

Online educational platforms as a tool for increasing the accessibility of higher education

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ABSTRACT

The study examines the role of online educational platforms in enhancing access to higher education, as well as the benefits and challenges they present in Kazakhstan. The study employed a mixed-methods approach design (systematic literature review and a quantitative survey). A sample of 20 literature materials and 20 undergraduate students was carefully chosen using the purposive sampling procedure. Data was collected using multiple studies and an online survey. Synthesis method and descriptive statistics were used to analyze the data. The results show that the advantages of online learning platforms include increased motivation and involvement, flexibility, autonomous learning, equal access to education, instructional innovation, and enhanced engagement. However, there are limitations, such as a deficiency of engagement, social and rural disparities, and the absence of institutional technical assistance. The results also showed that e-learning improves academic access and success for both regions, but to a greater extent for urban students (mean = 4.42) than for rural students (mean = 4.16). The perceived barriers for urban students include poor internet connectivity, financial constraints, and language barriers, while rural students perceive barriers such as language, limited access to devices, and inadequate technological infrastructure. The study concluded that online learning platforms enhance access to higher education in Kazakhstan.

Keywords: E-learning, Technology innovation, Inclusive education, Rural-urban divide, Kazakhstan

1. Introduction

In the last few years, information communication technologies (ICT), including digital ones, have brought major transformation in many fields, especially in health [1] and educational sector [2]. Educational systems around the world are actively using modern digital solutions and innovative strategies for learning, among such approach is online education, a crucial component of creative instruction. Modern educational transformations worldwide are setting new demands on higher education, positioning it as a key factor in shaping a nation's development and its role in the global arena [2]. According to Ref. [3], several researchers have highlighted the advantages of employing various digital platforms and learning resources [3]. This approach provides flexibility and improves education quality in the learning process [4]. Furthermore, opportunities to gain new skills while working are provided by e-learning and require a great deal of independence, time management, and self-evaluation [5], [6]. Online education employs several methods to deliver educational content and streamline the learning process [7]. Such methods include collaborative multimedia, internet-based courses, virtual classrooms, and educational software available for students from all over the world to access educational

resources [8]. Geographical, economic, and cultural hindrances have now been eliminated due to their adaptability, affordability, and accessibility to learning opportunities previously unattainable [9, 10]. As a result of online education, online courses are now available to students worldwide, with many being free or inexpensive. In addition to students' individualized education, working professionals who require flexibility also benefit, to improve their employability without requiring long-term dedication or full-time study, and lifelong learners [11, 12]. In addition, educational institutions using these platforms can reach a larger audience without the constraints of the physical classroom. Furthermore, the global COVID-19 epidemic has made e-learning grow in significance for students' learning continuity due to the absence of in-person meetings [13]. The pandemic also acted as a shock impact on higher education, compelling institutions to rethink their role, highlighting the importance of integrating innovative teaching practices and management approaches to meet the changing requirements and adaptability within universities [14]. Different online educational platforms have facilitated recent global expansion. These platforms take into consideration the needs of different audiences and geographical locations. More so, they offer courses and programs in multiple fields and languages [15]. To offer accredited online courses and degrees, these platforms also collaborate with top institutions and businesses around the world. These developments are being influenced by some of the most well-known online learning platforms, including Coursera, edX, and Khan Academy. Coursera online education platform started in 2012 and has more than 120 million followers presently. To date, they have been used by over 275 educational institutions and organizations that offer career-oriented programs and professional certifications [12]. Similarly, edX, established by Harvard and MIT in the same year, provides university-level courses and comprehensive degree offerings. Following its merger with 2U Inc. in 2021, edX has maintained its reputation as a pivotal platform for open education, particularly recognized for its Professional Certificate and MicroMasters programs that facilitate additional training and qualifications in specific fields [14]. Furthermore, in contrast to Coursera and edX, Khan Academy focuses on elementary through high school. free, excellent instructional content (videos and applications) and practice problems in subjects like science, math, and history. These e-learning platforms make learning inclusive, accessible, flexible, and responsive to learners' needs. In the last few years, Kazakhstan's educational system has undergone noteworthy restructuring, incorporating modern competitive and digital education needs. Physical evidence demonstrates the disparity in educational infrastructures for rural and urban institutions in Kazakhstan, notwithstanding the government's efforts to ensure that everyone has a comparable opportunity to receive education. Kazakhstan's rural-urban divide obstructs fair academic success and continues to be a crucial policy concern, with evidence shown in reports and data [16, 17]. This gap occurs because of geographical factors like the rural-urban divide and socioeconomic issues like poverty [18], [19]. The combination of these factors creates unequal opportunities for students across the country, leading to differential access to higher education [20], [21], [22]. According to ref. [23], some urban areas such as Almaty, Astana, Shymkent, and Karaganda have concentrated higher institutions with different academic programs and modern infrastructure, making them the focus of higher education for students. However, the condition is different for rural areas that lack nearby higher institutions, where students who pursue, higher education are forced to either relocate or give up on their career due to low socio-economic background and social inequities in the educational system of Kazakhstan [22]. Furthermore, there are regional disparities in access to students' loans, scholarships, and other forms of educational funding and resources. This negatively influences students' standardized test performance, reducing their chances of higher education accessibility compared to their urban peers. Rural areas' disparities in educational facilities and resources in Kazakhstan need to be given important consideration. Hence, the need to evaluate how well online learning environments can function as an inclusive and long-lasting means of increasing access to higher education. The way these e-learning platforms increase access to higher education in Kazakhstan can be fully understood using a mixed approach (a systematic review from the literature and a survey from students' perspectives). Even though existing sources have demonstrated the groundbreaking possibilities of platforms such as Coursera, edX, and Khan Academy, literature on how these platforms function within Kazakhstan's unique educational and regional disparities is not sufficiently represented.

The systematic literature review helps to map out current knowledge across the globe, identify patterns, trends, and gaps in existing research to produce objective and evidence-based findings on how online platforms are used to increase educational access [24]. However, a systematic review cannot capture the perspective of students, especially those from rural regions. Furthermore, the primary data of students' experience through the survey also provides information necessary to understand how students interact with online education platforms, how often they access them, what challenges they encounter, and how these platforms support their educational goals. Through the systematic review, the study seeks to bridge the gap on the use of online education platforms based on research in other parts of Asia or Europe, without taking into consideration the regional contexts of Kazakhstan. Also, despite several studies on the general effectiveness of these e-learning platforms, fewer studies are focused on their impact on students' educational equality and accessibility in rural areas. Moreover, empirical data from students' perspectives is necessary to know if these online platforms meet their individual educational needs, irrespective of their locality in Kazakhstan.

