



Innovation: The European Journal of Social Science Research



ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/ciej20

The conceptual framework of shock innovation in education: non-diffusive spread of innovations triggered with the pandemic

Diana Koroleva & Anastasiia Andreeva

To cite this article: Diana Koroleva & Anastasiia Andreeva (11 Mar 2024): The conceptual framework of shock innovation in education: non-diffusive spread of innovations triggered with the pandemic, Innovation: The European Journal of Social Science Research, DOI: 10.1080/13511610.2024.2323148

To link to this article: https://doi.org/10.1080/13511610.2024.2323148





The conceptual framework of shock innovation in education: nondiffusive spread of innovations triggered with the pandemic

Diana Koroleva Diana Anastasiia Andreeva D*

National Research University Higher School of Economics, Moscow, Russia (Received 11 July 2023; final version received 2 February 2024)

ABSTRACTThe paper provides insights on the transformation process in education triggered by the COVID-19 pandemic, and suggests a new theoretical concept of shock innovation. Based on interviews with school administrators and teachers (N= 15), we conceptualized the transition to distance learning as an innovation, and compared its characteristics with the typical spread of innovations. We use Rogers' diffusion of innovations theory to construct a three-tiered model that describes the universal spread of innovations in education. The analysis suggests that the transition to emergency remote teaching is not a 'diffusion spread' but a 'shock spread' as: (1) awareness was synchronized with implementation, removing the persuasion and decision steps; (2) the boundaries between 'innovators' and 'laggards' were erased; (3) schools made the transition on an equal basis with other industries.

Keywords: Shock innovation; distance learning; emergency remote teaching; digitalization of education; the diffusion of innovations theory; conceptual framework of COVID-19 in education

Introduction

The lockdown and social distancing provoked by COVID-19 have impacted more than 94% of the world's student population (Pokhrel and Chhetri 2021). Teachers and learners, for the most part of the world, could not physically meet in schools and had to transit and adapt to a new form of learning using digital tools. Although different education systems across the world experienced the transition differently, the national transitions to remote teaching occurred at approximately the same timeframe and proceeded very rapidly. The transition speed was expressed in months or even weeks, while a previous digital transformation of educational and other organizations took years (Catlin et al. 2017; Davis 2019; Koroleva 2016). Besides, studies describing the transition to distance learning in different countries have revealed some other common characteristics: the unexpectedness of the situation and the presence of challenges that exceeded the capabilities of educational organizations (Masten and Motti-Stefanidi 2020; Yildiz and Demir 2020) as well as the the wide-scale changes in educational systems all over the world (Nissen 2020; Schleicher 2020).

The dual nature of the effects of the pandemic on the education system can be inferred from a review of empirical studies and meta-analyses dedicated to the emergency transition to distance learning. On the one hand, the challenges presented by the pandemic

^{*}Corresponding author. aaandreeva@hse.ru Potapovskij, 16 (10), Moscow, 101000, Russian

led to a decline in the quality of education, students' skills, and future productivity (Donnelly and Patrinos 2022; Kosaretskiy et al. 2020). They increased stress for families and school employees (Ma et al. 2022), and increased inequality (Di Pietro et al. 2020). On the other hand, the COVID-19 challenges, whilst seeming to be significant, triggered teachers' professional development (Bond 2021), resource consolidation, and the emergence of innovative practices (White et al. 2021).

While there have been many strong empirical studies describing the education system in the context of this pandemic, there is a lack of conceptual papers revealing the nature of transition to distance learning as the phenomenon; our paper aims to address this gap. Conceptualization will enable us to identify the lessons that the pandemic has imparted to us (Rys, Krzyworzeka, and Żukowicka-Surma 2023) and set a precedent for the future description of potential similar events that may arise.

We analyze the transition to distance learning during the pandemic through the lens of theories of innovation (Cleland et al. 2020; Farrugia and Plutowski 2020), since the transition contains all the key characteristics of an innovation process. The first key characteristic of innovation is *novelty*. This is reflected in the emergency pandemic transition to online schooling in the fact that schools made use of many new digital tools (Saprykina and Volohovich 2020), and that a large number of new practices emerged (Abankina et al. 2020). The second characteristic of innovation is meeting societal needs (Serdyukov 2017). In this case, the transition to distance learning was dictated by the situation and society's need to avoid or reduce learning loss. It became necessary to organize the education process under new conditions (Hanushek and Woessmann 2020; Masonbrink and Hurley 2020). The third characteristic of innovation is that it must become solidified as a practice. Innovation is 'an invention that became needed' (Cros 2018, 5). Before the pandemic, the majority of participants did not accept a new way of organizing the education process, such as online learning, but it became universally required and a normal practice. Interest in it has partially continued to exist, even after the removal of many of the restrictions posed by the pandemic (Korkmaz and Toraman 2020; Scully, Lehane, and Scully 2021). The advantage of the innovative approach to studying the transition to distance learning is that it considers the introduction of digital technologies into the educational process as a part of a broader digital transformation of the education system rather than as a temporary measure (Al-araibi et al. 2019; Scully, Lehane, and Scully 2021). While many studies of the crisis discuss how to return to the pre-crisis state, innovation studies considers the integration of novel elements into the education system as a new stage of development (Cleland et al. 2020; Farrugia and Plutowski 2020; Mourshed, Chijioke, and Barber 2010; Scully, Lehane, and Scully 2021).

