic engagement, health benefits) as a focus in the government K-12 energy efficiency programs that underpin this review may reflect a desire to disseminate what students learn in school through the framework of traditional academic performance (Ladwig, 2010). However, change is unlikely as long as educational institutions support a pedagogy in which the teacher puts information into the student, and the student relies on the teacher to gain knowledge: a school-wide resilience approach is preferred (Karami-Akkary et al., 2019). One-off measures may have only a small effect, hence continuing education during school years with a focus on several dimensions of sustainability can lead to intelligent changes in the environmental orientation of young students. Other instruments, such as the Attitudes towards Sustainable Development scale, which are based on measuring many aspects of the environment, economy, society, and education, can be tested in similar contexts in future work to examine students' attitudes towards sustainability and their relation to other variables (Biasutti & Frate, 2017). One needs to develop an action plan that looks at how the education sector can mitigate, adapt, educate, and promote equity to respond to and address climate change. The purpose of these resources is to create a solution-oriented society in which people have the skills and knowledge to make a difference in society, the economy, and the environment. Peace education and positive youth development are two examples from many areas with results that are consistent with energy efficiency. Focusing on content, structure, and the results of interest in many peer-reviewed articles devoted to the environmental education of K-12 students published in recent years, our analysis shows that the field of environmental education (EE) research is expanding in various dimensions, including, in particular, diversity of the investigated results.

This paper is structured as follows: section 1 discusses the issues posed by the global network of environmental education, with all educational systems facing the broader environmental problems faced by humanity. Section 2 contemplates the globalization of environmental education and national educational systems. Section 3 focuses on international cooperation, as universities and HEIs worldwide are training specialists in similar areas and finding foreign partners. Section 4 outlines the data and methods. Section 5 reports the results of the empirical model and provides a discussion of its results. Finally, the conclusions offer an overall summary and policy implications, as well as suggestions for professionals and researchers.

1. Global network of environmental education

In recent years, there have been many efforts to build a global network of environmental education, with all educational systems facing the broader environmental problems faced by hu-

manity (Dhawan, 2020). In the last few decades, initiatives such as Agenda 21 and discussions on the Earth Charter have promoted debate on environmental education as an important part of the dialogue on the role of education in relation to human perspectives. Knowledge of social change and social justice can bring about change in local and global societies, but, at least initially, this has not focused on sustainability education because its roots lie in its narrow focus on environmental protection and resource conservation (Aikens et al., 2016).

A socio-political dimension should also be emphasized, as this aims to encourage people to act in accordance with the public good of the environment (Machin, 2012). Education for Sustainable Development (ESD) has many similarities with the distant education (DE) in addressing issues such as climate change, oil scarcity, water pollution, biodiversity conservation, poverty reduction, and human rights. It also extends the social and human rights dimensions of DE beyond those of other education sectors to include a strong environmental focus. The concept of ESD was developed when aiming environmental education at developing the knowledge, skills, values, attitudes, and behaviors of people who care about their environment (Kopnina & Cocis, 2017). The goal of ESD is to help people make decisions and implement measures to improve our quality of life without endangering the planet. ESD promotes the development of the knowledge, skills, understanding, values, and measures needed to create a sustainable world that assures environmental protection, promotes social justice, and promotes economic sustainability. As a necessary tool for the dissemination of environmental responsibility, environmental education in the Global South addresses environmental issues in terms of their impact on different communities and specific needs, where discourse differs on environmental education and sustainable development. Although it was developed in the Global North, where environmentalists focus on conservation and address the needs of communities, the South is pushing a conservation agenda alongside social, economic, and political development (Lele, 2021). The role of environmental education is focused on the potential for economic growth and development, with UNESCO projects on the application of environmental education to sustainable development being declared as creative and effective uses of human potential and capital to ensure rapid and equitable economic growth with minimal environmental impact (Richter & De Sousa, 2019). Figure 1 offers a scheme of online (or offline) education and e-learning for sustainable development.

