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COVID-19 online learning challenges: Kazakhstan secondary schools case study

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Background: The COVID-19 pandemic necessitated a rapid transition to online learning (OL) globally, posing significant challenges for educational systems. This study investigates the experiences of secondary school students in Kazakhstan, highlighting the adaptation processes, educational outcomes, and challenges faced during this shift.

Methods: Data were collected through an online survey administered to 3,670 secondary school students across Kazakhstan, selected through convenience sampling. The survey comprised 21 questions using a combination of Likert-type scales and multiple-choice questions to capture students' demographic details, satisfaction levels, perceived difficulties, and academic performance changes during OL. Data validation was ensured by cross-referencing responses, descriptive statistics, T-tests, ANOVA, correlation analysis, and regression were employed to analyze the data and identify factors influencing students' attitudes toward OL and the associated challenges.

Results: The results revealed that satisfaction with OL was positively correlated with satisfaction with education in general and negatively correlated with the level of difficulty in OL ($p < 0.001$). Rural students, while more satisfied with learning overall ($p < 0.001$), were less satisfied with OL compared to their urban peers, and also reported greater challenges ($p < 0.05$). A significant portion of respondents (44.2%) disagreed that OL was an effective learning method, and 43.7% expressed a need for face-to-face interaction with teachers, especially female and rural students ($p < 0.001$). Most students (40.8%) reported worse learning outcomes with OL, particularly urban students ($p < 0.001$), and 32.0% noted a decrease in motivation. Regression analysis identified older students and those who experienced greater difficulty with OL as less likely to prefer it, while those who showed improvement in academic performance and motivation were more favorable toward OL. These findings highlight the complexity of educational preferences and the disparities between urban and rural students during the pandemic.

Conclusion: While the findings may be applicable to other countries with similar educational systems, cultural, economic, and technological differences should be considered when generalizing the results. The insights gained from this study will be valuable for policymakers, educators, and academic institutions to

improve the resilience and effectiveness of educational practices in the face of such challenges.

KEYWORDS

attitude, challenges, COVID-19, online learning, perspectives, secondary school

1 Introduction

The COVID-19 pandemic triggered an educational shift worldwide, forcing secondary schools to transition to online learning (OL) format (Oliveira et al., 2021). This shift was primarily driven by the global fear of virus transmission, particularly in school environments. Although children were reported as less likely to contract COVID-19 than adults, this claim remains unproven (Assegaff and Zhong, 2020). Nevertheless, schools were closed in many countries due to concerns about transmission within family environments and the broader community (Viner et al., 2020). Kazakhstan, like many other countries, opted for school closures and the adoption of online learning to protect public health despite the lack of conclusive evidence regarding child-to-child transmission within school settings.

This sudden change was both a test and a transformation for educational systems, educators, and students. In many developing countries, such as Indonesia and Brazil, the shift to OL was particularly challenging due to existing inequalities in digital infrastructure and access to technology. For example, studies in Indonesia have highlighted the difficulties students faced due to a lack of internet access and digital devices, which disproportionately affected students in rural areas (UNICEF and UNESCO, 2021). Similarly, in Brazil, educational inequality was exacerbated during the pandemic, with students from low-income families struggling to access online education due to inadequate digital infrastructure and resources (Parreiras and Macedo, 2020). These challenges parallel the situation in Kazakhstan, where regional disparities in access to technology posed significant obstacles to effective online learning (Bolatov et al., 2022). This shift was particularly challenging, given the varied levels of infrastructure in different regions and the diverse socioeconomic backgrounds of the students. The relevance of this research is underscored by the ongoing uncertainties surrounding the pandemic and the potential for future disruptions in traditional educational settings.

Unfortunately, despite the transition to updated content in secondary education, most schools are still unprepared to use modern online teaching methods and digital technologies. The COVID-19 situation has brought to light all of the weaknesses of Kazakhstan's secondary education system.

These facts were also voiced in the statement of the Minister of Education and Science of Kazakhstan, A. Aimagambetov, for example.

'... the Internet in Kazakhstan is 'technically not ready' to conduct mass online lessons for schoolchildren...'

'... in general, there was no readiness for distance learning. Neither from the point of view of the regulatory framework nor infrastructure nor methodological preparation...' (Kazistaev, 2021)

Aisha Vauda, the top World Bank expert on education in Central Asia, attests to this fact.

'In Central Asia, including Kazakhstan [during the coronavirus crisis], they did not provide distance learning, but emergency access to training. The difference is that for distance learning, it is necessary to develop training materials and launch a pilot version of specialized modules. Teachers and instructors 'schedule classes so that they know how much information can be provided and what [students] will learn in that time. There was no time for this kind of planning when COVID hit Central Asia and the world...' (Toleukhanova, 2020).

Parents of Kazakh schoolchildren also regard online learning in Kazakhstan as more of a profanation than true learning. Knowledge assessments in online schools have become more formal. Grades were not assigned on the basis of the student's merits but rather at the level established in the previous three quarters. In general, this trend is associated with a poorly planned adaptation to online learning (Elitar.kz, 2020).

The above arguments that OL has an extremely negative impact on the education system prompted a case study focused on regional schools in Kazakhstan.

In the context of the current article, it is especially important that, in analyzing the conditions and possibilities for using OL during a pandemic, the emphasis is on the equality of opportunities for students located in different regions and socioeconomic conditions in Kazakhstan. Key areas of investigation include the accessibility of technology and digital resources, the adequacy of students' OL environments, and the capacity of teachers and schools to deliver quality education through online platforms. Furthermore, the study examines how these factors influenced student academic performance and motivation, providing information on the disparities in educational experiences between different demographic groups within Kazakhstan.

Thus, the study was developed in response to the issues of organizing the OL process in terms of the regulatory framework, infrastructure, and methodological preparation, which was a consequence of the inequality of Kazakh schoolchildren in access to education during the pandemic, a violation of the guarantee of equality and justice.

1.1 Questions for research

Q1: What are the main technological challenges faced by students, such as access to reliable Internet, digital devices, and OL platforms?