The study seeks to explore how online education platforms influence access to higher education in Kazakhstan through theoretical and empirical evidence. Based on these facts, the study raised the following questions:

1. Based on the literature review, what are digital platforms' advantages and hindrances in terms of expanding access to higher education?
2. How do university students in Kazakhstan utilize online education platforms, and how do they perceive their impact on academic access and success?
3. What barriers do students in different regions of Kazakhstan face when using online platforms for higher education?

1.1. Literature review

1.1.1. Global perspectives on online education and higher instruction accessibility

E-learning is the dissemination of instructional materials via technology or online platforms [25]. Additionally, described an approach where instructors and learners communicate online [26]. Students can access the course materials, take part in discussions, and do assignments from any location with this type of learning, which is related to several formats such as webinars, online courses, and digital simulations. One way to give instructions is by using virtual settings that make use of digital tools and platforms [27]. The evidence demonstrates that e-learning is flexible since it accommodates various learning schedules and styles, allowing students to study at their own speed [28].

Globally, there has been the introduction of online learning options known as Open-access online courses (OAOCs) or Massively Open Online Courses (MOOCs) [29]. OAOCs and online certification programs have been recognized as a transformative force in facilitating university education accessibility due to their creation of flexible classroom settings that meet diverse learners' requirements. According to Moral and Villarente, digital platforms, such as learning management systems (LMS), mobile applications, and interactive multimedia, have enhanced the delivery and engagement of online education at higher institutions [30]. Numerous institutions provide MOOCs through online resources such as Coursera, edX, and FutureLearn, which together comprise 91 institutions, while other institutions are also investigating the potential of these initiatives. Zawacki-Richter et al. affirmed that the e-learning resources of Coursera, edX, FutureLearn, and Khan Academy have given millions of learners worldwide access to University-level content at little or no fee [31].

These E-learning platforms provide online degree programs, professional certificates, competency-based credentials, and more academic materials for students in various locations. According to several studies, MOOCs have greatly increased access to higher education for non-traditional learners, such as working adults and people from underdeveloped or remote areas [29], [32], [33].

Nevertheless, certain obstacles prevent MOOCs from being used to their full potential to access higher education levels, even with their global reach. According to studies, such obstacles are time-consuming, instantaneous feedback, socioeconomic factors, technological illiteracy, motivation barriers, and English language proficiency [34], [35].

1.1.2. Digital transformation and regional disparities in Kazakhstan's higher education

The global quarantine restrictions brought about by COVID-19, not only highlight the urgent need for distance learning but also revealed its potential, demonstrating both its effectiveness and its prospects for wider integration into educational processes [36]. In light of this, various educational institutions in Kazakhstan were forced to use online learning systems, including Moodle, Google Classroom, and Zoom, due to the COVID-19 pandemic. However, these changes highlighted important issues regarding student participation, teacher preparedness, and infrastructure. Kazakhstan, among other countries, encounters inconsistent adoption rates attributed to rural and urban region disparities, as evident in the quality of educational institutions, learning infrastructure, internet connection, and digital literacy [23, 35]. Students are influenced by this divide since they are less likely to use or gain from online learning environments.

The issue of unequal access to higher education mirrors global trends, where students from rural areas, marginalized minority groups, and those from poor classes. In countries like the U.S., Australia, Russia, and Kazakhstan, a significant number of educational facilities are in urban settings, which disadvantages rural communities. Urban colleges, equipped with better connectivity and resources, adapted more rapidly, while their rural counterparts encountered difficulties such as sporadic internet connection, a shortage of devices, and limited digital literacy among educators and students. On the other hand, learners from remote environments are less privileged when pursuing higher education, largely due to factors like poverty, geographic isolation, and limited access to resources [37-39]. Despite these significant barriers, rural communities are frequently disregarded in both policy and academic conversations, leading to their further marginalization and social exclusion.

1.1.3. Digital inclusion and equity

Increasing involvement and entry to higher institutions has also been facilitated by the late 19th-century emergence of flexible learning options and distance learning [40]. To meet their unique circumstances, students can join higher education through several bridging programs, learning takes different forms (for example, it can be either on-campus or off, permanent or remote learning), and they have varied statistics of enrollment. This increased enrolment flexibility by an increase in online learning environments utilization. Higher education institutions assert that they are boosting enrolments in higher education on this platform.

Digital equality is the state in which all individuals, irrespective of their locality or social status, have the digital infrastructure required for full engagement in society. To guarantee inclusive and productive digital learning settings. Resta, Laferrière, McLaughlin, and Kouraogo identified five key aspects of digital equity: access to technology infrastructure to promote greater participation and diversity. The second aspect is culturally relevant information in local languages. He further highlights the significance of giving people the ability to produce, share, and exchange digital material. Also, being proficient in the use of digital tools and thoroughly studying digital technology learning outcomes [41].

Diverse student groups can be included in education by a variety of means, such as improving educational content accessibility, boosting personalization, and offering chances for online learning, as was the case during the global pandemic of COVID-19. However, ongoing gaps in digital access could jeopardize equitable digital participation, especially for the most underprivileged learners [42], [43]. Access, infrastructure, use, and results are all aspects of digital inclusion, making it a multifaceted notion [44], [45]. Encouraging technological accessibility for students in the classroom should involve components such as creating sufficient digital infrastructure and access, supporting the integration of digital technology into the teaching and learning process,

and similarly to virtual equality in education [46]. Hence, without the right policies, it can increase educational disparities among learners, especially in remote areas of Kazakhstan, despite increasing internet adoption.

1.1.4. Government digital policies in Kazakhstan

With internet connection being available in every nation, information and communication technology have recently been heavily integrated into the field of education in Kazakhstan. The current generation is accustomed to using technology, and the government must satisfy Kazakhstan's needs for inclusive and equal education. Access to equal knowledge and using state-of-the-art technological tools ensure that the program seeks to improve the quality of instruction. Ruslan Yensebayev claims that e-learning helps to connect parents and schools to manage children's attendance [47], to mitigate the problems that could be brought on by low attendance, low class involvement, tardiness of students, thus giving an efficient platform for collaborative work.

1.1.5. University acceptance of virtual platform tools post- COVID-19

Virtual learning was adopted globally, as educational institutions and organizations had to move rapidly to remote learning to comply with lockdowns and social distancing measures. The restrictions on quarantine brought on by the disease's worldwide spread have shown the potential of distance learning and its potential applications in the future [48]. By the end of 2020, there had been a significant switch to online educational platforms by higher institutions. This transition extensively leads to virtual classrooms, online evaluations, besides digital materials aimed at educational continuity purposes. Now, e-learning has come to stay as a crucial substitute for conventional classroom environments [49].