Innovation studies possess an array of theoretical models previously used to understand the transformation processes in education: the concept of strategic reflexivity (Fuglsang and Sundbo 2002), an evolutionary model of innovations (Leydesdorff 2000; Love 2008), the concerns-based adoption model (Gabby et al. 2017), the innovation maturity model (Essmann and Preez 2009; Zugec, Balaban, and Divjak 2018) and others. Rogers (2003) diffusion of innovations theory stands out from these many models as the most mainstream approach for describing an innovation process in education (Arthars and Liu 2020; Curtis 2020; Roberts and Edwards 2020).

Therefore, the theoretical framework employed to discern attributes of the innovation process in the transition to distance learning is grounded in Rogers' Diffusion Innovation Theory. The research question is formulated as follows:

What are the characteristics of the innovation process in the transition to distance learning?

Three characteristics of the diffusion of innovations

Rogers (2003) described the spread of innovations as a continuous process of diffusion. He saw it as a 'planned or spontaneous spread of a new idea among members of the social system' (Rogers 2003, 12). This is compared to the diffusion process, in which molecules of one substance penetrate between molecules of another substance, leading to a spontaneous equilibrium of their concentrations. In the case of innovation, new practices are slowly and gradually adopted by community members through communication. Rogers clarified the previous understanding of innovation by adding a time axis to his model, which comprehensively revealed the essence of the innovation adoption process. Based on Rogers' extensive theoretical description, we propose a three-level model of innovation adoption, which allows us to consider the diffusion of innovation in education in a more structural way.

First, at the micro-level, a particular teacher adopts a given educational innovation. Rogers conceptualized this as an innovation-decision *process*. He described this process as arduous and lengthy, including five steps: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation. At the *knowledge* step, the individual becomes aware of an innovation and reaches a basic understanding of the innovation's function. In the *persuasion* step, individuals form an attitude to innovation. When available information is sufficient to overcome an individual's uncertainty, the *decision* step occurs, which involves making a decision on whether to try or reject an innovation. If the individual decides to try out the innovation, the *implementation* step takes place. Finally, this experience of using an innovation leads an individual to the *confirmation* step, which is the final stage of an innovation-decision process as described by Rogers.

Second, at the meso-level, educational innovations are adopted consistently by different groups of educators (*innovations categories*). Rogers (2003) described 5 categories of adopters: (1) innovators, (2) early adopters, (3) early majority, (4) late majority, and (5) laggards. Innovation is spread among these categories in a domino effect. At the beginning, the new practice is adopted by *innovators*, namely the most sensitive and opento-change members of a community. Further, early adopters quickly pick up the innovation; they are not ready for hazardous decisions like the innovators but are still open to new things. The innovation extends to covering half of the entire community when the *early majority* joined in. The *later majority* includes those who are even more careful, and adopt a new idea when at least half of the community has done so. Finally, the *laggards* show the greatest resistance to new ideas and adopt the innovation only at the latest stage (Rogers 2003).

Third, at the macro-level, these transitions are carried out within the context of an entire education system (the rate of innovation adoption by the education system). Rogers (2003) highlighted how the speed of diffusion of an innovation depends on system-level factors, such as social norms and values. Divergent social contexts lead to the difference in time required for all adopters, from innovators to laggards, to confirm the innovation. The diffusion of innovations cannot be explained only by individual factors, since system-level factors might slow down the process of moving through the 5 steps of the innovation-decision process, as well as between the adoption categories. This explains why the same innovation may have different rates of adoption in different communities. The field of education is often described as a conservative and hermetic system, with many internal barriers that delay the adoption of innovations that have

long been successfully put to use in other fields (Fullan 2015; Fuller 2020; Kuzminov and Yudkevich 2007).

Thus, it is possible to use Rogers' diffusion of innovations theory to construct a threetiered model that describes the spread of innovations in education: the innovation-decision process on the part of a particular teacher (micro-level), the spread among innovation categories of teachers (meso-level), the rate of innovation adoption by the education system (macro-level). We propose applying these three characteristics of diffusion of innovation to the innovation processes that accompanied the emergency transition to remote teaching. Thus, here arises an opportunity of exploring universal characteristics of innovation diffusion in the context of the pandemic, as well as the specifics of this phenomenon in the context of education.

Materials and methods

Our research design is based on a comparison of the theoretical framework with a new empirical phenomenon (Koroleva and Simpson 2018; Thomas, Lazarova, and Inkson 2005). By applying Rogers (2003) three characteristics of diffusion of innovation to the actual diffusion of innovation in the emergency transition to distance learning.

In the first stage of the study, we elaborated prior concepts using a theory-driven approach. For this purpose, we reviewed Rogers' theory and extracted the specific characteristics of the diffusion process to form a basis for comparison. His detailed and extensive description of the diffusion process was narrowed down to three characteristics: (1) at the individual level, the adopter passes through each of the 5 stages, from awareness to final adoption; (2) at the group level, the spread of innovations moves gradually from innovators to laggards; (3) at the system level, aspects of the social system impact the speed of adoption. These three structures also reflect the multilevel nature of the innovation processes, covering innovation spread at micro-, meso- and macro- levels.

At the second stage, 15 interviews with school principals, their deputies, and teachers were collected. All respondents represent Russian public schools. The interview guide covered the details of the transition to remote teaching in the spring of 2020, including: how long did the preparation and the transition take? What were the procedures and key barriers to the transition? How did the school staff perform? The average interview time was about 67 min (range from 37 to 98 min). The narrative form of presentation used in the interviews seemed most appropriate for describing the transition process.

We used key aspects of Rogers' diffusion of innovations theory as an a priori code for structuring the narratives produced by the participants in the educational process. This allowed us to compare characteristics of the innovation process that took place during the emergency transition to distance-learning with the typical characteristics of innovation diffusion.