Q2: What pedagogical strategies did educators use during the transition to OL, and how effective were they from the students' perspective?

Q3: How has the shift to OL influenced students' engagement with course materials and their overall motivation to learn?

Q4: What impact did OL have on students' academic performance?

Q5: What support systems were provided to students during OL and were they effective?

Q6: How did students' pandemic experiences shape their perceptions of the future of OL and their preferences for continuing education through online or hybrid models, as well as suggestions for improving online educational practices?

1.2 Objectives

This study aimed to explore students' perspectives on OL in secondary schools in Kazakhstan and identify the challenges they faced during OL.

2 Review of the literature

The COVID-19 pandemic significantly disrupted education for millions of school children worldwide. School closures were part of broader national strategies to minimize overall physical interactions in society, aiming to reduce community transmission during lockdowns. Even though the evidence of child-to-child transmission was not robust, these measures prioritized caution and aimed to protect public health amidst uncertainty. This disruption affected learning outcomes, social development, and mental health, with students from low-income families bearing the greatest impact due to limited access to technology.

In Kazakhstan, the shift to online learning mirrored global challenges. The country implemented distance learning through TV broadcasts and online platforms. However, a study in Kazakhstan revealed that many students, particularly in rural areas, faced difficulties due to insufficient access to devices and internet connectivity. The pandemic highlighted the need for digital infrastructure improvements to ensure equal educational opportunities for all students. Kazakhstan's experience emphasizes how global educational disruptions due to COVID-19 exacerbated existing inequalities in access to education.

The sudden transition to OL during the pandemic has spurred a substantial body of research, focusing on its impact across various educational contexts globally (Al-Kumaim et al., 2021; Bordoloi et al., 2021; Coman et al., 2020; Kim, 2020; Larmuseau et al., 2019; Tomasik et al., 2020; Vlachos et al., 2021).

This review of the literature synthesizes relevant studies, theories, and findings exploring the dimensions of online learning, with a focus on the experiences and challenges faced by schoolchildren. This review sets the stage for understanding the specific context of Kazakhstan's transition to online education during the pandemic.

Uses and gratifications theory load have been extensively referenced in the online education literature (DeFleur and DeFleur, 2016). The theory is still relevant today, and one key area of focus is how global health crises, such as the COVID-19 pandemic, have altered what people are willing to share about themselves online.

Another approach is to discuss deeper into the crisis or emergency communication concepts that play a crucial role in mitigating risk and managing crises. Crisis and Emergency Risk Communication (CERC), as described by Reynolds and Seeger (2005) for instance, integrates risk and crisis communication, addressing the dynamic nature of crises and the evolving communication needs of different audiences.

This CERC approach aims to extend the timeline for action, enhancing resilience and crisis-coping capacities. During the COVID-19 pandemic, health communication and management became a central focus within CERC, which is used in professional training to support preventive measures and avert health crises.

Research from various countries has highlighted common challenges in OL. Technological access remains a significant barrier, with disparities in internet and device access affecting students disproportionately (MacIntyre et al., 2020; An et al., 2021; Robinson et al., 2023). Furthermore, studies have noted that online learning can exacerbate feelings of isolation and negatively impact mental health (Armstrong-Mensah et al., 2020).

Some research indicates that while online learning can be as effective as traditional formats, this often depends on the discipline, the quality of the material presented, and the level of interaction (Fontenelle-Tereshchuk, 2021; Garbe et al., 2020; Eberle and Hobrecht, 2021). However, there is a consensus that effective OL requires not just replication of face-to-face teaching, but a transformation of pedagogical approaches (Mok et al., 2021; Schwartzman, 2020; Lovrić et al., 2020).

The literature also explores how educational institutions have adapted to OL, highlighting the rapid adoption of various platforms and tools that improve interactivity and accessibility (Ferri et al., 2020; Dhawan, 2020). Several case studies provide information on localized responses and student experiences. For instance, studies from universities in regions similar to Kazakhstan, such as eastern Europe and Central Asia, show that swift governmental and institutional actions played a pivotal role in the transition's success but also revealed significant gaps in readiness and resource distribution (Ahmed and Opoku, 2022; Rapanta et al., 2021; Tabatadze and Chachkhiani, 2021).

The pandemic's effects on educational systems differed based on the socioeconomic, geographic, and technological infrastructure of each nation. The shift was more disruptive in nations with substantial inequality and underdeveloped technology than in those with robust digital infrastructures. Kazakhstan, a Central Asian country with a diverse population and varying levels of technological infrastructure, was no exception (Yelubayeva et al., 2023).

Relating these findings to Kazakhstan, it becomes clear that, while the challenges are not unique, the country's specific socioeconomic and educational landscape shapes the experiences of its students. The insights of global research must be contextualized with Kazakhstan's infrastructure, cultural, and pedagogical specifics to fully understand and improve its educational strategies during crises like the pandemic.

Kazakhstan's socioeconomic diversity, particularly the gap between urban and rural populations, played a pivotal role in the success of online learning initiatives (Toimbek, 2023). This urban-rural divide contributed to a significant digital gap during the pandemic. In urban areas, students had greater access to reliable internet connections, computers, and smartphones, which enabled them to participate more effectively in online learning. In contrast, many students in rural regions faced significant barriers due to poor internet connectivity and a lack of access to digital devices. This discrepancy exacerbated educational inequalities (Mathrani et al., 2023; Zhao et al., 2022).

Throughout the pandemic, Kazakhstan's technological infrastructure—particularly its internet speed and coverage—played a crucial role in determining how effective online learning was. Mobile internet services and broadband were generally accessible in urban

areas. Still, there was a big problem with the quality of internet service in rural areas. Rural areas typically had internet speeds far lower than those advised by online learning platforms like Zoom or Microsoft Teams, which depend on dependable connections for audio and video chat (Burmistrova and Makoelle, 2023).

To address the issue of device shortages, the Kazakh government initiated a large-scale program to distribute tablets and laptops to students from disadvantaged backgrounds. Despite these efforts, the demand for devices exceeded the supply, with many students still lacking the necessary tools to engage in online education effectively.