Institutions around the world have finally reopened three years after the outbreak began. The epidemic prompted nations, partners, and stakeholders to work together to prevent learning losses and guarantee learning continuity. The need that students to take ownership of their education is a key aspect of education in many nations. Distance learning requires students to ensure their learning by attending and engaging in the sessions, in contrast to classroom settings where teachers maintain discipline and learning. Several studies revealed the role of virtual learning, proving that it appeared to be an invaluable resource for maintaining educational continuity worldwide, especially during the pandemic. Institutions and authorities swiftly implemented digital platforms and tools to facilitate remote education [50], [51], [52]. According to research by Li and Lalani, COVID-19 intensified technology integration and changed education from traditional classrooms to online delivery [53]. Nowadays, educational institutions make investments in adaptable venues, infrastructure that supports both in-person and online learning [54], [55]. Anastasakis et al. investigated the challenges Greek higher education institutions' undergraduate students had when they had to switch to virtual learning [56]. The most mentioned obstacles are the result of their instructors, internet connection problems during an online class, and the perceived lack of social interaction that synchronous settings allow [56]. To satisfy the demands of their students, numerous institutions have already implemented strategies to make their educational offerings accessible and flexible. Higher education institutions in Kazakhstan were compelled by the COVID-19 epidemic to switch to remote learning, which sped up the digitization of teaching and learning methods. The shift has been uneven, even though several colleges have made investments in blended and hybrid learning approaches, and the use of online platforms has become both possible and difficult.

1.1.6. Literature Gap

As a result of the growing interest in e-learning, numerous studies have been conducted globally, however, empirical research on students' perception and utilization of online platforms as a medium of access to advanced learning in Kazakhstan is scant. Additionally, literature materials in global studies were focused on their effectiveness, with only a few studies on equity, language barriers, and regional disparities. From the review, while majority of studies are based on only literature analysis, with no studies on student primary data in the Kazakhstan context. Hence, there is a need for an empirical investigation into how these e-learning tools are utilized to access higher education by students and the challenges they encounter.

2. Research method

2.1.1. Research design

The mixed approach (systematic literature review and quantitative survey). The systematic analysis of existing literature using the PRISMA approach to rigorously collect and process multiple studies across different settings and populations [57]. This approach was used to identify and analyze patterns and trends, considering a wide range of sources of information to offer a thorough understanding of educational online platforms as well as increase accessibility to higher learning. In addition, a survey was employed to obtain primary data from undergraduate students in Kazakhstan. This approach provides primary data from undergraduate students on online education platforms utilization.

2.1.2 Search strategy and sample

Literature review process: To assess the current body of research on online education platforms and access to higher education, a comprehensive review of published materials was conducted. Four major electronic databases (Google Scholar, ERIC, Scopus, and local academic publications from Kazakhstan) were searched to identify relevant articles. Keywords derived from appropriate source materials were used to construct a search strategy that included all applicable publications [58]. The search terms included “online education platforms” OR “e-learning” OR “MOOCs” AND “access to higher education” OR “educational access” OR “digital inclusion” OR “infrastructure access” OR “digital literacy.” As shown in Table 1, articles that met the following eligibility criteria were selected for review.

Table 1. Criteria for including and excluding studies in the systematic review

Criteria	Include	Exclude
Publication Years	Studies published between 2015 and 2025	Studies published before 2015
Language	Articles published in English	Articles published in other Languages
Focus Area	Studies focused on higher education or higher institutions	Studies focused on lower education or focused on K-12 education (primary and secondary schools)
Online Platforms	Studies on online education platforms (MOOCs, Coursera, edX, FutureLearn, and Khan Academy)	Not focused on education platforms They are used at Universities in Kazakhstan now!
Availability	Full-text articles are available and accessible online	Not online or closed access
Accessibility Focus	Studies on access to education, regional disparities, digital inclusion and equity, and rural-urban disparities	Studies that do not address access to education, digital inclusion, and equity.
Geographical Focus	Studies conducted globally, with a preference for those conducted in Central Asia, particularly Kazakhstan, and comparable environments	Studies that do not specify the country or region

After the rigorous search, 20 scholarly sources were identified using the updated PRISMA methodology (see Figure 1). The quality of the selected studies was assessed based on criteria developed by Straub et al. [58]. During the data extraction process, the author independently collected key information from each source, including the article title, year of publication, sample, study design, and findings. The extracted data were then analyzed using Microsoft Excel. A synthesis-based analytical method was applied.

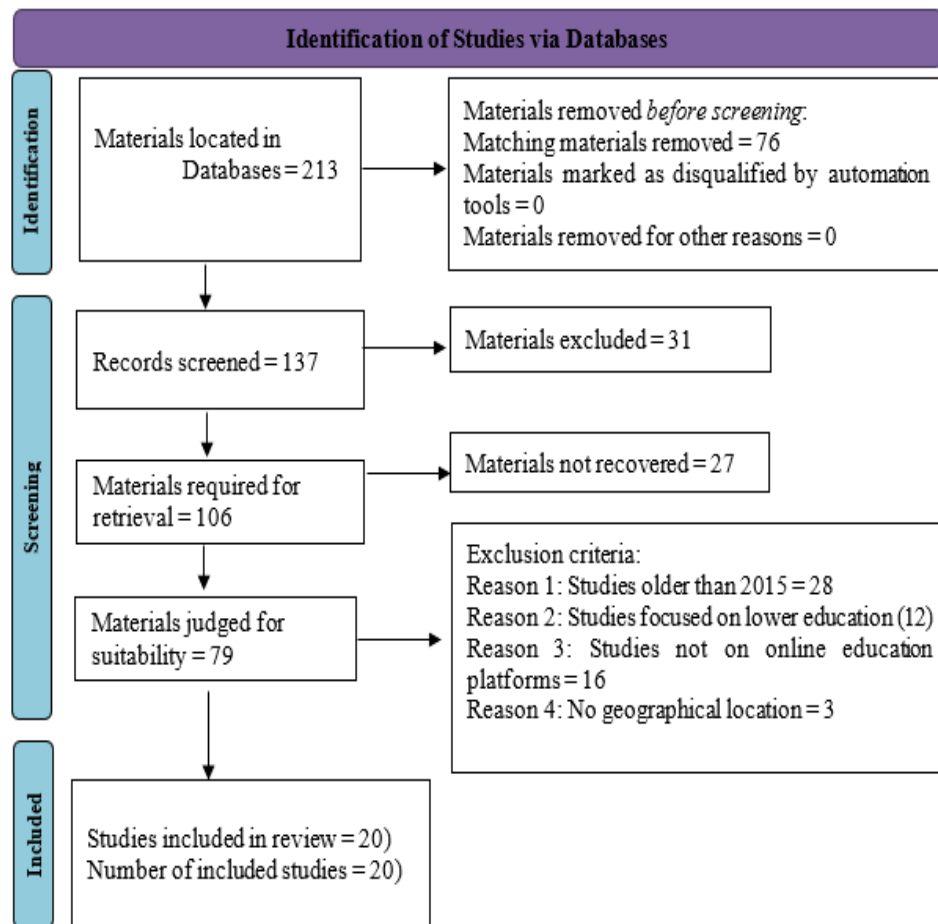


Figure 1. Studies PRISMA flowchart

Survey process: A quantitative survey was conducted to examine online learning platforms. The survey targeted Undergraduate students from urban and rural universities in Kazakhstan. A purposive sampling strategy was employed to select a sample of 20 undergraduate learners, ensuring representation across rural and urban contexts and accounting for disparities in access conditions. Data were collected through an online survey administered via Google Forms and the university's Learning Management System (LMS).