Table 1 displays participant information. Based on the information from the national agency's rating (Public education inspector's blog 2021), which ranks regions based on the quality of school education, our sample includes schools from the leading regions (Moscow and Krasnoyarsk Krai), the average regions (Nizhny Novgorod and Voronezh oblasts, Perm Krai), as well as a region that demonstrates below-average results (Orenburg Oblast). We included schools located in large cities with well-developed infrastructure as well as schools from small towns. The sample also included both general-education schools and schools with specialized curricula. The number of the teaching staff ranged from 27 to 227, and the student body size ranged from 221 to 1124. The sample reflected varying levels of technological readiness at the moment of transition to distance learning

Table 1. Informants' background information.

№	Position	Number of years in experience	Region	City population size	School type	School technology readiness	Number of students	
1	Principal	10	Krasnoyarsk region	up to 100,000, but less 250,000	general education school	middle	above 500	
2	Principal	19	Krasnoyarsk region	up to 100,000, but less 250,000	general education school	low	up to 1,000	NNO
3	Vice-Principal and Computer science teacher	11	Nizhny Novgorod region	over 1 million	general education school	low	up to 500 but less 1,000	INNOVATION:
4	Geography teacher	26	Nizhny Novgorod region	over 1 million	enhanced education schools	middle	up to 500 but less 1,000	ON: T
5	Vice-Principal and Science teacher	25	Nizhny Novgorod region	over 1 million	enhanced education schools	low	up to 500 but less 1,000	THE EUI
6	Principal	20	Orenburg region	up to 100,000, but less 250,000	general education school	high	up to 1,000	ROPI
7	Vice-Principal and Mathematics teacher	20	Voronezh region	above 50,000	general education school	high	up to 500 but less 1,000	EUROPEAN JOURNAL
8	Principal	34	Perm region	above 50,000	general education school	high	above 500	nor
9	Vice-Principal and Guidance counselor	8	Moscow	over 1 million	general education school	no data	up to 1,000	RNA
10	Principal	28	Krasnoyarsk region	over 1 million	general education school	no data	up to 1,000	L OF
11	Vice-principal and Russian language teacher	25	Nizhny Novgorod region	over 1 million	general education school	low	up to 1,000	\sim
12	Vice-principal and Chemistry teacher	25	Nizhny Novgorod region	over 1 million	general education school	middle	up to 500 but less 1.000	SOCIAL RESEA
13	History teacher	21	Nizhny Novgorod region	over 1 million	general education school	high	above 500	OCIAL SCIENCE RESEARCH 5

Table 1. Continued.

№	Position	Number of years in experience	Region	City population size	School type	School technology readiness	Number of students
14	English language teacher	4	Nizhny Novgorod region	over 1 million	general education school	low	above 500
15	Mathematics teacher	6	Nizhny Novgorod region	over 1 million	enhanced education schools	low	up to 500 but less 1,000

INNOVATION: THE EUROPEAN JOURNAL OF SOCIAL SCIENCE RESEARCH 7

(Technology Readiness Index) (Parasuraman 2000). This differentiation was based on the results of a previous study by the authors of this paper (Khavenson, Kotik, and Koroleve 2020).

Three characteristics of the transition to distance learning

From 'awareness' to 'trial' at the micro-level

Educators' adoption of innovative practices during COVID-19 did not take place along the standard progression from first knowledge to confirmation, but was a compressed version of the diffusion process described by Rogers (2003). Teachers learned about the innovation and tried it almost at the same moment, skipping the stage of subjective evaluation.

Interviews show that in response to the necessity of social distancing, educators dived into the new teaching format by 'grabbing new instruments' and 'testing them out in the process of teaching itself' (the words of respondents are reported here and further in italics). An opinion on the application of the innovation formed only after they started teaching using those innovations. Looking at this process through the lens of the innovation-decision framework, we see that first knowledge occurred in parallel with the implementation phase, while the persuasion and decision steps were skipped.

We rushed everywhere at first. For us, everything was new, and we rushed into all platforms, into all these ... And then, when everyone had tried, we realized that we needed to pause somewhere. (Principal at a general school)

In the schools we looked at, it is possible to identify two strategies of school teachers in response to the situation. In the first group were teachers *awaiting* a concrete recommendation from the top (school authorities, education department, etc). When highly-anticipated recommendations finally reached the individual level, those teachers would quickly adopt innovations from the top, with persuasion and discussion being out of the picture. Another group were teachers who organized their transition to distance learning independently. This group could potentially be involved in the process of decision-making. Still, because of the emergency situation, their actions were chaotic and were not based on proper information gathering and choosing between different alternatives. In this way, innovations during the pandemic did not pass through the filter of subjective evaluation to understand if the innovation would be beneficial to a certain teacher in a particular situation. Regardless, these innovations were often implemented, and moreover, they were scaled to other teachers.

In order to speed up the process of implementing digital innovations, school principals and teachers usually used what was available to them: 'things that are much talked-about', 'at hand', or 'familiar to a particular teacher or student'. Teachers also adapted tools from everyday life to education: social networks (Facebook, Vkontakte); messengers (WhatsApp); office tools (Google forms, text editors).