Kazakhstan's regional disparities in education quality were also highlighted by the shift to online learning. Schools in wealthier, urban regions generally had more resources to support the transition to digital education. Teachers in these areas were more likely to have received training in digital pedagogy and had access to better tools and platforms for online teaching. In contrast, schools in rural areas, particularly in economically disadvantaged regions such as East Kazakhstan and Kyzylorda, struggled with a lack of resources and training (Seilkhan et al., 2022).

Students in rural regions faced not only technological barriers but also issues related to the quality of instruction during online learning (Mustafa et al., 2024). Teachers in rural areas, many of whom had limited experience with digital platforms, were often unprepared for the sudden transition to online teaching. Moreover, the lack of digital materials adapted to the Kazakh language and the specific curriculum needs of rural students further compounded the challenges of providing a high-quality education during the pandemic.

In Kazakhstan, the abrupt transition to online learning revealed gaps in teacher preparedness. The need for digital skills development became apparent as teachers struggled to adapt their teaching methods to virtual classrooms.

Thus, the COVID-19 pandemic exposed Kazakhstan's educational system's strengths and weaknesses, especially with regard to its capacity to modify international educational theories to fit the local environment. To sum up, the transition to OL was a forced and emergency measure; not all schools were ready for this radical restructuring of the educational process. Of course, a stressful situation for all participants cannot help but affect their attitude toward OL. A vision for the role of OL has yet to be developed in Kazakhstan's educational policy. This is due to both the general uncertainty surrounding the pandemic and the perception of OL as a temporary solution.

3 Methods

3.1 Study design

We conducted an online survey study with a quantitative data collection approach to explore students' perspectives on online learning in public schools in Kazakhstan and identify the challenges they faced during OL. This design used an online survey, which was suitable for the study, especially during a pandemic when students are away from educational institutions. Quantitative research methods are always based on clear mathematical and statistical models, which result in accurate quantitative values for the indicators being studied (Foster, 2024). Advantages of the quantitative research method: (1) coverage of a large number of research objects (respondents); (2) possible

anonymity of survey participants (Savela, 2018). The survey of students was carried out using a questionnaire. In this study, in order to fully cover relevant role positions, surveys were conducted among respondents: public school students from various regions of Kazakhstan. This solution made it possible to consider the same problem from different points of view, thereby increasing the objectivity of the conclusions obtained and avoiding one-sidedness and distortion.

Several limitations should be noted. First, as the data were self-reported, there is a potential for response bias, such as recall inaccuracies or social desirability effects. While we assured participants of anonymity to mitigate this risk, these biases remain a concern. Second, the use of convenience sampling may affect the generalizability of the results. Although we included students from diverse regions and backgrounds, the findings may not fully represent the entire population or be directly applicable to other educational contexts. Despite these limitations, the study offers valuable insights into the challenges faced by students during the transition to online learning in Kazakhstan.

3.2 Participants, data collection, and procedure

The study was carried out in regional schools, including all regions of Kazakhstan. Consequently, all regions of Kazakhstan were covered, which confirms the reliability of the study results. This study has a robust sample size ($N=3,670$), which provides a good representation of the experiences of Kazakhstan's high school students, and the sample is geographically and demographically diverse. Average age was 13.8 ± 1.62 . The survey was conducted in May–June 2021. Data were collected using an online questionnaire. Researchers asked schoolchildren, teachers, and school principals to distribute a link to a web-based survey to their friends, classmates, and colleagues using multiple tools (e.g., email, Moodle, and WhatsApp), inviting active participation in the online survey. Data were collected over a three-week period following students' online learning experiences, where learning occurred through both asynchronous and synchronous tools, including Moodle and Microsoft Team, respectively.

While convenience sampling was necessary due to the logistical challenges posed by the COVID-19 pandemic, we acknowledge that this method may introduce potential biases. Specifically, students with better internet access or greater engagement in online learning may be overrepresented, while those facing more significant barriers might be underrepresented. To mitigate this, we made an effort to include students from diverse regions across Kazakhstan, including both urban and rural areas. Additionally, subgroup analyses were conducted to compare the experiences of different demographic groups, such as urban versus rural students, which allowed us to account for some of the potential biases in the sample. Although not fully representative, the inclusion of a wide geographical spread and the focus on regional differences helped to reduce the impact of these biases on our findings.

3.3 Study measures

The study employed a structured questionnaire designed to assess the experiences and perspectives of secondary school students in Kazakhstan regarding OL during the COVID-19 pandemic. The

questionnaire was developed to capture a broad range of variables, from demographic information to detailed insights into the student's academic and social experiences during this period. The survey consisted of 21 items covering the following areas:

- **Demographic Information:** Students were asked about their gender, age, the number of children in their family enrolled in school, their living area (city or rural), type of school attended (general education, gymnasium, lyceum, specialized, or boarding school), grade level, and household size.
- **Satisfaction and Difficulty Levels:** Two items asked students to rate on an 11-point scale of 0–10 their overall satisfaction with their education and with online learning specifically during the pandemic. Another item asked them to rate the difficulty of studying online using a similar scale.
- **Perceptions of Online Learning:** Students were queried about their agreement with the statement that online learning is an effective method of education, using a five-point Likert-type scale ranging from “completely disagree” to “absolutely agree.”
- **Communication Challenges:** Questions explored difficulties students faced in communicating with teachers, classmates, and parents during the OL period. Students could select “Yes,” “No,” or “Unsure” in response to these questions; however, only “Yes” and “No” responses were included in the subsequent regression analysis to ensure clarity and consistency in the results.
- **Changes in Academic Performance, Preferences, and Motivation:** Students were asked how their academic performance changed with the shift to OL, with the response options “Not changed,” “Improved,” or “Deteriorated.” Preferences for continuing with online learning were assessed by asking, “If you were offered to continue your studies in an online format, would you agree?” with the response options “Yes,” “No,” or “Unsure.” Changes in motivation for learning were measured using the options “Didn't change,” “Increased,” or “Decreased.”
- **Concerns about the Future:** Students were asked, “Are you worried that online learning will negatively affect your future?” with the response options “Yes,” “No,” and “Difficult to answer.”