Survey instrument: The survey instrument consisted of both Likert-scale items and a section capturing demographic information. Key variables measured included device availability (e.g., computers, smartphones), internet connectivity, and frequency of use of online educational platforms. Additionally, the instrument assessed students' perceptions regarding the effectiveness and accessibility of online higher education, as well as challenges encountered, such as connectivity limitations, language barriers, digital equity, and digital literacy. Frequency count, percentage, average, and standard deviation were used to analyze the data.

2.1.3 Ethical considerations

The personal belongings of respondents were not collected. Respondents voluntarily participated and were informed that they could withdraw whenever they felt uncomfortable. Participant responses were mainly for research purposes.

3. Results and discussion

3.1.1 Literature findings

While examining online educational platforms, 20 empirical materials were reviewed and outlined in Table 2 as follows.

Table 2. Article summary on educational online platforms as a tool for increasing access to higher education

№	Region	Study design	Sample size	Objective	Major findings
[1]	Ukraine	Survey	10	The research examined the role of e-learning during Martial law in the Ukrainian experience	E-learning ensured educational continuity and contributed to enhanced student learning outcomes, especially in crisis contexts during emergencies, such as Martial law in Ukraine
[2]	Kazakhstan	autoethnographic approach	Nil	Explored rural disadvantage in accessing higher education.	Rural-urban disparities in Kazakhstan hinder rural students' participation and success in higher education. They face lower quality schooling, financial difficulties, limited parental expectations, and geographic isolation. Social capital, including support from family, teachers, peers, and community, is crucial for their success. However, many rural students struggle to build the necessary capital, limiting access to quality education and job opportunities.
[3]	Jordan	analytical descriptive approach	130 Lecturers	Examined the Massive open online learning (MOOC) benefits and challenges	The study reveals that faculty members encounter barriers in using MOOCs, including gender differences, but they perceive MOOCs as a great advantage for users. Professors agree that they offer better learning opportunities.
[4]	Poland	Survey	621 students	Examined the advantages and disadvantages of innovative e-learning during the COVID-19 pandemic in higher education	The study found that e-learning has advantages, such as ease of content acquisition. Still, disadvantages include a lack of direct contact, challenges in teaching hands-on subjects, and excessive screen time. Students with better digital skills and access to technological resources rated e-learning more positively.
[5]	Ukraine	Descriptive survey design	331	Examined the Challenges facing distance learning during martial law in Ukraine	Most students in Ukraine, despite being displaced or abroad, managed to continue learning despite air raid alerts and war conditions. 12% volunteered, while 18.8% did not. Many students experienced psychological strain, and most institutions adopted blended or distance learning.
[6]	Australia	Survey	42 Universities	Exploration of institutional conceptions of digital literacy based on document analysis of university-published information online.	Findings show that universities vary in their definitions of digital literacy, focusing on developing technical skills and capabilities for living, learning, and working in a digital world. These practices are deeply rooted in their graduate outcomes.
[7]	London	Survey	151 Students	Explored Aston University's Bioscience students' experiences of studying from home, and the impact of the lockdown on mental wellbeing and quality of life.	Most students are positive about online open-book assessments, with minimal technical difficulties. However, students have mixed preferences for online interaction. Home learning environments are inequivalent, with some lacking workspace. The pandemic has negatively impacted mental health, and universities are adopting hybrid learning models to maintain hands-on learning and campus support.
[8]	United State	Mixed Method	36 Students	explored the perspectives of graduate students about the instructional activities of hybrid courses	The findings of the study describe the experiences of the students in hybrid courses and their suggestions to enhance the online and face-to-face components. Four overarching themes emerged from the data: organization and flexibility, online activities, interactive classes, and balance.
[9]	Australia	Survey	1658 Students	Explored Student perceptions of 'useful' digital technology in	The study highlights 11 benefits students associate with digital technology in higher education, including flexibility, task management, revisiting teaching

№	Region	Study design	Sample size	Objective	Major findings
				university teaching and learning	materials, and visual learning options, suggesting these tools enhance teaching and learning.
[10]	Malaysia	Survey	135 Students	Cross-cultural learning via Massive Open Online Courses for higher education	The study suggests that animations and live action videos can enhance MOOC learning, while learning task design prioritizes both structured and loose tasks, and high and low autonomy.
[11]	South Africa	Online Survey	15 Students and teachers	Rural Online Learning in the Context of COVID-19 in South Africa	The South African government's online learning strategy for COVID-19 is limiting rural learners due to lack of internet access, learning management systems, and low-tech software. The study emphasizes the importance of involving rural learners in education and combating the pandemic, ensuring social justice and their rights.
[12]	Jordan	Survey	4,037 Students	Jordanian university students' views on emergency online learning during COVID-19	Personal challenges decrease students' willingness to learn online, while quality of online experience improves attitudes. Students believed that Arts & Humanities courses are better suited for online teaching than Science courses, despite controlling for personal challenges.
[13]	Australia	Survey	33 Students	Google Classroom: A Pedagogical Framework for Tertiary Educators	Google Classroom enhanced student participation and learning but raised concerns about pace and user experience. A framework was developed to evaluate online platforms' usefulness and pedagogical practices.
[14]	Sweden	Survey	5 Participants	Described the use of globally accessible Massive Open Online Courses, MOOCs, for addressing the needs of learners at community learning centers in Northern Sweden	The participants were satisfied with the course and their participation but faced challenges in the English language and the special discourse of design concepts. The term "affordances" was a significant challenge, as it seemed to have no clear translation in other languages. Cultural issues were also discussed, with some participants expressing a lack of understanding of time in different cultures.
[15]	Malaysia	Survey	73 Students	Development and evaluation of massive open online course (MOOC) as a blended learning approach in higher education	Findings showed that students were generally satisfied with the MOOC, with positive results for most of the usability items.
[16]	Ukraine	mixed-methods approach	77 Students	Explored the Challenges and prospects for the development of online education in Ukraine	The study reveals challenges in implementing online systems, including infrastructure issues, technical issues, and energy interruptions. Students report low motivation. The findings underscore the need for innovative solutions and recommendations for improving online education quality in Ukraine.
[17]	Jordan	Survey Method	400 Students	Examined students' barriers of utilizing online learning	The study reveals that online learning infrastructure is a significant barrier to Jerash University's use, with gender and studying year variables playing a significant role. While online learning is convenient, it also lacks interaction, clear assessment strategies, feedback, and student interest.