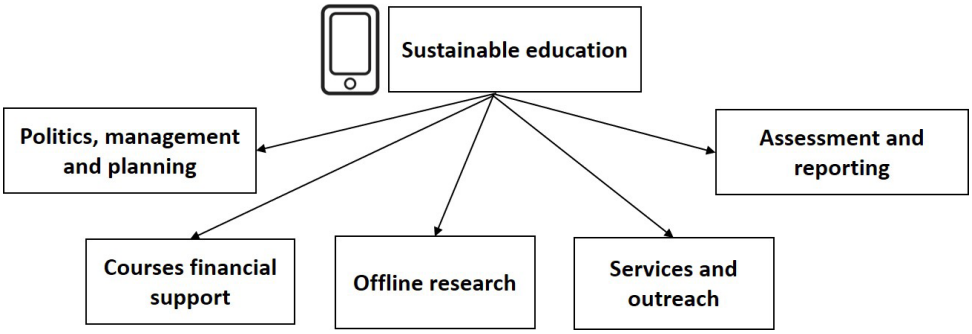

Figure 1. *Education and e-learning for sustainable development*

If environmental education can keep pace with potential audiences, it and the entire envi-

ronmental movement will benefit by remaining relevant to future generations and inspiring individuals to act to protect natural resources and the environment. Overcoming these obstacles is the goal of a partnership recently created by the World Resources Institute (WRI) and the Global Network of Environmental Education Centers. A 1992 survey by the National Consortium for Environmental Education Training found that teachers had difficulty finding help for students. In response, the consortium created a teacher's manual entitled Getting Started, a toolbox of information, and workshops throughout the country to prepare teachers for environmental education. The consortium also linked key sources of K-12 education materials on the environment and sustainable development that could be accessed through websites (Čábelková et al., 2020).

In general, ESD broadens the social and human rights dimensions in educational institutions and other education sectors, with a particular focus on the environment. ESD also promotes social inclusion, and it is at the core of the ECO-UNESCO ECO-Choices program, a drug prevention and awareness initiative that highlights the key role of the environment in human well-being and proposes environmental action projects for young people (Edwards et al., 2020). By providing engaging content and hands-on activities and by leading by example, teachers can empower students to play an active role in the sustainable development movement.

Well-designed and integrated education programs for sustainable development at the school level can have a significant positive impact on raising student awareness in this area. In this context, one can show how collaboration between high schools and universities can play an important role in the development of a comprehensive educational program on the specific topic of sustainability (Kiely et al., 2021). These forms of education can develop and grow, and can examine best practices in the school self-evaluation (SSE) in the context of national education policy, with a particular emphasis on how SSE can fit into this framework. The systematic thinking method of education creates an environment in which sustainability can be integrated into the entire campus, curriculum, and community. Incorporating system thinking into education before the age of 12 enables young people to look at sustainable development issues from different perspectives and work hard to find solutions to complex environmental, social, and economic problems (García-González et al., 2020). Sustainability education in K-12 schools can respond to the complex challenges facing our world by providing learners with experience and knowledge in systems thinking, civic action, and sustainable development goals. Education must be transformative and must enable us to make informed decisions and take individual and collective action to change our society and care for the planet. To do this, we need to take action today, and our education sector can be an important tool to help us decarbonize by 2050 and prepare the next generation for resilience.

Due to the COVID-19 pandemic, states and countries are facing tight budgets. Serving nearly one in six Americans, K-12 public schools can play a vital role in moving towards environmental sustainability. This is why sustainable schools are important; we must give students an educational curriculum, physical location, and organizational culture to foster the development of environmentally conscious global citizens (Ferreira et al., 2020). By introducing sustainability principles into classrooms – both as a mindset and as a pedagogy – teachers are inspiring the next generation of environmentalists and transforming students into global citizens. Leading sustainable lifestyles and traveling with students will be one of the most powerful ways to inspire a new generation of environmental leaders and leaders. One can visit Green Teacher, another non-prof-

it organization that helps educators, both in and out of schools, raise environmental awareness among youth. As primary and secondary schools find innovative ways to meet the needs of students during the COVID-19 pandemic and switch to distance learning, new initiatives aim to make public education have a significant impact on the environment and provide advice for schools to support environmental sustainability. A new report from the Aspen Institute's K-12 Climate Action Initiative examines schools that have a significant impact on the environment and considers government policies that can help schools adopt sustainable practices and advance the school's educational mission in the process (Aspen Institute, 2020).