We found ourselves in a situation where the ground shifted underneath our feet - they deprived us of classrooms and of the place where we came together - the schools. We began to look for the fastest possible design solution that would allow the students to reassemble. Our question was - where are our children? We realized that we would not be able to register a thousand students on any one platform quickly. The decision came quickly - they were all registered in the Vkontakte social network < ... > Then we needed to register the pedagogical team there. We followed the children. (Vice-principal at a comprehensive school)

8 D. KOROLEVA AND A. ANDREEVA

At that time, there was a tumultuous pandemonium, so initially we used the same methods of communication with each other that we had used before. We already had a chat on VKontakte, where we exchanged homework questions before the pandemic. In the first weeks of the pandemic, I would send assignments to the students in this chat. (English language teacher at a general school)

Educators highlight the role of external requests (from parents, students, etc.) in the fast adoption of innovation by individuals in the education sector. The necessity to organize the learning process in a new way, due to the closure of schools for quarantine, led to the mass acquisition of new digital tools. This was unlike the schools' previous attempts of digital transformation prior to the pandemic. Federal and regional educational authorities had launched digitization programs long before the pandemic (so-called innovations 'from above'), but the majority of teachers had resisted these reforms and ignored the digital innovations. There had also been some employees' initiatives (innovations 'from below') before the transition. Still, these were sporadic and did not scale from proactive teachers to other members of the teaching staff. Therefore, the external requests from the community and the attendant pressure emerged as catalysts for change, exerting a more profound impact than formal directives from higher authorities.

Blurring the lines between 'Innovators' and 'Laggards' at the Meso-Level

The process of innovation diffusion during the pandemic equalized the innovation status of all participants in the education process, blurring the boundaries between *innovators* and *laggards* from the point of view of adoption speed.

In the schools we looked at, the vast majority of teachers switched to remote teaching in a short period of time, both those expected to do so, who were active and open to change, as well as groups of teachers who previously needed more time to change their practices. School principals pointed out that, for some teachers, it was very difficult to make the transition, as they were not prepared and initially felt skeptical about new technologies. However, these educators could not ignore the new formats, and were forced to engage in the new practices. Looking at the way this process unfolded in the 'adopter' category, we argue that the experience of innovation implementation during the pandemic occurred almost simultaneously for all employees regardless of their level of innovativeness.

The requirements were the same for everyone, and the school staff tried to fulfill them. There were difficulties, but they coped with them and performed their work according to the algorithm they were given. Refusals to follow a unitary regime were an exception and a temporary phenomenon: "teachers who were critical at first then went on to do the best of all". Special attention was given to such educators. As a result, the entire school team started working the same way at the same time. (Vice-principal at a general school).

Our research reveals that the laggards (teachers of lower innovativeness) received extra support from their colleagues. The teachers-innovators pulled the rest of the team along into the innovation flow by taking on the role of the person who 'can be called at any time to give advice'. Those teachers turned out 'to have a voice' and be 'in demand from the team'. Moreover, innovators themselves took a step towards interacting with the rest of the team by suggesting innovations that the 'late' categories were able to manage. They shared them simply and understandably, e.g. with 'instructions,' 'cheat-sheets,' 'manuals,' and 'lesson plans'. They also helped in coping with difficulties, for example, by 'telling which button to press' and 'how to deal with online hooliganism.'

It is the support within the staff: "how do you do here?", "this is how it is for me", "but here, this is not working for me, what do I need to do?". We would join in, advise, help, teach, and conduct the lesson together. (Principal at general school)

I created screenshots: how we do it, where to click. All of this was written in the most convenient way so that the colleagues could easily apply it. (History teacher at enhanced school)

The large-scale adoption of innovative tools can be linked to the fact that these innovations were forced. According to the interviews, the situation of urgent transition to distance learning practically *excluded the possibility of resistance* except as an extreme measure, which implied the possibility of being fired. As a result, the vast majority of teachers had no choice but to try on the role of innovator. Ultimately, this proportion of innovators does not fit into Rogers' framework, and represents a new type of educational organization. A teaching staff composed entirely of innovators is an entirely novel phenomenon.

From 'Inertia' to a 'Quick Jump' at the Macro-Level

In contrast to what follows from Rogers' model (2003), the education system did not show its usual inertness, but rather made an innovative breakthrough and adopted the distance format almost simultaneously with other industries.

According to our respondents, educational organizations switched to the remote format in a very short time, which is also confirmed by the official website of the Ministry of Education (On approval of the temporary procedure for supporting the implementation of educational programs for primary general, basic general, secondary general education, educational programs for secondary vocational education and additional general educational programs using e-learning and distance learning technologies 2020). Comparing the dates of the transition to remote learning with the dates of transition of organizations in other industries (museums, banks, government organizations, etc.), we see that during the pandemic, the timeline for all industries was approximately the same (see Table 2). Applying the concept of *the rate of innovation adoption*, we suggest that social structures did not slow down the speed of innovation adoption in previously inert industries like education.

Source: Adopted from Tadviser (2020).

Our informants described the weeks of the transition as a 'breakthrough', a 'powerful time'. They claimed that they and their colleagues did a huge amount of work, which was hard to complete and reminded them of a marathon. Although some schools adjusted to distance learning practices only after the end of the mandatory vacation period, in the cases we reviewed, most of the work to complete the transition was completed during this break. In the interviews, this information is accompanied by narratives disclosing

Table 2	. Dates of transition to	o remote formats at	Russian companies.
№	Company name	Industry	Date of the start of

№	Company name	Industry	Date of the start of work in a remote format
1	The Pushkin Museum	Art	20.04.2020
2	ObninskOrgSintez	Chemical	13.05.2020
3	Rostelecom	Telecommunications	02.04.2020
4	Rostec	Military	25.03.2020
5	X5 Group	Trading	23.03.2020
6	VTB Bank	Finance	16.04.2020
7	Gazprom	Energy	19.03.2020
8	Russian Post	Logistics	23.03.2020
10	Call-center Gran	Household services	14.05.2020

an increased load on all participants of the educational process, a state of stress and uncertainty, and tasks that 'exceeded the usual capabilities' of the school staff.