Data validation was ensured by cross-referencing responses to check for inconsistencies in students' demographic information and other answers. This helped confirm the accuracy and reliability of the data collected. For instance, students' demographic responses were cross-verified with their reported school grades and other background details. This method ensured that any anomalies in responses were identified and addressed before data analysis.

3.4 Data analysis

The initial analysis involved descriptive statistics to summarize the demographic characteristics and responses of the study participants. Measures of central tendency (mean) and dispersion (standard deviation) were calculated for continuous variables, and frequencies and percentages were used for categorical variables. To compare means across two or more groups, we used the independent t-test and one-way ANOVA. Where ANOVA showed significant

results, post-hoc tests were conducted to identify specific group differences. Pearson and Spearman correlation coefficients and chi-square test were calculated to explore the relationships between variables. Linear and ordinal regression models were constructed to identify predictors of students' preference for OL and their satisfaction with their educational experience during the pandemic. All analyses were performed using Jamovi software, and significance was set at $p < 0.05$.

3.5 Ethics approval and informed consent

This study was conducted in accordance with the ethical standards set forth by the Ethical Committee of the Academic Council at Abai Kazakh National Pedagogical University, Kazakhstan. Ethics approval was granted on 14 October 2021 (Ref. No. 4). All participants were informed about the purpose of the study and their role as respondents. Informed consent was obtained from all participants prior to their inclusion in the study. Since the participants were secondary school students, additional parental consent was sought where applicable, in accordance with national and institutional guidelines. Participants were assured that their responses would remain anonymous and confidential, and that their participation was entirely voluntary with the option to withdraw at any time without any consequences.

4 Results

The study surveyed a total of 3,670 secondary school students from various regions of Kazakhstan. The majority of the participants were female (59.9%, $n = 2,200$), while males constituted 40.1% ($n = 1,470$) of the respondents. The distribution of participants across different regions varied significantly, with the highest representation from the Capital City—Astana (51.7%, $n = 1896$), followed by West (25.2%, $n = 925$), and North (16.5%, $n = 604$) regions. The other regions, including Almaty City, Central, East, and South, had minimal representation, all combining for less than 7% of the total sample. The average age was 13.8 ± 1.62 . Participants varied widely in their year of study with the majority in the 7–8th grades (42.8%), followed by 6th grade (25.5%), 9th grade (14.5%), 10th grade (11.4%), and 11–12th grades (5.8%). The sociodemographic characteristics of the study population are presented in Table 1.

A majority of students resided in urban areas (57.6%), compared to 42.4% who lived in rural locations. Regarding the type of school, 44.5% attended comprehensive schools, 28.0% were in gymnasium schools, and 26.2% went to lyceum schools. Schools for gifted children and boarding schools had very low representation, making up only 1.4% of the sample combined.

Regarding household composition concerning school-children, 36.3% of the participants had two school-children in their homes, while 29.6% were the only child. Families with three to five school-children represented 32.1%, and a smaller fraction (2%) had six or more school-children. Family size was predominantly in the range of 4–6 persons (62%), with 22.0% having more than seven persons and 16.0% having 2–3 persons per household.

TABLE 1 Sociodemographic characteristics of the study population (N = 3,670) and levels of satisfaction with education in general, with OL, and level of difficulty in OL.

Variable		n	%	Level of satisfaction with education in general (R ² = 0.056, p < 0.001)		Level of satisfaction with OL during the COVID-19 (R ² = 0.023, p < 0.001)		Level of difficulty in OL (R ² = 0.016, p < 0.001)	
				(M ± SD)	β	(M ± SD)	β	(M ± SD)	β
Gender	Female	2,200	59.9	6.98 ± 2.41	ref	5.35 ± 3.10	ref	5.02 ± 3.07	ref
	Male	1,470	40.1	6.91 ± 2.47	-0.02	5.16 ± 3.35	-0.07*	4.98 ± 3.15	-0.004
Region	Astana city	1,896	51.7	6.51 ± 2.49	ref	5.30 ± 3.16	ref	4.89 ± 3.03	Ref
	Almaty city	12	0.3	7.17 ± 2.89	0.28	5.25 ± 3.22	0.06	5.17 ± 3.71	0.06
	NK (North RK)	604	16.5	7.46 ± 2.31	0.32**	5.77 ± 3.25	0.30**	4.60 ± 3.09	-0.14*
	CK (Central RK)	25	0.7	6.28 ± 2.34	-0.07	5.40 ± 3.14	0.19	4.68 ± 2.15	-0.11
	EK (East RK)	165	4.5	7.44 ± 2.14	0.32**	5.57 ± 3.04	0.14	5.07 ± 3.09	0.06
	SK (South RK)	43	1.2	6.98 ± 2.54	0.11	4.14 ± 2.80	-0.25	5.63 ± 3.65	0.20
	WK (West RK)	925	25.2	7.45 ± 2.26	0.28**	4.89 ± 3.25	0.03	5.48 ± 3.19	0.12
Number of school-children at home	1 (only me)	1,085	29.6	6.81 ± 2.40	ref	5.35 ± 3.17	ref	4.86 ± 3.09	Ref
	2	1,331	36.3	6.93 ± 2.38	0.01	5.38 ± 3.14	0.02	4.95 ± 3.04	0.02
	3-5	1,179	32.1	7.13 ± 2.50	0.06	5.12 ± 3.29	-0.03	5.17 ± 3.17	0.04
	≥6	75	2.0	6.71 ± 2.87	-0.17	4.67 ± 3.33	-0.17	5.37 ± 3.22	0.11
Residence	Urban area	2,113	57.6	6.60 ± 2.46	ref	5.37 ± 3.18	ref	4.88 ± 3.05	ref
	Rural area	1,557	42.4	7.43 ± 2.29	0.11	5.14 ± 3.23	-0.06	5.17 ± 3.17	0.003
School type	Comprehensive school (CS)	1,632	44.5	7.30 ± 2.35	ref	5.16 ± 3.29	ref	5.11 ± 3.19	ref
	Gymnasium school (GS)	1,026	28.0	6.57 ± 2.46	-0.02	5.41 ± 3.18	0.10	4.86 ± 3.06	-0.03
	Lyceum school (LS)	961	26.2	6.82 ± 2.46	-0.03	4.33 ± 3.06	-0.10*	4.97 ± 3.01	-0.05
	School for gifted children (SG)	29	0.8	5.86 ± 2.40	-0.28	5.76 ± 3.28	0.26	4.93 ± 2.55	-0.03
	Boarding school (BS)	22	0.6	6.77 ± 2.88	-0.09	4.23 ± 3.37	-0.23	5.09 ± 3.58	-0.04
Year of study	6	937	25.5	7.32 ± 2.43	ref	5.47 ± 3.22	ref	4.81 ± 3.08	ref
	7-8	1,570	42.8	6.87 ± 2.39	-0.19**	5.43 ± 3.13	-0.01	5.00 ± 3.02	0.05
	9	532	14.5	7.00 ± 2.45	-0.20**	4.98 ± 3.32	-0.14*	5.36 ± 3.25	0.16*
	10	417	11.4	6.69 ± 2.43	-0.35**	4.94 ± 3.17	-0.15*	5.05 ± 3.06	0.05
	11-12	214	5.8	6.34 ± 2.56	-0.43**	4.66 ± 3.25	-0.29**	4.91 ± 3.36	0.05
Family size (n of family members)	2-3 (small)	587	16.0	6.58 ± 2.52	ref	5.48 ± 3.13	ref	4.78 ± 3.14	ref
	4-6 (middle)	2,277	62.0	6.95 ± 2.38	0.08	5.34 ± 3.18	-0.02	4.90 ± 3.07	-0.001
	≥7 (big)	806	22.0	7.23 ± 2.49	0.18	4.95 ± 3.31	-0.08	5.46 ± 3.15	0.12