No	Region	Study design	Sample size	Objective	Major findings
[18]	Afghanistan	Survey	30 Students	UiTM post-graduate students' perceptions on online learning	The study found that online learning is convenient, promotes student participation, and caters to their needs, but also presents challenges like lack of interaction, unclear assessment strategies, and a lack of interest in learning.
[19]	Philippines	Survey	462 Students	Examined Students' Perception of Barriers to online learning	Students encounter multiple obstacles in the learning process, which can be broadly categorized into technological, individual, domestic, institutional, and community-related barriers. Technological barriers encompass limited access to devices, inadequate internet connectivity, insufficient technical skills, and platform-related challenges. Individual barriers include mental and physical health concerns, while domestic barriers may involve household responsibilities and financial hardships. Institutional barriers relate to systemic or organizational constraints, whereas community-level barriers include restricted mobility and socio-political challenges.
[20]	Ukraine	Survey design	173 students	Use of Information and Communication Technologies as a pedagogical value in times of crisis	Digital learning offers advantages like independent learning, adaptability, and motivation for self-education. Teachers need better skills to support digital learning environments. Students recommend training individuals in digital competencies, expanding access to electronic resources, and offering financial support. Challenges include formalization of education, excessive academic pressure, and insufficient digital skills among faculty. Systematic digital transformation is necessary for meaningful change in education.

Source: author's development

The selected studies exhibit some methodological variations, reflecting diverse locations, research designs, sample sizes, research instruments for data collection, and outcomes as presented in Table 2. The studies span multiple countries around the world, which ensures a broad representation of different educational contexts on online educational platforms as a tool for students' access and success in higher education. 4 studies were in Ukraine, 3 studies were carried out in Jordan and Australia, respectively, 2 studies were conducted in Malaysia, while 1 study was conducted in Poland, Kazakhstan, the UK, the US, South Africa, Sweden, Afghanistan, and the Philippines (see Figure 2). Also, the frequency of selected studies by year of publication is shown in Figure 3.

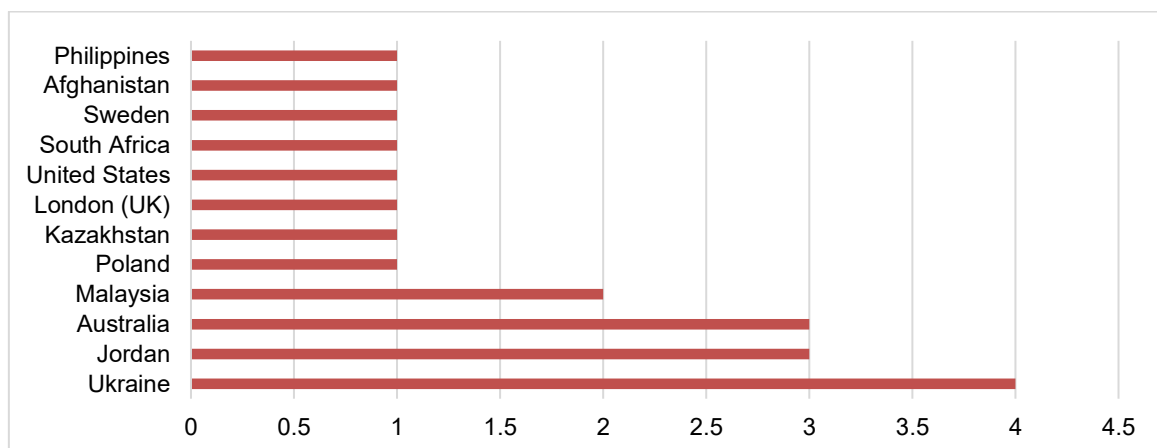


Figure 2. Selected studies by location

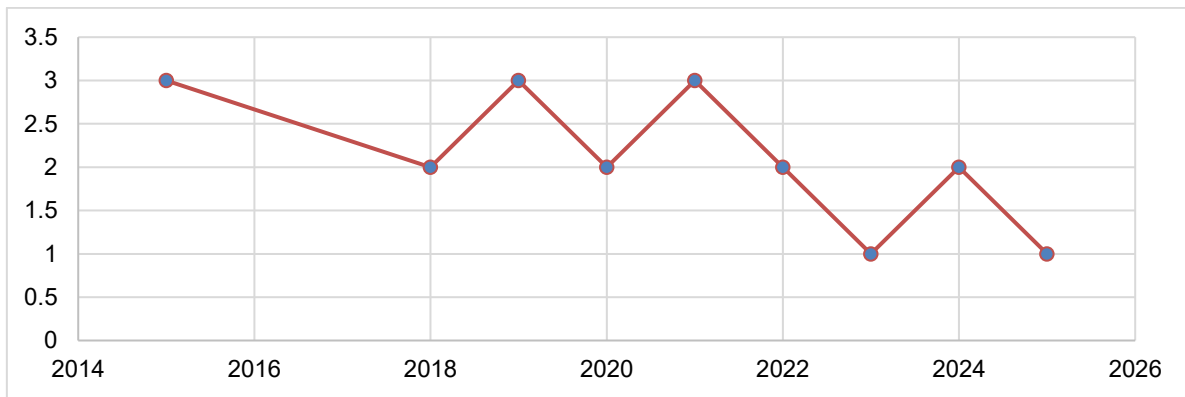


Figure 3. Selected studies by year of publication

Research question one: Advantages and limitations of online platforms in improving access to higher education, according to existing studies?

The 20-study systematic review highlights various benefits and challenges of the online platforms for students in higher education. These benefits and challenges are presented in a theme format as shown in Tables 3 and 4, respectively.

Table 3. Benefits of online platforms in higher education

Theme	Description	Authors
Flexibility and Convenience	An online educational platform offers learner self-paced learning, removes the barrier of physical distance, increases accessibility for students with limited resources, enhances personal schedules, and enhances continuous learning.	References [48], [57], [41], [47], [54], [49], [50]
Independent and Self-directed Learning	Foster learner autonomy, learners set their own learning goals, self-directed learning, manage time, optional assignments, flexible deadlines, and multiple resources.	[59], [44], [43], [58]
Digital Literacy and Skills Development	Improves learners' digital literacy, enhances skills in online communication, collaboration, and information management	[42], [49], [59], [52]
Increased Participation and Motivation	High learner participation and engagement enhance students' motivation, track progress, provide instant feedback to users, inclusive participation	[48], [55], [54], [56], [57]
Blended/Hybrid Learning Effectiveness	Complement traditional instruction, fast reach to the audience, online assignments, improve retention, and adaptable learning styles	[48], [44], [56]
Equity in Access During Crisis	Provide continuous learning despite physical barriers, serve as a lifeline for education, and maintain educational access during lockdowns	[43], [44], [50], [58], [51]
Pedagogical Innovation and Engagement	Encourages adoption of innovative pedagogies, create highly engaging and personalized learning experiences, tailors content to individual needs, and tracks progress and adjusts instruction.	[52], [53], [41], [56]

Source: author's development

The thematic analysis of 20 literature studies shows several advantages of online platforms, summarized in Table 3. One of the identified benefits from literature is flexibility and convenience, especially during crises.