It was hard times, but the hard times got us where we are now. We were able to take this step forward because of the pandemic, we stepped into the digital world, which we probably wouldn't have done if it weren't for this unpleasant event. It would've taken us a long time to get moving. There was a leap forward, a breakthrough. Today, for example, our high school did a practice EGE (standardized test). The school is closed, so some classes are online, but we are handling it. (Mathematics teacher at an enhanced education school)

Our study also reveals that parents, schoolchildren and the local community mobilized around schools and showed an unusual involvement in the educational process. Both the school staff and the communities surrounding the school temporarily united and began to act as a 'single organism', as they recognized the need for innovation and got involved in the process of change. The position of resistance toward innovation by individuals was either replaced by acceptance of the situation, or 'carried away by the whirlwind' of innovation flow as 'their opinions were not heard'.

Not everyone was happy about the transition to distance learning, and it was difficult to change mentally from one format of working to another. And then, once we accepted it, everything went well. Teachers, children and parents came together because there was no choice. It was the only possible format under such conditions. (Geography teacher at a public school)

The transition to remote learning provoked an innovation breakthrough and reached a sufficient level of readiness for the system to implement the urgent transition. This happened due to a trial-run of the online learning innovation that was triggered by external impetus at the micro-level. Every teacher was forced to temporarily become an innovator at the meso-level. There was also a mobilization and consistency of effort on the part of school principals, staff, and the whole community at the macro-level. The experience gained by the education system during the pandemic can now be used even after the epidemiological situation has improved.

Shock vs Diffusion

Generalizing our findings across the three levels, we can conclude that the transition to distance-learning resulted in a 'condensed' process of innovation diffusion. Given that the emergency transition to distance-learning during the COVID-19 pandemic bore the characteristics of an innovation process, we can say that it occurred extremely quickly, with an explosive growth in the diffusion of innovations. That falls outside of the Rogers diffusion models (Rogers 2003). Thus, there is now a need to expand the theory of innovation to include a description of such instantaneous transformations.

The transition to distance learning we have observed differs from traditional diffusion of innovation, adding additional characteristics (Rogers 2003). Firstly, at the micro level, this involves the absence of the step-by-step process of adoption of innovative practices on the part of participants. Responding to an external requirement, teachers began using digital tools en masse, skipping over the second stage of innovation adoption described by Rogers, which involves forming an opinion about the innovation. Secondly, innovation diffusion in the pandemic context leveled the playing field for all participants; this applies to the meso level of our analysis. The lines between innovators and laggards, in terms of the speed of adoption were erased, since the conditions essentially precluded the

INNOVATION: THE EUROPEAN JOURNAL OF SOCIAL SCIENCE RESEARCH 11

possibility of resisting innovation. Thirdly, at the macro or system level, schools themselves could not remain inert and resistant, and joined the race towards transformation and digitalization, keeping pace with other industries. This required the education system to undergo an *innovation breakthrough*, mobilizing all its resources and achieving a *temporary consensus* among various participants in the educational process.

Based on these observations, we propose that the transition to distance learning during the pandemic should be considered as a new type of innovation, which we suggest calling shock innovation. In order for this definition to be accepted, the following critieria must all be met: (1) a triggering moment created externally; (2) the inescapable need for a response (mandated change); (3) the emergence of a leap forward, bolstered by the extreme mobilization of resources and the emergence of a temporary consensus; (4) the exclusion of traditional innovation diffusion processes on three levels: individual (micro), group (meso), and systemic (macro).

Conclusion and discussion

Our study focused on the processes that took place at the moment of the escalation of the epidemiological situation in the Spring of 2020. We managed to observe the shock nature of innovation spread during this period. The Diffusion of Innovations Theory (Rogers 2003) laid the groundwork for studying its characteristics.

Firstly, describing the shock innovation allows us to formulate lessons from the pandemic. The conducted research confirmed the dual nature of the pandemic effects described in the literature (Bond 2021; Di Pietro et al. 2020; Donnelly and Patrinos 2022; Kosaretskiy et al. 2020; Ma et al. 2022). Among the advantages is a massive trial of innovation. The process of transitioning from awareness of an innovation to its practical implementation represents the most challenging phase in the journey toward widespread adoption. The exigencies of the pandemic compelled individuals to overcome this hurdle, thereby alleviating certain psychological barriers, such as the fear of the unknown and the perceived resource demands of mastering new techniques. Notably, even those categorized as laggards within Rogers' model were coerced to embrace the shift to distance learning alongside their more progressive peers. Consequently, this transformation reshaped the outlook on innovation within educational institutions, augmenting the human capital potential of teaching staff through enhanced professional development and fortifying internal relationships, thereby fostering team unity.

Conversely, a discussion of the specific outcomes of shock innovation reveals several drawbacks. The rapid nature of shock innovation circumvented the conventional process of persuasion, thus diminishing individuals' autonomy and failing to provide the necessary space for informed decision-making and wholehearted commitment. Moreover, the accelerated nature of the adaptation process also impacted the efficacy of the tools employed, without guaranteeing that the chosen instruments were the most optimal among available options. Lastly, this form of implementation placed a significant burden on all members of the collective, thereby increasing the potential for deferred resistance.