There are many projects that link vulnerable populations with integrated technology programs to engage underserved students in environmental education and to investigate the effectiveness of integrating technology into their educational experiences. One study observed the effects of the use of digital technologies in outdoor training. High school students conducted a scientific study of their urban ecosystems using geographical information systems (GIS) and computer models in an intensive summer program focusing on urban ecology. In addition to acquiring valuable skills and environmental knowledge, students also experience progress in other academic areas (Barnett et al., 2011). Nature programs are courses that teach students other skills, and the use of outdoor facilities (e.g. schoolyards, nearby parks, public land, nature reserves, wetlands, and national parks) gives the traditional curriculum a sense of wealth and relevance.

2. Globalization of environmental education and national educational systems

In general, it is clear that the process of the globalization of environmental education implies fundamental changes in national educational systems. Educational research must recognize the value of change and provide opportunities for research to rethink what is appropriate and successful in educational practice (Malik, 2018). Innovation in education should embrace the view that interaction and enrichment among each other is for the common good of society. In the globalization of education, it is useful to think outside the box in order to develop our own innovations and create a broad basis for implementation. The problem is that our education system does not provide for the future competencies of the prevailing worldview of our society, which is enshrined in values, content, objectives, and educational methods. It is as if the education system were a prisoner of its history, derived from the worldview of industrial time and scientific reductionism (Marouli, 2021). The implicit goal of education is to convey this world view and our value system to the next generation so that they can become good citizens and administrators of the system. The main difficulty of modernization theory is that it focuses on changes in societies and nations relative to themselves, with Western societies as its main point of reference, neglecting the interconnectedness of these societies, their interdependence, and the role that non-Western countries play in the West's development. Immanuel Wallerstein was one of the earliest and most influential scientists to point out the weaknesses of modernization theory. He developed the theory of the world system to explain how the world expanded to shape relations between societies driven by a capitalist system of economic exchange. In contrast to the emphasis on linear development in modernization theory, he showed that rich and poor societies were trapped in a world system in which the progress of their relative economic advantages and disadvantages was achieved through politics and culture (Gilman, 2018). Globalization implies that information and knowledge are more widely distributed and shared. At the same time, the

arrival of foreign goods, services, and capital into a country creates incentives and demands to strengthen the education system so that a country's citizens recognize the upcoming competitive challenges. Globalization also creates a framework for cooperation between nations on a wide range of non-economic issues, with cross-border implications such as migration, the environment, and legal issues (Wang & Garduno-Rivera, 2021).

Specialization objectives aim to help students develop the knowledge, skills, and dispositions required to be competent citizens and world-class teachers. The new specializations offered by national universities focus on the universal need for continuous improvement of teaching and learning, and offer students a balance between philosophy, theory, practice, and application through joint research projects and field-related activities. The main focus of these specializations is on advanced, innovative, effective, and international approaches, ideas, and strategies in the field of learning that take into account the needs of nations and create contemporary school environments that accommodate different groups of pupils to empower students to become fellow learners in the creation of a sustainable society. The formal education system finds a co-creative and transformative relationship with society, as radical modern learning organizations emerge on both sides that reinforce change and exert their influence in all areas of society (Pavel & Isak, 2022). This process creates a strengthening loop between education and social change, which affects the design of the education system. There are many different ways to achieve financial stability, economic growth, and a higher standard of living, and each country will vary according to the specificity of its national economy and political system. Sustainable development consists of a balance between local and global efforts to meet basic human needs without destroying or damaging the natural environment. Dealing with the tension between sustainability and sustainable development is a key role played by international organizations such as the UN, governments of various countries, NGOs, and civil society organizations (Mensah, 2019).

In order to ensure sustainable development, every company, government, or civil society organization, whether global, regional, or national, is advised and expected to show ownership, leadership, and citizenship. The concept of ESD arose from the need for education to meet the increasing ecological challenges of the planet. ESD aims to empower and equip current and future generations to meet their needs with a balanced and integrated approach to the economic, social, and environmental aspects of sustainable development. It understands that education promotes changes in knowledge, skills, values, and attitudes to enable a sustainable and just society (Shulla et al., 2020).

Based on ITC standards, ESD covers all products – in particular agricultural products, followed by processed foods. The increasing pace of globalization and its impact on the environment is a major global concern. Research is full of conflicting results, but many believe that increasing globalization is harmful to the environment. A large number of environmentalists who support this view base their arguments on the premise that globalization leads to more global demand, which leads to more production. Increasing global demand contributes to the exploitation of the environment and the depletion of natural resources. As environmental concerns mount, an important question is whether deglobalization will have the opposite effect on the environment. Several World Trade Organization (WTO) trade-related measures are compatible with environmental protection and the sustainable use of natural resources. For example, the Green WTO rules instruct countries to protect human, animal, and plant life and to conserve

their inexhaustible natural resources (Philibert, 2019).