References [48], [57], [41], [47], [54], [49], and [50] emphasized that online learning is particularly valuable in this modern century unlike traditional face-to-face instruction that is bound by location and time. This enables students to access educational content at any time and from any location, which is particularly valuable in this modern century unlike traditional face-to-face instruction that is bound by location and time. Independent and self-regulated learning was also highlighted by [59] and [40]. These studies observed that online education platforms empower individuals to take control of their learning process. This autonomy encourages learners to explore knowledge beyond course requirements, which enhances learning habits, develops critical thinking, compared to the traditional class that follows a rigid structure and already set instructional objectives with limited room for self-learning. Furthermore, reference [47], [49], [59], and [52] established that digital platform enhances students' digital literacy skills and development. These platforms indicate that students not only acquire competence in digital communication, collaboration, and information management, but they also develop their general and specialized technical skills. This advantage is in contrast with the traditional method, with limited exposure to digital tools and technologies, and focuses on theoretical knowledge with less application. The blended/hybrid learning model emerged as an effective pedagogical strategy in [48] and [51], combining traditional and digital instruction to enrich and improve academic outcomes for learners. This approach implies that online educational platforms enhance retention, attitudes, satisfaction, and adaptability to different learning styles, thereby addressing one of the weaknesses of the traditional method. Finally, educational equity and access represent additional advantages, particularly in contexts of geographical isolation and crisis, as highlighted by [43] and [58]. These authors emphasize that online educational platforms ensure continuity of learning during emergencies, when conventional educational institutions may be inaccessible. Moreover, such platforms promote lifelong learning by supporting professional development and expanding educational opportunities for marginalized groups, including refugees, displaced persons, and underserved communities. Unlike traditional educational environments, which often present considerable physical and institutional barriers, online platforms substantially enhance access to education for individuals who might otherwise be excluded.

Table 4. Limitations of online education platforms

Theme	Description	Authors
Lack of Interaction/Engagement	Reduced interpersonal interaction, feelings of isolation, lack of peer and teacher engagement, passive learning, shallow thinking and understanding	References [57], [41], [56], [49]
Assessment Feedback Limitations	Feedback lack depth, essay grading or assessment, and personalized feedback can be superficial. Cheating and integrity concerns, feedback accuracy and reliability concerns	[57], [56], [58]
Equity and Inclusion Gaps (Rural, Socioeconomic)	Lack of devices, unstable internet connectivity, and low levels of digital literacy contribute to the digital divide, which is further exacerbated by the absence of localized content, culturally relevant materials, and persistent barriers faced by rural and low-income learners	[41], [50], [51], [56]
Mental Health and Motivation	Mental fatigue, stress, burnout, loneliness and low motivation may result from long hours in front of screens. Lack of social interaction and unstructured routines.	[49], [58], [56], [55]
Systemic Institutional Challenges	poor planning, fragmented implementation, inadequate teachers training, lack of technical support	[56], [41], [44], [55], [59]

Source: author's development

Despite the various benefits, studies also identified several challenges and limitations associated with online platforms in higher education. According to the thematic analysis, 5 major challenges emerged, as presented in Table 4. Frequently reported barriers are digital infrastructure and access particularly in rural and low-income

regions. References from different countries [42], [50], and [58] highlighted those rural and low-income students often face difficulties accessing reliable internet and digital devices, which significantly hinder participation in online learning. According to [59] and [42], many students and educators face challenges in effectively integrating technology into their education due to inadequate training or resistance to digital change. Another barrier is the lack of interaction and engagement, as highlighted by [57], [63], and others. According to studies, online environments can often feel isolating, leading to reduced motivation or reduced sense of social interaction among students. In addition to the limitations, is the lack of clear instructions and technical assistance from institutions is also a barrier [42], [47]. Many students report difficulty navigating platforms and resolving technical issues without structured assistance. Finally, reference [55] and colleagues reported assessment and feedback limitations. They observed that online assessment often lacks timeliness and clarity. In summary, these studies observed that online learning environments provide a great deal of potentials, however, their weaknesses need careful consideration. This suggests that more pedagogical innovation, infrastructure, and emotional support networks are required than with traditional methods.

3.2. Survey findings

A total of 20 Higher education students were selected using purposive sampling technique to capture real and diverse perspective of students from urban and rural regions of Kazakhstan. A structured and validated questionnaire was administered online yielding 100% response rate. The demographic variables included in the questionnaire are age, gender, location, device ownership, and digital literacy skills. Mean, frequency and standard deviation were employed to analyze the data. Table 5 displays the respondents' demographic characteristics, including gender, age, field of study, year of study, device ownership, and level of digital literacy.

Table 5. Demographic characteristics of respondents

Variable	Category	Urban Students (n=10)	Rural Students (n=10)
Gender	Male	6	7
	Female	4	3
Age Range	18–20 years	7	5
	21–23 years	3	5
Field of Study	Humanities and Social Sciences	5	6
	STEM (Science, Technology, Engineering, Math)	5	4
Year of Study	Year 1	3	4
	Year 2	4	3
	Year 3	2	2
	Year 4	1	1
Device Ownership	Laptop and Smartphone	9	4
	Only Smartphone	1	6
Digital Literacy Skill	High	7	2
	Moderate	3	5
	Low	0	3

Source: author's development

The demographic data in Table 5 provides the frequency of 20 undergraduates from the urban and rural universities in Kazakhstan. Results show that urban male students were 60%, with 40% females, while rural students showed 70% of males (70%) and 30% of females (30%). A majority of urban students (70%) were aged 18–20 years, while rural students were evenly distributed, with 50% in the two age categories. The distribution of students across both groups remained relatively consistent throughout the academic years. However, first-year students were slightly more represented among rural students, with a proportion of 40% in contrast to 30%. 90% of students in urban universities had access to both laptops and smartphones, with only 40% of rural students. Additionally, 60% of students in rural higher institutions owned smartphones only. Finally, 70% of urban students demonstrated high levels of digital literacy, in contrast to just 20% of rural students who reported comparable skills.

Research question two: How do university students in Kazakhstan utilize online education platforms, and how do they perceive their impact on academic access and success?

Student's online education platform utilization in Kazakhstan is shown in Figure 4. After which, Table 3 the present the perceived impact of these platforms on academic access and success, as reported by 20 respondents. The data were collected using the 10-item survey question and scored on a 5-point Likert scale ranging from Strongly Disagree to Strongly Agree.