*p < 0.05; **p < 0.001.

4.1 Learning satisfaction and difficulty levels

Table 1 shows the responses of 3,670 secondary school students regarding their satisfaction with education in general and online learning (OL) during the COVID-19 pandemic, as well as the difficulty experienced during OL. The average level of satisfaction with education in general was 6.95 ± 2.44, the level of satisfaction with OL during the COVID-19—5.27 ± 3.29, and 5.00 ± 3.10 for the level of difficulty in OL. Satisfaction with OL was positively correlated with satisfaction with education in general (r=0.364, p<0.001) and negatively correlated with level of difficulty in OL (r=-0.358, p<0.001); moreover, the level of difficulty in OL was negatively

correlated with satisfaction with education in general (r=-0.130, p<0.001).

The linear regression analysis was conducted to evaluate demographic factors influencing the level of satisfaction with general education, satisfaction with OL during the COVID-19 pandemic, and the level of difficulty experienced in OL among secondary school students in Kazakhstan.

The model of satisfaction with education in general explained 5.6% of the variance. Gender, number of school-children at home, school type, and family size showed no significant associations with satisfaction levels. Students from north, east, and west regions showed significantly higher levels of satisfaction. The year of study was negatively associated with education satisfaction. At the same time,

the level of satisfaction with education in general was positively correlated with family size ($\rho=0.085$, $p<0.001$) and number of school-children at home ($\rho=0.060$, $p<0.001$).

The model of level of satisfaction with OL during COVID-19 explained 2.3% of the variance. Males reported slightly lower satisfaction with OL compared to females. Moreover, region, school type, and year of study were significant predictors of satisfaction with OL. While other factors did not have significant relationships. However, satisfaction with online learning had a negative correlation with the number of school children in the family ($\rho=-0.033$, $p=0.046$) and the size of the family as a whole ($\rho=-0.052$, $p=0.002$).

The model for the level of difficulty in OL accounted for 1.6% of the variance. Significant predictors were region and year of study. At the same time, the level of difficulty in OL was positively correlated with the number of school children in the family ($\rho=0.010$, $p=0.046$) and the family size ($\rho=0.072$, $p<0.001$).

Despite the fact that regression analysis did not reveal an association between place of residence and satisfaction and severity of learning, the t-test revealed that: rural schoolchildren were more satisfied with learning in general ($t=10.43$, $p<0.001$), but less satisfied with online learning at the time of the pandemic ($t=2.20$, $p=0.028$), moreover, the average severity of online learning was higher among rural schoolchildren in contrast to urban ones ($t=2.81$, $p=0.005$).

4.2 Perceptions of online learning

Among the study participants, 914 (24.9%) agreed that the OL format is a good way of learning, whereas 1,621 (44.2%) disagreed with this statement. The level of agreement that OL format is a good way of learning was positively correlated with satisfaction with their education ($r=0.132$, $p<0.001$) and with OL during the pandemic ($r=0.547$, $p<0.001$), and negatively correlated with the level of difficulty of studying online ($r=-0.338$, $p<0.001$). Rural schoolchildren more often noted that they disagree with this statement, unlike urban ones (48.0% vs. 41.3%, respectively, $\chi^2=22.0$, $p<0.001$). Moreover, the level of agreement with the statement that the online format is a good way of learning had a weak-negative but reliable correlation with the year of study ($r=-0.060$, $p<0.001$), the family size ($r=-0.045$, $p=0.007$) and the number of schoolchildren in their family ($r=-0.034$, $p=0.042$).

4.3 Communication challenges

More than 40% of respondents ($n=1,604$, 43.7%) felt the need for live face-to-face communication with a teacher during OL. Female participants were more likely to note this need compared to males (46.6% vs. 39.4%, respectively, $\chi^2=23.3$, $p<0.001$). Rural schoolchildren also noted this more often in comparison with urban ones (51.4% vs. 38.0%, respectively, $\chi^2=93.9$, $p<0.001$). Higher school students ($\rho=0.057$, $p=0.003$) and those from bigger families ($\rho=0.065$, $p<0.001$) more often felt the need for live communication during the period of OL. Moreover, study participants who felt the need for live communication with a teacher during OL had lower rates of satisfaction with OL during the pandemic (5.03 ± 3.13 vs. 5.56 ± 3.35 , $t=4.34$, $p<0.001$) and higher rates of the difficulties of OL (5.32 ± 3.09

vs. 4.51 ± 3.16 , $t=6.77$, $p<0.001$) compared to those who did not experience this need.