Therefore, it would be prudent to be cautious about abandoning the traditional, straightforward, socialized university model, as blind acceptance of "disruptive technologies" will make many question what they know and do, which will make this period of change even harder to graduate from. Rather, the digital transformation of universities will continue to change the teaching, learning, and experiences of students and faculty for years to come. While digital transformation is about how people use technology, not technology itself, research shows that digital technology can make education more efficient, scalable, and accessible. For example, one study pointed out that digital transformation can provide students with knowledge and skills for life and work, as well as reimagining processes such as recruiting and interacting with students in clubs and companies, including student groups during college and after graduation. Although HEIs are at different stages along the journey of digital transformation, other institutions can provide important experience for promoting digital transformation into higher education and becoming digital education institutions. Through social media, web seminars, and virtual seminars, HEIs can allow citizens of other countries to use digital technology (Mhlanga & Moloi, 2020).

During digital learning transformation, the behaviors of universities, students, and employers change, at the same time making this a critical moment for evaluating business results and cases and rethinking strategies and policies from a new perspective. As the education sector recovers from the pandemic, leaders and managers face the challenge of challenging the status quo and introducing new methods of management institutions and organizations. The education industry, like any other industry, can use more technologies and innovative solutions to improve efficiency and survive in the post-COVID-19 world. The core business model of the university must become a digital business model. To this end, most universities need to rethink their IT methods and allocate the necessary level of resources. It is time to realize that in order to create a modern user experience, universities must first invest in efficient IT infrastructure, especially when everything in higher education depends on technology and new cutting-edge technologies. The art building is empty; this will force many institutions to reinvent the way they provide students with experiences and services. With education shutting down all over the world, it is time for university administrators to study how e-learning programs can improve the accessibility of more students. The end of 2020 marks a clear turning point, as students, educators, and government leaders are exploring the cost and value of higher education through new traditional classroom perspectives and multiple digital delivery methods. Education is one of the least digitized and labor-intensive sectors in the economy, which shows that the opportunities and risks associated with technology-related disruption are great. To achieve these goals, this paper explains some of the obstacles and challenges that universities face, as well as the technical resources and methods they use in their current scenarios to transform higher education in response to the spread of COVID-19 (Blankenberger & Williams, 2020). It is likely that we are going to witness a long-term impact of the COVID-19 pandemic, with all of its restrictions on higher education lasting for several years and changing the way we experience higher education. We now see that COVID-19 has redirected and amplified the concerns and actions of universities around the world, reshaping and challenging their interests in ensuring short-term business continuity while ensuring long-term institutional viability. In addition, the COVID-19 pandemic

quickly put pressure on previously predicted trends in education such as the University of the Future. We then move on to more detailed results to answer the second research question which looks at additional factors in detail, providing detailed reports on how rapid change has impacted students and staff and the role of HEIs and systems in this process. This includes questions about the perceived impact of the rapid digital transition on learning outcomes and access to education, higher education readiness, responses to crisis management, major challenges in the transition to online learning, innovation arising from the pandemic, and long-term outlook effects (Watermeyer et al., 2021).

While some students do not like online learning and the digitalization of education, we have to stress that the process is inevitable and needs to be implemented. COVID-19 showed us that online education is not a myth and can be conducted with some creativity and effort. Hence, we need to learn how to use it wisely and within reason in order to ensure the dissemination of knowledge with the basic human need for socializing and being a part of a group.

3. International cooperation

Alongside the aforementioned, one can also acknowledge that international cooperation and exchange are extremely important for sharing ideas and the dissemination of knowledge around the world. International relations programs are conducted at colleges of professional studies, where students are invited to participate as compulsory electives and enjoy the benefits of international experience in an applicable discipline. For a week, students work on the basis of international experience to solve real problems for established multinational organizations, where they act as international consultants and apply their learning to practical scenarios. Students not only study abroad during their schooling, but also receive huge benefits to their education and careers. Some organizations and HEIs that engage these kinds of programs typically have ties to the United States, but tend to cooperate with hundreds of other organizations engaged in international exchanges. After working for a long time in the Middle East and North Africa (MENA countries), they offer experience in program management, proposal development, implementation, event coordination, and training design – not only in these countries, but all around the world.