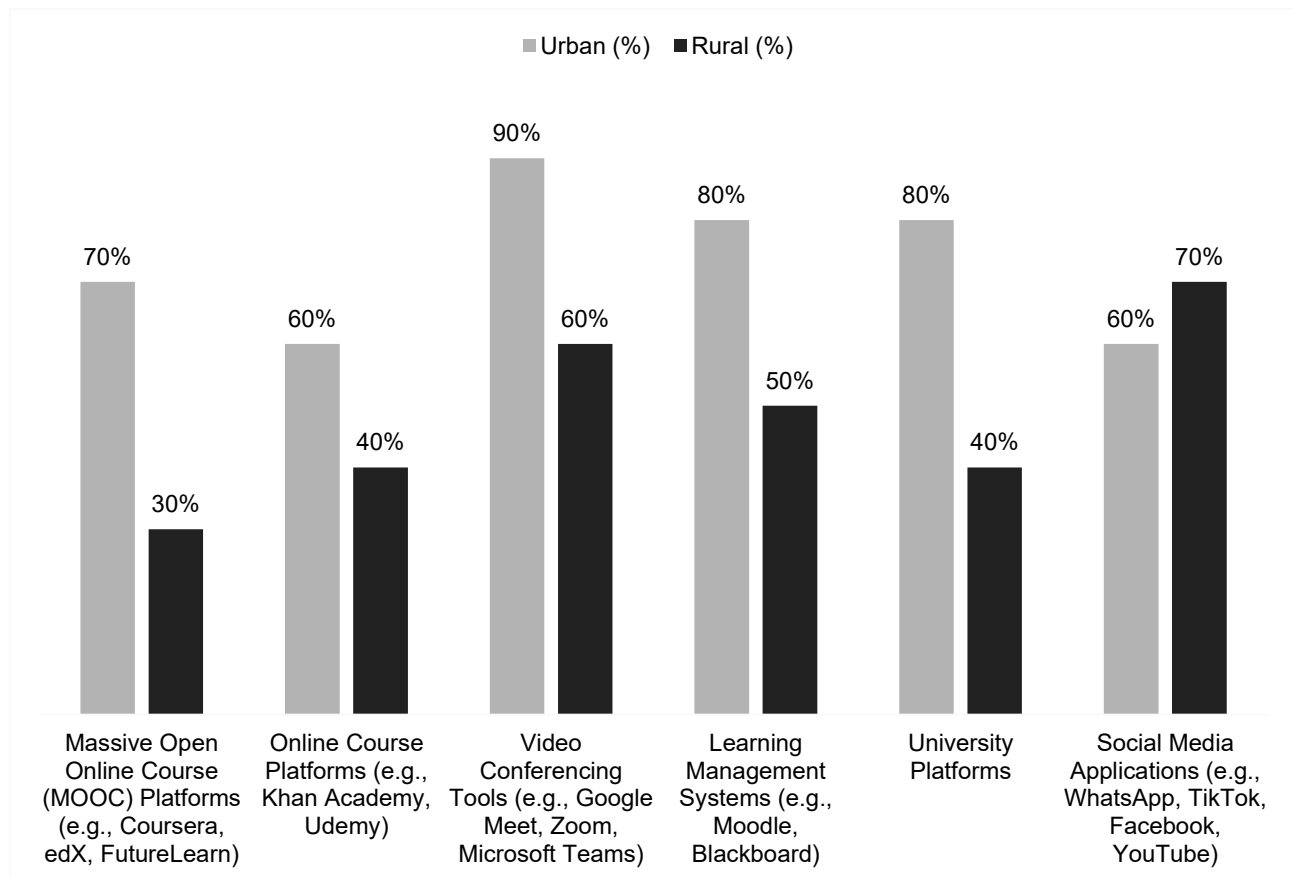


Figure 4. Usage of e-learning platforms among urban and rural students

Figure 4 illustrates the utilization of e-learning platforms by university students in Kazakhstan for urban and rural areas. Rural peers had 60%, while urban students had 90% of using video conferencing software. Only 50% of students in rural areas used learning management systems (LMS), whereas 80% of students in metropolitan areas used Moodle and Blackboard. Similar patterns were seen with university-specific platforms, which were used by 80% of urban students and 40% of rural students. Rural students use social media platforms for learning (70%) compared to urban students, with 60%.

Table 6. Perceived impact of online platforms on academic access and success

S/N	Survey Question	Urban Students (n=10)		Rural Students (n=10)		t-test Statistics	Sig.
Academic Access		Mean	SD	Mean	SD	5.47	0.056
1	Online education platforms have made it easier for me to access university courses.	4.5	0.41	3.8	0.54		
2	Without online education platforms, it would have been more difficult for me to pursue higher education.	4.2	0.51	4.6	0.46		
3	I can access a wide range of academic resources through online platforms.	4.6	0.48	3.5	0.47		
4	Online platforms allow me to overcome geographical barriers to education.	4.1	0.46	4.7	0.58		
5	The flexibility of online platforms has made higher education more accessible to me.	4.7	0.43	4.2	0.32		
Academic Success						34.8	0.001
6	Using online platforms has helped me improve my academic performance.	4.3	0.49	3.7	0.33		
7	I have completed more courses because of online platforms.	4.0	0.43	3.6	0.31		
8	Online learning platforms provide high-quality educational materials.	4.4	0.57	3.8	0.55		
9	I feel more confident in my academic abilities when using online tools.	4.2	0.59	3.5	0.53		
10	Online platforms help me develop critical thinking, research, and independent learning skills.	4.1	0.42	3.6	0.56		

Source: author's development

Students' perceptions of impact of online platforms on academic access and success for urban and rural universities are presented in Table 6. In terms of academic accessibility, students from urban areas reported more positive experiences with online education platforms. Urban students positively agreed that online platforms have made it easier for them to access university courses, with a mean score of 4.5 out of a possible score of 5, compared to 3.8 among rural students. There are also higher levels of satisfaction with the availability of academic resources online for urban students, unlike a mean of 3.5 for rural students, and they appreciated the suppleness that online learning provides. However, rural students emphasized the need for online platforms as it helped them to overcome barriers to pursuing their studies, with a mean score of 4.6 compared to their urban counterparts of 4.2. They also agreed more strongly that online platforms help overcome geographical challenges (mean= 4.7). Furthermore, the result showed that difference between rural and urban students in relation to academic access was statistically significant ($t = 5.47, p < 0.05$), indicating that urban students reported higher usage of online platforms to access higher education. It also suggests digital divides even though online platforms are meant to educational access. In terms of students' academic success, urban students also have positive experiences. They agreed that online platforms have impacted their academic achievement with a mean score of 4.3 compared to their rural counterparts (3.7). There is also an improvement in completed courses from rural students (mean=3.6), though not as high as that of urban students with a mean of 4.0. Rural students felt less confident using online tools for academic work (mean = 3.6) than urban students, with a mean of 4.2. Similarly, the result showed that difference between rural and urban students in relation to academic success was also statistically significant ($t = 34.8, p < 0.05$), indicating that urban students reported higher success as a result of online platforms adoption and usage. It also suggests that a student's ability to use digital learning

resources for academic success is still significantly influenced by their geographic location. Furthermore, the grand mean of academic access and success is shown in Figure 5.