Secondly, recording the phenomenon itself – distinct from the usual diffusion, but shocks – allows us as researchers to create an artifact for potential future reference. The escalating uncertainty and the swift pace of technological progress suggest a recurring need for emergency changes triggered by shocks (Christensen and Eyring 2011). In the realm of technology, this could be linked to their rapid development, such as the emergence of artificial intelligence with its disruptive implications for education, or the possible abandonment of technology that society has grown accustomed to, a consequence of widespread internet

outages or systemic failures (Bross 1999). Consequently, the concept of shock innovation is gaining relevance, and as a novel type, it calls for further exploration in future research.

Limitations

The study is subject to certain limitations that merit consideration in the discourse surrounding its findings. Our investigation pertains to the innovation dynamics within the context of an exceptionally distinctive circumstance associated with the COVID-19 pandemic. The prospect of similar occurrences in the future is uncertain, and the conclusions drawn may retain a specificity contingent upon the temporal and situational aspects of the pandemic. Nevertheless, we posit that documenting this particular scenario is of paramount importance for both academic scholars and practical implementers, offering a valuable snapshot for retrospective analysis.

Furthermore, the study's distinctive features warrant attention, particularly in relation to the sample composition, which primarily consists of school directors and teachers. We acknowledge the multifaceted nature of the education system, encompassing various stakeholders, such as parents and students, each potentially experiencing a distinct trajectory in the diffusion of innovation. However, given the intricate interplay of elements within our model, which operates on three hierarchical levels, it was imperative for us to engage specifically with official representatives of the educational system.

Additionally, the contextual backdrop of the Russian educational landscape assumes a pronounced significance. The hierarchical structure of the Russian education system, characterized by limited horizontal interconnections, adds a unique dimension. Nonetheless, international assessments such as TALIS, TIMS, and PISA imply a degree of alignment between Russian data and the broader international educational discourse. It is crucial, however, to interpret these findings in consideration of the distinctive national characteristics shaping the Russian educational context.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

This article is an output of a research project implemented as part of the Basic Research Program at the National Research University Higher School of Economics (HSE University).

Ethics approval

Empirical materials (interviews) were collected and analyzed in accordance with modern ethical principles.

Data, materials and/or code availability

The database generated and analysed during the current study are not publicly available due the fact that the interviews contain a large number of details preventing from maintaining anonymity but are available from the corresponding author on reasonable request.

Authors' contribution statements

All persons who meet authorship criteria are listed as authors, and all authors certify that they have participated sufficiently in the work.

Notes on contributors

Diana Koroleva, PhD, currently leads the Laboratory for Educational Innovation Research (LEIR) at the Institute of Education, National Research University Higher School of Economics in Moscow, Russia. Her research focuses on integrating digital innovations into education, with a particular emphasis on artificial intelligence. As the founder and director of the Education Innovation Competition (KIVO), Dr. Koroleva is dedicated to fostering innovative ideas in education.

Anastasiia Andreeva, a deputy director of the Laboratory for Innovation in Education Higher School of Economics, and program director of the Education Innovation Competition (KIVO), whose interests lie in exploring the psychological and socio-cultural factors of innovation acceptance and resistance. Her work delves into understanding innovation as a process, identifying barriers and drivers to innovation at the individual and organizational levels.

ORCID

Diana Koroleva http://orcid.org/0000-0001-5296-8708

Anastasiia Andreeva http://orcid.org/0000-0003-1537-0517

References

- Abankina, Irina, Anna Vavilova, Kirill Zin'kovskij, Kristina Semenova, and Nadezhda Surkova. 2020. "Цыплят по осени считают: уроки COVID-19 для школ" [Don't Count Your Chickens Before They are Hatched: COVID-19 Lessons for Schools]. Sovremennaya Analitika Obrazovaniya 14 (44): 1–52.
- Al-araibi, Asma, Mohd Naz'ri bin Mahrin, Rasimah Yusoff, and Suriayati Chuprat. 2019. "A Model for Technological Aspect of e-Learning Readiness in Higher Education." *Education and Information Technologies* 24 (2): 1395–1431. https://doi.org/10.1007/s10639-018-9837-9.
- Arthars, Natasha, and Danny Liu. 2020. "How and why Faculty Adopt Learning Analytics: Wide-Scale Adoption Through a Diffusion of Innovation' Lens." In *Adoption of Data Analytics in Higher Education Learning and Teaching*, edited by David Gibson and Dirk Ifenthaler, 201–220. Springer. https://doi.org/10.1007/978-3-030-47392-1_11.
- Bond, Melissa. 2021. "Schools and Emergency Remote Education During the COVID-19 Pandemic: A Living Rapid Systematic Review." *Asian Journal of Distance Education* 15 (2): 191–247. https://doi.org/10.5281/zenodo.4425683.
- Bross, Ulrike. 1999. "Technology Audit as a Policy Instrument to Improve Innovations and Industrial Competitiveness in Countries in Transition." *Innovation: The European Journal of Social Science Research* 12 (3): 397–412. https://doi.org/10.1080/13511610.1999.9968611.
- Catlin, Tanguy, Johannes-Tobias Lorenz, Bob Sternfels, and Willmott Paul. 2017. "A Roadmap for a Digital Transformation." McKinsey & Company. https://www.mckinsey.com/industries/financial-services/our-insights/a-roadmap-for-a-digital-transformation.
- Christensen, Clayton, and Henry Eyring. 2011. The Innovative University: Changing the DNA of Higher Education from the Inside Out. New York: John Wiley & Sons.
- Cleland, Jennifer, Judy McKimm, Richard Fuller, David Taylor, Janusz Janczukowicz, and Trevor Gibbs. 2020. "Adapting to the Impact of COVID-19: Sharing Stories, Sharing Practice." Medical Teacher 42 (7): 772–775. https://doi.org/10.1080/0142159X.2020.1757635.
- Cros, Françoise. 2018. Innovation and Society. London: Wiley-ISTE. https://doi.org/10.1002/9781119492221.
- Curtis, Mary. 2020. "Toward Understanding Secondary Teachers' Decisions to Adopt Geospatial Technologies: An Examination of Everett Rogers' Diffusion of Innovation Framework." *Journal of Geography* 119 (5): 147–158. https://doi.org/10.1080/00221341.2020.1784252.
- Davis, Ben. 2019. "How Long does Digital Transformation Take." Econsultancy. https://econsultancy.com/how-long-does-digital-transformation-take-timescale/.