Less than one-fifth of respondents (17.7%) indicated that they had difficulty communicating with their parents during the online learning period. Female students (19.0%) more often felt communication difficulties with parents compared to males (15.7%), $\chi^2=93.9$, $p<0.001$. This difficulties were associated with grade ($\rho=0.057$, $p=0.003$), family size ($\rho=0.065$, $p<0.001$), and number of schoolchildren at home ($\rho=0.043$, $p=0.023$). Moreover, such students were less satisfied with OL (4.07 ± 3.29 vs. 5.59 ± 3.12 , $t=11.1$, $p<0.001$) and experienced the severity of such a learning format (6.28 ± 3.11 vs. 4.65 ± 3.04 , $t=12.3$, $p<0.001$) more than those who did not experience such difficulties.

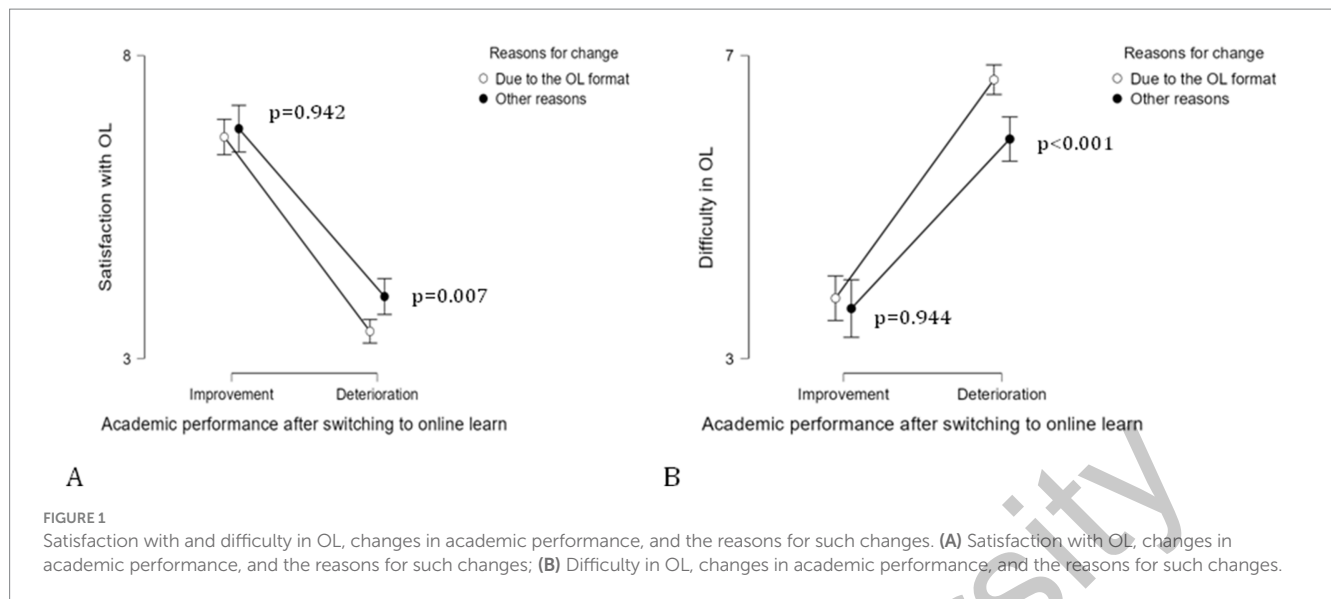
4.4 Changes in academic performance and motivation

The respondents were asked: “Do you think the learning outcomes (your knowledge) when using online learning are better or worse than with the usual method of learning?” Most of the respondents (40.8%) indicated that learning outcomes have become worse with the online learning format, 36.4% replied that they have not changed, and 14.9% indicated improvement in knowledge. At the same time, urban schoolchildren (44.6%) more often than rural schoolchildren (35.5%) indicated deterioration ($\chi^2=41.8$, $p<0.001$).

The respondents answered the question “How has your academic performance changed after switching to online learning?” About half of the respondents (48.7%) indicated that academic performance has not changed, however, 34.1% indicated deterioration, and only 17.2% replied that they began to study better. Most often, students in grades 9 (38.2%) showed deterioration in academic performance, and to a lesser extent it was among 6th-graders (30.9%). Then we clarified whether these changes were related to the transition to OL or whether there were other reasons according to the respondent students (Table 2). Students who showed deterioration in academic performance had a lower level of satisfaction with OL compared to those who indicated improvement (3.64 ± 2.94 vs. 6.71 ± 2.97 , respectively, $t=21.3$, $p<0.001$). Regardless of the changes in academic performance, about two-thirds of respondents attributed these changes to the transition to an OL format. Moreover, among those who noted an improvement in academic performance, the level of satisfaction with online learning did not differ from the reason for such a change; whereas, among those students who indicated deterioration in academic performance, the level of satisfaction with online learning was significantly lower due to the transition to an online format than for other reasons (Figure 1A). Conversely, among those who indicated deterioration in academic performance, the level

TABLE 2 Changes in academic performance after switching to an online format.

Changes in academic performance after switching to OL	Reasons for change	
	Due to the OL format	Other reasons
Improvement	399 (63.1%)	233 (36.9%)
Deterioration	839 (67.0%)	413 (33.0%)



of difficulty with the online format was higher among those who associated this deterioration with the online format (Figure 1B).

Slightly more than half (51.2) of the respondents indicated that their level of academic motivation did not change after switching to OL, 32.0% indicated a decrease, and only 16.8% of schoolchildren replied that their level of academic motivation increased after switching to the online format. The level of satisfaction with education in general ($\rho=0.217$, $p<0.001$), satisfaction with OL during the pandemic ($\rho=0.331$, $p<0.001$), and the level of difficulty during OL ($\rho=-0.282$, $p<0.001$) differed significantly depending on changes in academic motivation (from less to more motivated).