The World Bank Group (WBG) provides financial and analytical support to governments in a wide range of fields, from systems and institutional development to targeted training programs. It works with countries and multilateral development partners to ensure that individuals have access to high-quality education and training and to help employers gain the skills they need. Countries also need policy interventions to better support skills development and measure the results of programs. There is a need for the WBG to conduct programs and policy research and analysis to improve interventions and the measurement of capabilities. During the resilient recovery phase, the WBG should focus its support on building skills development systems (World Bank, 2021).

Presently, we can observe educational programs that train large numbers of workers, but for the most part there are no mechanisms that enable them to train themselves. We need more emphasis on the fundamental purpose of education, not skills. In recent years, academics have begun to realize that the idea of offering education as an off-site education rather than an on-site one is misguided, because it is more expensive and less effective than self-directed learning.

Therefore, transformation is needed, and whilst it is coming, the questions of how we will face it and how this will change higher education remain, and can only be answered in time.

4. Data and methods

The data used in this study was collected using our own online survey administered in the Czech Republic and Russian Federation between September 2020 and March 2021. We applied the quasi-random method of sampling that featured both the elements of the snowball sampling technique as well as parts of opportunity sampling. All of the participants were recruited either personally via social networks and online modes of communication or via personalized e-mail messages.

The two countries in question were not selected at random but due to their specificities: both represent post-communist countries that embarked on the path of economic transition over 30 years ago; however, the tracks of their development have started to differ for economic, social, and geopolitical reasons. The level of digitalization and e-government participation in both countries is also quite different, with Russia lagging behind the Czech Republic in the early 2000s but quickly catching up and implementing digitalization and e-participation by the early 2020s (United Nations, 2021).

In total, a sample of 400 respondents from the Czech Republic (136 respondents) and Russian Federation (264 respondents) was obtained. The sample consisted of 58% women and 42% men (M ± SD = 45.53 ± 11.46, median 44). All of the respondents completed our questionnaire voluntarily and anonymously.

Since the majority of the respondents operated in the sphere of higher education and learning, most of them had a higher education degree (master's degree or higher). The positions best describing their work duties at their respective universities and research institutions were managers (73%), analysts (14%), and top managers and decision-makers (13%). The survey featured a number of questions, but only a few were used in this study. The questions were answered on a 5-point scale, which ranged from 1 (*strongly agree*) to 5 (*strongly disagree*). Table 1 reports the results of the cross-tabulation of the response related to the personal development induced by online teaching in both countries.

Table 1. *Time for personal development (cross-tabulation of responses)*

			1 – disagree[a]	2[a]	3[a]	4[a]	5 – agree[a]	Total
Country	Czech Republic	% within country	29.20	25.50	19.70	15.30	10.20	100.00
	Russian Federation	% within country	46.00	21.10	14.30	13.20	5.30	100.00
Total		% within country	39.70	23.80	16.40	13.40	6.70	100.00

Note: Due to online teaching, there is more time for personal development: 1 – strongly disagree, 5 –strongly agree

In general, we can observe remarkable differences between the two countries, with online

teaching proving more burdensome in the case of Russia than in the Czech Republic.

Table 2 reports the results of the cross-tabulation of the responses related to engagement in online collaborations induced by online teaching in both countries. Once again, we can see that the digital surge caused by the COVID-19 pandemic had a more positive impact on distant research collaboration in the Czech Republic than in Russia.

Table 2. *Motivation to use distant methods of scientific research (cross-tabulations of responses)*

			1 – disagree[a]	**2[a]**	**3[a]**	**4[a]**	**5 – agree[a]**	**Total**
Country	Czech Republic	% within country	16.10	22.60	29.90	20.40	10.90	100.00
	Russian Federation	% within country	24.50	16.20	20.40	23.80	15.10	100.00
Total		% within country	20.50	19.20	24.60	23.10	12.50	100.00

Note: Online teaching motivated me to use distant methods of engaging in scientific collaborations: 1 – strongly disagree, 5 – strongly agree

Using the data obtained in the course of our research, we can build an ordinal regression analysis in order to test the relationships between the components of emotional creativity on one side and motivation to look for new ways of teaching and research during and after the COVID-19 pandemic on the other. Our formal model can be presented in the form of the following equation (1):

$$motivation = logit\ (\alpha_0 ECI + \alpha_1 age + \alpha_2 gender + \alpha_3 country + \\ + \alpha_4 sciences + \alpha_5 position + e \quad (1)$$

where:

motivation – indicators of motivation;

emotional creativity (ECI) – measured by its subscales of novelty, preparedness, and subsequent effectiveness/authenticity;

age – age of the respondent;

gender – gender of the respondent;

country – country of the respondent;

sciences – type of education (formal sciences, natural sciences, or social sciences);

position – position at the university which best describes the job: lecturer, researcher, manager;

e – is an error term.