- Di Pietro, G., F. Biagi, P. Costa, Z. Karpiński, and J. Mazza. 2020. *The Likely Impact of COVID-19 on Education: Reflections Based on the Existing Literature and Recent International Datasets*. Luxembourg: Publications Office of the European Union.
- Donnelly, Robin, and Harry Anthony Patrinos. 2022. "Learning Loss During Covid-19: An Early Systematic Review." *PROSPECTS* 51 (4): 601–609. https://doi.org/10.1007/s11125-021-09582-6.
- Essmann, Heinz, and Niek Preez. 2009. "An Innovation Capability Maturity Model –Development and Initial Application." *World Academy of Science, Engineering and Technology* 53 (1): 435–446.
- Farrugia, Gianrico, and Roshelle Plutowski. 2020. "Innovation Lessons from the COVID-19 Pandemic." *Mayo Clinic Proceedings* 95 (8): 1574–1577. https://doi.org/10.1016/j.mayocp. 2020.05.024.
- Fuglsang, Lars, and Jon Sundbo. 2002. *Innovation as Strategic Reflexivity*. London: Routledge. https://doi.org/10.4324/9780203219270.
- Fullan, Michael. 2015. The New Meaning of Educational Change. 5rd ed. London: Routledge.
- Fuller, Cricket. 2020. "Education Innovation Clusters: Supporting Transformative Teaching and Learning." *Childhood Education* 96 (1): 34–47. https://doi.org/10.1080/00094056.2020. 1707534.
- Gabby, Shwartz, Shirly Avargil, Orit Herscovitz, and Yehudit Dori. 2017. "The Case of Middle and High School Chemistry Teachers Implementing Technology: Using the Concerns-Based Adoption Model to Assess Change Processes." *Chemistry Education Research and Practice* 18 (1): 214–232. https://doi.org/10.1039/C6RP00193A.
- Hanushek, Eric, and Ludger Woessmann. 2020. "The Economic Impacts of Learning Losses" *OECD Education Working Papers* 225:1–25. https://doi.org/10.1787/21908d74-en.
- Khavenson, Tatyana, Nikita Kotik, and Diana Koroleva. 2020. "Digital Technological Readiness of School Teachers." *Monitoring of Education Markets and Organizations (MEMO)* 8:1–6.
- Korkmaz, Günes, and Çetin Toraman. 2020. "Are we Ready for the Post-COVID-19 Educational Practice? An Investigation Into What Educators Think as to Online Learning." *International Journal of Technology in Education and Science* 4 (4): 293–309. https://doi.org/10.46328/ijtes.y4i4.110.
- Koroleva, Diana. 2016. "The Third Wave of Informatization Mobile Learning and Social Networks in the Modern School for Upgrading the Educational Process." 8th International Conference on Computer Supported Education (CSEDU) 2: 9–15.
- Koroleva, Diana, and Ashley Simpson. 2018. "Coup D'etat in the Panopticon: Social Networking in Education." In *Transforming Education*, edited by Leon Benade and Mark Jackson, *Transforming Education* 213–225. Springer https://doi.org/10.1007/978-981-10-5678-9 14.
- Kosaretskiy, Sergey, Joao Azevedo, Victoria Collis, Isac Froumin, Kohen Geven, Afraa Hassan, Syedah Aroob Iqbal, Yulia Kersha, Harry Patrinos, George Psaharopoulos, Alina Sava, Tigran Shmis, Emiliana Vegas, and Roman Zvyagintsev. 2020. "Прогнозируемые потери для школьного образования из-за пандемии COVID-19: оценки и поиск способов компенсации" [The COVID-19 Pandemic Losses for Education: Forecasts and Search for Ways of Compensation]. Sovremennaya Analitika Obrazovaniya 8 (38): 1–40
- Kuzminov, Yaroslav, and Maria Yudkevich. 2007. "Университеты в России и в Америке: различия академических конвенций" [Universities in Russia and in the US: Differences in Academic Concepts]. Voprosy Obrazovaniya 4:141–158.
- Leydesdorff, Loet. 2000. "The Triple Helix: An Evolutionary Model of Innovations." *Research Policy* 29 (2): 243–255. https://doi.org/10.1016/S0048-7333(99)00063-3.
- Love, Alan. 2008. "Explaining Evolutionary Innovations and Novelties: Criteria of Explanatory Adequacy and Epistemological Prerequisites." *Philosophy of Science* 75 (5): 874–886. https://doi.org/10.1086/594531.
- Ma, Kang, Luyao Liang, Muhammad Chutiyami, Sandy Nicoll, Teguh Khaerudin, and Xuan Van Ha. 2022. "COVID-19 Pandemic-Related Anxiety, Stress, and Depression among Teachers: A Systematic Review and Meta-Analysis." Work 73 (1): 3–27. https://doi.org/10.3233/WOR-220062.
- Masonbrink, Abbey, and Emily Hurley. 2020. "Advocating for Children During the COVID-19 School Closures." *Pediatrics* 146 (3): 1–4. https://doi.org/10.1542/peds.2020-1440.
- Masten, Ann, and Frosso Motti-Stefanidi. 2020. "Multisystem Resilience for Children and Youth in Disaster: Reflections in the Context of COVID-19." *Adversity and Resilience Science* 1 (2): 95–106. https://doi.org/10.1007/s42844-020-00010-w.