4.5 Concerns about the future and preference for OL

To the question “Are you worried that online learning will negatively affect your future?” the respondents answered as follows: 33.2%—yes, 48.0%—no, 18.8%—indicated that they found it difficult to answer. To the question “If you were offered to continue your studies in an online format, would you agree?” respondents answered as follows: 54.4%—no, 25.8%—yes, 19.8%—indicated that they were unsure of the answer. Predictors of preference for OL are presented in Table 3.

The regression analysis identified several significant predictors influencing students’ preference for OL. Older students were less favorable toward online learning. Higher satisfaction with general education was associated with a lower preference for OL. In contrast, higher satisfaction with online learning experiences significantly increased the preference for OL. Moreover, Greater difficulty experienced during OL was associated with a lower preference for it.

Students who reported improvement in academic performance after switching to OL showed a significantly higher preference for OL compared to those who experienced deterioration. Increased motivation after switching to OL was significantly associated with a higher preference for OL. A preference for live face-to-face communication significantly reduced the preference for OL. Students

expressing concerns about the future impact of online learning on their education significantly preferred face-to-face learning. These findings suggest the complexity of educational preferences influenced by diverse experiences and expectations from the educational system during the pandemic.

5 Discussion

This study aimed to collect data on the attitude of Kazakhstani schoolchildren toward OL in secondary schools in Kazakhstan and identify the problems they encountered during OL. The results of this study confirmed that the real experience of organizing the OL process for Kazakhstani schoolchildren is not enough effective and is, indeed, a problem from the point of view of the regulatory framework, infrastructure and methodological preparation. These findings are confirmed by previous studies (Basar et al., 2021; Mushtaque et al., 2021; Selvaraj et al., 2021). The findings of the study Butnaru et al. (2021), in particular, demonstrate the significant effects on social and educational levels of Romanian school closures in response to the pandemic. Without the benefit of advance planning or official directives, educators and families were forced to adapt quickly to the new teaching and learning environment. In this regard, certain schools performed better than others in terms of adapting to the new environment. Likewise, children from different backgrounds have varying opportunities to learn due to the composition and size of the economic, social and cultural capital of families. One of the conclusions of a study by Mastour et al. (2023) is that, while not all students gain equally, online learning mechanisms seem to be a useful way to substitute in-person instruction, at least in an emergency. Concerns have been raised about the impact on student learning as a result of the pandemic-related suspension of in-person instruction in schools, according to Blackwell et al. (2024) and Guariso and Björkman Nyqvist (2023). The findings highlight a number of educational, technological and social issues. The primary causes of technological difficulties are the erratic nature of Internet connections and the lack of essential electronic devices among many students (Xia et al., 2022; Barrot et al., 2021).

TABLE 3 Predictors of preference for OL.

Predictor	Estimate	<i>p</i>
Gender		
Male–Female	–0.0287	0.745
Grade	–0.1343	<0.001
Residence		
Rural–Urban	–0.4268	0.777
Satisfaction with education	–0.153	<0.001
Satisfaction with OL	0.2266	<0.001
Difficulty in OL	–0.0809	<0.001
Changes in academic performance after switching to OL		
No changes–Deterioration	0.3379	0.006
Improvement–Deterioration	0.4132	0.009
Reasons for changes		
Duo to OL–other reasons	–0.1964	0.023
Academic motivation after switching to OL		
No change–less motivated	0.214	0.06
More–less motivated	0.6412	<0.001
Academic performance after switching to OL		
Better–Worse	0.4927	0.001
No change–Worse	0.3598	0.003
Not sure–Worse	0.6398	<0.001
Need for live face-to-face communication (Yes–No)	–0.5615	<0.001
Difficulty communicating with parents (Yes–No)	0.128	0.292
Concerns about the future		
Yes–No	0.7689	<0.001
Unsure–No	0.7246	<0.001

We noticed that some similar problems of schoolchildren in Kazakhstan were also identified in the results of researchers from other countries, for example, [Almaiah et al. \(2020\)](#), [Day et al. \(2021\)](#), [Annamalai \(2021\)](#) and [Kapasias et al. \(2020\)](#). One possible explanation is that in the last few years, Kazakhstan has been transitioning from the “industrial” model of education to a new model based on a competency-based approach to learning. As part of this transition, the state educational standards were updated and a new curriculum (known as “renovation”) was developed. Despite the fact that active transformation of educational policy began in 2016, by the time quarantine was implemented, the secondary education system had fallen far behind modern trends. Experts point out that Kazakhstan has been slow to adopt online learning ([Hetrick, 2019](#); [Hajar and Manan, 2023](#)). The global situation indicated that the education sector would undergo significant changes, primarily as a result of large-scale digitalization and the spread of new technologies. As a result, Kazakhstan needed to adapt to new conditions and gradually implement online learning formats. However, the country’s education system proved to be overly conservative and slow. As a result, online learning, with its widespread implementation, became exotic for Kazakh students and teachers.

Compared to rural students, we found that urban children believe that the online format is an effective way to learn. Schoolchildren in rural areas had a greater need for live communication with their teachers than children in cities. Most students believe that online learning produces poorer learning outcomes (knowledge) than traditional methods of learning. These findings are consistent with research ([Csonka-Stambekova, 2024](#)). We have found that one of the most serious problems is the level of learning decline among students from low-income families or remote rural areas who do not have a computer, Internet access or often parental support. This fact is a new obstacle to successful learning. The study by [Azevedo et al. \(2021\)](#) and [Onyeaka et al. \(2021\)](#) found that the pandemic had a negative impact on education for over 90% of students worldwide. In addition, there was worsening nutrition, increased mental health disorders, a lack of physical activity, and other detrimental outcomes for school-age children and adolescents. Even before online learning, there was concern about the disparity in educational quality between urban and rural students in Kazakhstan. According to PISA, rural students had lower levels of knowledge than urban students ([Sarmurzin et al., 2021](#)). However, during quarantine, this gap has widened. 75% of all Kazakhstan schools are located in rural areas, implying that only 25%

of schools have better conditions than the teachers and students in the village. Fewer lessons were delivered through Zoom, Google Classroom, Moodle, and Microsoft Teams in rural areas. At the most, WhatsApp Messenger was used during the learning process.