The results of the empirical model estimations are presented in the next section and discussed with regard to the research topic and focus.

Research findings

Table 3 reports the results of ordinal regression analysis, with the effectiveness of creativity

as a key factor that enhances motivation for novel ways of doing research during the COVID-19 pandemic.

Our empirical findings confirm that the ECI variable comes through as significant in all cases. Additionally, it became obvious that the effectiveness/authenticity component of emotional creativity proved to be positively associated with motivation for novel ways of doing research during the COVID-19 pandemic, while age was negatively related to the motivation to learn and embrace new technologies regardless of the field of research or education.

Table 3. *Effectiveness as a key factor that improves motivation for novel ways of doing research during the COVID-19 pandemic*

	Qualification enhancement		Online research		Research partners		Interdisciplinary research		Personal development	
	Estimate	**Sig.**	**Estimate**	**Sig.**	**Estimate**	**Sig.**	**Estimate**	**Sig.**	**Estimate**	**Sig.**
Threshold 1	0.462	0.528	-1.033	0.157	0.274	0.712	0.127	0.865	1.595	0.034
Threshold 2	1.275	0.082	-0.068	0.926	1.332	0.073	1.156	0.121	2.619	0.001
Threshold 3	2.375	0.001	0.980	0.179	2.928	0.000	2.714	0.000	3.489	0.000
Threshold 4	3.392	0.000	2.368	0.001	4.246	0.000	4.045	0.000	4.783	0.000
ECI	0.054**	0.002	0.042*	0.012	0.056**	0.001	0.067***	0.000	0.057**	0.001
Age	-0.008	0.311	-0.017*	0.020	-0.006	0.411	-0.014	0.069	-0.012	0.116
Gender (men)	-0.025	0.892	-0.188	0.298	0.131	0.477	0.109	0.556	0.405*	0.029
Country										
Czech Republic	-0.288	0.157	0.141	0.487	0.095	0.647	0.050	0.810	0.617**	0.003
Sciences										
Formal Sciences	0.383	0.270	0.453	0.188	0.053	0.879	0.272	0.437	0.237	0.499
Natural Sciences	0.797	0.070	-0.002	0.997	-0.224	0.616	-0.031	0.944	0.020	0.965
Social Sciences	0.623*	0.014	0.177	0.478	-0.268	0.291	-0.169	0.507	0.080	0.756
Position										
Lecturer	-0.022	0.930	-0.332	0.190	-0.392	0.128	-0.668*	0.010	0.436	0.103
Researcher	-0.228	0.490	0.002	0.994	-0.116	0.728	-0.562	0.093	0.674*	0.049
Pseudo R-Square										
Cox and Snell	0.051		0.043		0.051		0.064		0.069	
Nagelkerke	0.053		0.045		0.054		0.068		0.073	

McFadden	0.017		0.014		0.018		0.023		0.025	
Sig		0.007		0.027		0.007		0.001		0.000
N	400									

Note: Reference Variables: gender (women), country (Russian Federation), science (applied sciences), position (manager). Link function: Logit.

It became apparent that young researchers and lecturers are more motivated in driving digital enhancement into educational and scientific processes and introduce more novel elements into existing structures. In addition, it also appears that system shocks such as the COVID-19 pandemic might also become the triggers of profound changes, such as wide-scale digitalization, that would have taken years to be implemented under normal circumstances (Polycronidou et al., 2021). Here, one can recall the Schumpeterian concept of "creative destruction," which resonates similarly.

Conclusion

Overall, we can see that higher education is undergoing massive digitalization in recent years. This process is reinforced by the sustainable development and digital transformation of educational systems. Various experiments with computer-aided education began in the 1950s, such as the computer-aided teaching program, in which a computer was used to present learning materials from text, audio, and video, and to evaluate students' progress. For example, in 1950, the University of Iowa began developing television courses, and in the 1970s, community colleges in the United States created courses that could be broadcast on local television stations.