INNOVATION: THE EUROPEAN JOURNAL OF SOCIAL SCIENCE RESEARCH 15

- Ministry of Education of Russian Federation. 2020. "On Approval of the Temporary Procedure for Supporting the Implementation of Educational Programs for Primary General, Basic General, Secondary General Education, Educational Programs for Secondary Vocational Education and Additional General Educational Programs using e-Learning and Distance Learning Technologies." https://docs.edu.gov.ru/document/750dd535d2c38b2a15cd47c9ea44086e/.
- Mourshed, Mona, Chinezi Chijioke, and Michael Barber. 2010. "How the World's Most Improved School Systems Keep Getting Better." *Education McKinsey & Company* 1: 1–126.
- Nissen, Laura. 2020. "Social Work and the Future in a Post-Covid 19 World: A Foresight Lens and a Call to Action for the Profession" *Journal of Technology in Human Services* 38 (4): 309–330. https://doi.org/10.1080/15228835.2020.1796892.
- Parasuraman, Ananthanarayanan. 2000. ".Technology Readiness Index (TRI) a Multiple-Item Scale to Measure Readiness to Embrace New Technologies" *Journal of Service Research* 2 (4): 307–320. https://doi.org/10.1177/109467050024001.
- Pokhrel, Sumitra, and Roshan Chhetri. 2021. "A Literature Review on Impact of COVID-19 Pandemic on Teaching and Learning." *Higher Education for the Future* 8 (1): 133–141. https://doi.org/10.1177/2347631120983481.
- Public Education Inspector's Blog. 2021. "Rosobrnadzor Ranked Russian Regions by Education Quality." https://eduinspector.ru/2021/03/13/rosobrnadzor-sostavil-rejting-rossijskih-regionov-po-kachestvu-obrazovaniya/.
- Roberts, Richie, and Craig Edwards. 2020. "Overcoming Resistance to Service-Learning's use in the Preparation of Teachers for Secondary Agricultural Education: A Reframing of the Method's Diffusion Challenges." *Journal of International Agricultural and Extension Education* 27 (1): 15–33. https://doi.org/10.5191/jiaee.2020.27102.
- Rogers, Everett. 2003. Diffusion of Innovations, 5th ed. New York: Free Press.
- Rys, Maciej, Paweł Krzyworzeka, and Anna Żukowicka-Surma. 2023. "Dermatologist, Orthopaedist, and Psychiatrist Walk Into a COVID Ward: On the Permeability of Professional Boundaries in a Competition-Free Context." *Innovation: The European Journal of Social Science Research* 1–19. https://doi.org/10.1080/13511610.2023.2247569.
- Saprykina, Daria, and Alexey Volohovich. 2020. "Проблемы перехода на дистанционное обучение в Российской Федерации глазами учителей" [Problems of Transition to Distance Learning in the Russian Federation Through the Eyes of Teachers]. Fakty Obrazovaniya 4 (29): 1–28.
- Schleicher, Andreas. 2020. "The Impact of COVID-19 on Education Insights from Education at a Glance 2020." *OECD Publishing*: 1-31. https://www.oecd.org/education/the-impact-of-covid-19-on-education-insights-education-at-a-glance-2020.pdf.
- Scully, Darina, Paula Lehane, and Conor Scully. 2021. "It is no Longer Scary': Digital Learning Before and During the COVID-19 Pandemic in Irish Secondary Schools." *Technology, Pedagogy and Education* 30 (1): 159–181. https://doi.org/10.1080/1475939X.2020.1854844.
- Serdyukov, Peter. 2017. "Innovation in Education: What Works, What Doesn't, and What to do About it?" *Journal of Research in Innovative Teaching & Learning* 10 (1): 4–33. https://doi.org/10.1108/JRIT-10-2016-0007.
- Tadviser. 2020. "Опыт перехода компаний на удаленную работу [The experience of companies in switching to remote work]." https://www.tadviser.ru/a/520810
- Thomas, David, Mila Lazarova, and Kerr Inkson. 2005. "Global Careers: New Phenomenon or new Perspectives?" *Journal of World Business* 40 (4): 340–347. https://doi.org/10.1016/j.jwb.2005. 08.002.
- White, Erin, Matthew Shaughnessy, Andrew Esposito, Martin Slade, Maria Korah, and Peter Yoo. 2021. "Surgical Education in the Time of COVID: Understanding the Early Response of Surgical Training Programs to the Novel Coronavirus Pandemic." *Journal of Surgical Education* 78 (2): 412–421. https://doi.org/10.1016/j.jsurg.2020.07.036.
- Yildiz, Öğr, and Mehmet Demir. 2020. "COVID-19 Pandemic Disaster and Role of Schools." *The Journal of Academic Social Sciences* 105 (8): 132–145. https://doi.org/10.29228/ASOS.42900.
- Zugec, Bojan, Igor Balaban, and Blazenka Divjak. 2018. "The Development of an Instrument for Assessing Digital Maturity of Schools." In *Proceedings of Edulearn 18 10th International* Conference on Education and New Learning Technology, 8557–8565. IATED Academy. https://doi.org/10.21125/edulearn.2018.1990.