The findings reveal that more than 40% of students expressed a need for live (face-to-face) interaction with teachers during OL, with this need being more pronounced among females, rural students, older students, and those from larger families. This need was strongly associated with lower levels of satisfaction and greater difficulties in online learning, suggesting that the lack of direct interaction may hinder student engagement, motivation, and academic success (Wallace, 2023). Educational systems must address this gap by exploring how live communication can be better integrated into online learning models.

To accommodate the need for live interaction, educational institutions should consider increasing the frequency of interactive sessions, such as live video calls and virtual office hours, where students can directly engage with their teachers. Moreover, leveraging digital tools like interactive polls, breakout rooms, and chat features can foster greater student participation and engagement. Teachers should also be trained on how to effectively use these tools to create a more dynamic and interactive learning environment. For students in rural areas, where internet access may be limited, additional support in the form of one-on-one virtual tutoring or recorded lessons could help mitigate some of the challenges posed by online learning. Ensuring that these strategies are integrated into online education models will not only improve student satisfaction but also enhance overall learning outcomes.

Therefore, schoolchildren in Kazakhstan have had a mixed experience transitioning to OL during the pandemic. Although it posed significant challenges in terms of access to technology and engagement, it also promoted adaptability and skill development. The findings suggest that educational institutions should consider blended learning approaches after the pandemic, which combine the benefits of online and traditional education. These insights contribute to understanding the impacts of sudden educational changes and inform future preparedness for online education in Kazakhstan and similar contexts.

6 Limitations and future direction

It is acknowledged that this study has limitations. Due to the restrictions of the current quarantine, an online survey was used. This imposed its characteristics on the communication with study participants: the lack of direct communication could affect the responses of study participants and limit the opportunities for a more detailed and in-depth conversation. The data were self-reported, there is a potential for response bias, such as recall inaccuracies or social desirability effects, where students may not have felt entirely comfortable reporting negative experiences. While we assured participants of anonymity to mitigate this risk, self-censorship may still have occurred. Furthermore, data were collected from only one type of respondent, that is, schoolchildren. In the future, we would like to explore the opinions of teachers and parents to obtain more generalizable results. We cannot exclude the factors of sensitive issues and possible self-censorship of the teaching community, especially

school leaders who are not accustomed to presenting the problems of secondary education to the general public. Additionally, the use of convenience sampling limits the generalizability of the findings. However, despite these limitations, the absence of this kind of research would have left critical gaps in understanding how online learning affected students in Kazakhstan, particularly in terms of regional disparities and the need for live interaction during online learning.

Had this research not been conducted, policymakers and educators would have lacked evidence-based insights into the unique challenges faced by rural students, females, and those from larger families in transitioning to online learning. The absence of such data would have made it more difficult to design targeted interventions or implement strategies to support the most vulnerable students. Furthermore, without this study, the importance of live communication in improving student satisfaction and reducing learning difficulties during online education might have remained underexplored. This research helps address these gaps, providing a foundation for future educational reforms in Kazakhstan and similar contexts.

This study can also be extended or reproduced: (1) identification of psychological and pedagogical effects caused by the transformation of secondary education in the digital era and identification of priority areas of psychological and pedagogical support for students in OL; (2) potential application of the results of the study of transformations of the subject of education for the preparation of methodological developments, teaching aids, and other educational materials for organizing the educational process in OL conditions; (3) in the future it is necessary to study the key barriers that limit the widespread introduction of digital technologies in education.

7 Conclusion

This study demonstrates that Kazakhstani schoolchildren face a variety of challenges in organizing the OL process in secondary school due to flaws in the regulatory framework, infrastructure, and methodological planning. Issues with OL during the pandemic have had a negative impact on students, as a result of the unequal access of Kazakhstani schoolchildren to education, which violates the guarantee of equality and justice.

The contribution of the study to this problem is that the number of Kazakhstani studies on the obstacles and problems faced by Kazakhstani schoolchildren is very limited compared to the studies of scientists from around the world. Finally, the study complements the existing literature on the current and future impact of the transition of the educational process to a remote mode on the educational outcomes of students by examining the views of Kazakhstani schoolchildren on OL during the pandemic and the main problems they face. This will help better understand the problems faced by Central Asian countries and propose measures to improve OL in Kazakhstan.

To address the identified inequalities in online learning, policymakers should prioritize expanding internet infrastructure in rural and underserved regions to ensure equitable access to online education. Additionally, programs that provide students, particularly those from low-income families, with digital devices such as laptops

and tablets should be scaled up. Teacher training in digital pedagogy is also essential, equipping educators with the skills and resources needed to engage students effectively in a digital environment. Implementing hybrid learning models that combine online and in-person teaching can further bridge the gap, offering flexibility while ensuring students in areas with limited digital access are not left behind.

The findings from this study directly inform the broader digital transformation of education in Kazakhstan by highlighting key areas that need improvement. In regions facing technological limitations, addressing infrastructure gaps and providing equitable access to digital tools is essential for the success of OL initiatives. Furthermore, these findings can guide similar countries or regions with unequal educational access, where investment in both digital infrastructure and teacher training can significantly improve learning outcomes.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by The Ethical Committee of the Academic Council, Abai Kazakh National Pedagogical University, Kazakhstan. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin.

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Author contributions

SN: Conceptualization, Data curation, Writing – original draft. AB: Conceptualization, Methodology, Writing – original draft. SA: Conceptualization, Software, Writing – review & editing. SZ: Validation, Visualization, Writing – review & editing. BK: Formal analysis, Supervision, Validation, Writing – review & editing. UK: Resources, Validation, Writing – review & editing.

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