The advent of new technologies has also led to teaching methods requiring special training. As evidence grows that there are promising opportunities to engage students, identify difficulties students have with learning materials, and adapt teaching methods, the current gap in the preparation that most doctoral students receive could become a major handicap. More work is needed to develop better methods for colleges to measure student learning, not only for critical thinking and writing, but also for other primary education purposes. Without reliable learning measures, competition among students will not do much to improve the quality of teaching, and applicants will have no way of knowing which universities offer the best teaching.

Research is the engine of growth and innovation, which explains the strong emphasis placed by leading universities on it, but that does not excuse the neglect of the actual education offered to students, including critical issues that prepare them for the real world. Rising graduation rates and educational attainment will do little if students do not learn something of lasting value. Students learn best when they understand what they are learning and control their own learning. A metacognitive approach to teaching helps students take control of their own learning outcomes by using a set of personalized learning strategies to define their own learning goals and monitor their progress towards those goals. Teachers need to know how to help their students assess their own understanding of the best approach to learning.

The 11 members of the UIA work together to identify and test innovative programs that aim to improve students' objectives and create textbooks that work on a large scale to help all students, regardless of background, obtain a degree. This paper is a tutorial on the learning opportu-

nities provided by online and blended learning, as well as practical practices for online courses. A few institutions have made significant progress in improving student success. This is a promising result, given that only three out of ten children who drop out of high school achieve a degree by the age of 25. Schools that support large numbers of non-traditional and at-risk students can opt for a model of blended learning. Teachers can support those who need to learn independently in the room, and students can learn and practice new concepts in a digital environment. For schools with scarce resources, the online laboratory model for blended learning is a viable option to help students to complete courses, including those that are not offered at specific school locations.

Joint learning is the process in which two or more students work together to learn together, consisting of a small group of participants of different skill levels who have a variety of learning activities to master materials and develop teacher-constructed knowledge of content issues. The Flex model of blended learning is an Advance Path Academy approach to blended learning in which schools collaborate with school districts to address the needs of students with behavioral, academic, and socioeconomic challenges. Team members are responsible for learning, teaching, and supporting team-mates in learning. According to a recent UCLA Higher Education Research Institute survey, collaborative learning methods are used in two-thirds of higher education courses.

Online learning does not focus on delivering content, and reproduces the basic teacher-centered and transmissive face-to-face model. Courses offer prepared material, dialogue, feedback, and opportunities for teachers to adapt, but the risk of disaster is high and much of students' distress is invisible. The complicated economic scenarios associated with the online model cover the training that citizens need to be ready to solve new problems. Intelligent pedagogy is a teaching approach that uses technology to improve the learning experience. Examples include the use of Learning Analytics to help tutors design curricula and support students in managing their learning, and the creative use of technologies such as virtual and augmented reality in learning and teaching. To achieve a self-overlapping model of blended learning, successful students must be self-motivated. While many see university as an opportunity to take advantage of promising career prospects, it is also a unique opportunity to think about oneself and consider how a person can benefit from this experience. In return, top lecturers who publish research results generate scholarship income that can be used by doctoral students for their teaching. The journals in which they publish research are based on a questionable business model: they own a profitable publishing empire that generates billions in revenue. We believe that the entire higher education system prioritizes the classroom over the research laboratory, and changing this dynamic is a challenge. Students are paying more and more for less, and student debt is at an all-time high. Many universities exacerbate inequality by accepting students from higher socio-economic backgrounds at higher rates. These problems are compounded by the fact that many high schools in low-income communities do not help students develop the study skills they need to excel in college. Without preparation, students find it difficult to keep up in college and lose the confidence and motivation that are essential to completing their studies.

Thus, barriers to the effective implementation of digital higher education include a wide range of factors, from digital gaps among employees, caused by inadequate training, unwanted attitudes, or systemic isolation, to inequalities between students that increase and arise around the conditions of insufficient preparation for the crisis caused by the COVID-19 pandemic. How-

ever, we need to overcome these barriers to be able to face the challenges that digitalization and other civilizational changes pose to our higher education systems. All of us need to learn how to transform and adapt in order to be able to cope with the new threats and issues that might arise in the years to come.

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