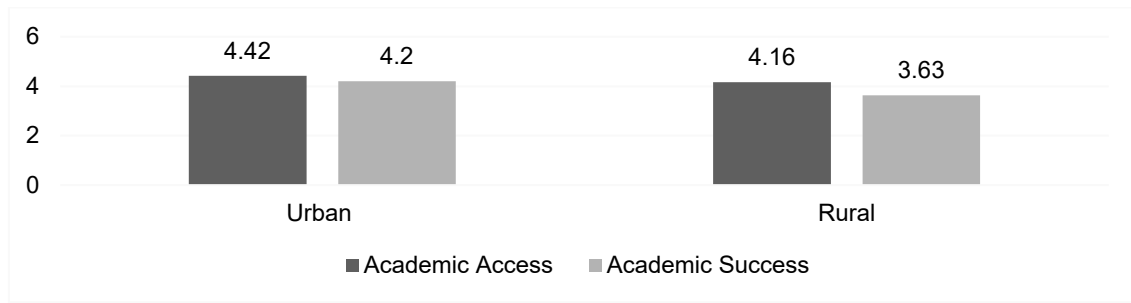


Figure 5. Mean Academic Access and Success

Figure 5 shows significant regional disparities in access to education and academic outcomes of students, which favour urban university students in Kazakhstan.

Research question three: What barriers do students in different regions of Kazakhstan face when using online platforms for higher education?

The responses from 12 survey questions by 20 students from urban and rural universities were scored on a 5-point Likert type scale measuring the barriers encountered using online platforms for higher education. The mean and standard deviation of these regions were presented in Table 7.

Table 7. The mean and standard deviation of the barriers facing online platform utilization

S/N	Survey Question	Urban Mean	Urban SD	Rural Mean	Rural SD
1	I often experience a poor internet connection during online classes	3.2	0.98	3.3	1.27
2	My internet connection is steady enough to attend full-length online lectures.	3.2	1.08	3.1	1.30
3	I have access to a reliable computer for academic use	4.5	1.28	3.6	1.02
4	I feel isolated and disconnected from my classmates when learning online	3.6	0.87	3.2	1.08
5	I face difficulties in accessing adequate technological resources	2.6	1.36	3.4	1.02
6	I struggle with understanding course materials because of the language used	3.3	1.27	3.2	0.98
7	I would learn better if more course content were available in my preferred language.	2.8	0.98	3.5	1.20
8	I often find it difficult to stay motivated when learning through online platforms	4.0	1.18	3.5	1.02
9	My institution doesn't provide clear instructions and help for using online platforms	3.6	1.20	2.8	1.33
10	I receive timely technical support when I face issues with online platforms	3.5	1.12	2.3	0.90
11	My financial situation limits how often I can access online learning resources	3.2	1.33	3.5	1.28
12	Online classes do not effectively support subjects that require hands-on practice	3.5	1.02	2.8	1.17

Source: author's development

Table 7 shows students' perceived barriers to online learning for urban and rural universities in Kazakhstan. Results from mean scores show that both urban (3.2) and rural students (3.3) agreed that poor internet

connectivity is an issue, though more negative perceptions from rural students. A barrier of digital devices and access is more prevalent for rural students (3.6) than their urban counterparts (4.5). Also, rural students perceived more challenges in technological resources, reflecting lower infrastructure. Language barrier is also experienced by both urban and rural regions, although rural student is more affected, preferring their local language. Finally, urban students experience positive digital confidence (4.0) compared to rural digital confidence (3.5). Rural students feel less supported by their institution (2.3) while urban students had a positive experience in terms of support (3.5). Both urban and rural students experience financial constraint, but rural students are more burdened concerning online learning costs (3.5) while having difficulty affording data (3.5).

In addition, the survey responses of students from the open-ended question on possible improvements to enhance the e-learning experience in Kazakhstan resulted in 5 major themes. These themes are discussed and students.

Theme 1: Free data and internet connection for students: Students highlighted that free internet or data will increase online education participation. A student shared his experience.

"I often miss lectures due to unstable or expensive internet" Urban Student.

Theme 2: E-learning platform suitability: Students emphasized the importance of having e-platforms that is user friendly and meet their needs.

"We need platforms that work well even with slow internet and are easy to understand without a lot of training." Rural Student

Theme 3: Improvement in rural institution infrastructure: The Majority of the rural students perceived those rural institutions required better infrastructure to be able to match the urban standard. They highlighted that rural universities deserved the same support.

Theme 4: Digital literacy training: Many students usually struggle with using e-learning platforms. They highlight the need for digital skills training. A year two student shared her experience.

"In my first year in the university, I struggled with e-learning platforms because it was new to me. So, training students will really help"

Theme 5: Communication support: According to the students, online course content should be available for students in their preferred language.

3.3. Discussion

The study explored how online educational platforms contribute to improving the accessibility of higher education for undergraduate students in Kazakhstan. Findings from the synthesis of 20 literature studies revealed that online platforms enhance access to higher education enhancing versatility, independence in learning, digital advancement of skills, and equitable access based on region and during emergencies like COVID-19, natural disaster or social crises [44]. These findings align with global trend that, when used properly, online education serves as a potent instrument for democratizing education of digital learning, especially in contexts where traditional face-to-face instruction is constrained by location and institutional limitation. Also, online education serves as a powerful tool for expanding educational research when effectively implemented. This is supported by findings of [60] and [61] that distance learning has meaningful and obvious aids, implying that distance learning offers clear and tangible benefits, including flexibility and broader course selection as compared to traditional method that is time bound and possess rigid academic and curriculum structure. Similarly, e-learning facilitates self-paced learning, time management, and personalized self-evaluation, enabling students to learn in accordance with their own cognitive abilities and life or family obligations, as noted by [62]. Non-traditional learners, working students, and students from rural areas where physical access to colleges may be limited will especially benefit from these features.

However, the findings also showed that this technological integration is also not without critical restrictions. The study found that online platforms can inadvertently exacerbate existing educational inequalities if not designed with inclusive strategies and equitable infrastructure. Issues like limited interaction and engagement can hinder peer networks, discourage active participation, and reduce motivation were identified as common barriers. Erratic internet connections and digital devices are another issue that has been brought to light. These limitations cause access gaps between students, especially in rural areas. Socioeconomic factors like mental health and motivational issues, frequently contribute to these disparities. The findings of [63] further revealed that the lack of social cues, face-to-face feedback, and institutional support contributes to a lack of adequate institutional support, such as trained instructors, mental health services, and academic guidance, which can result in a feeling of disengagement.

Furthermore, survey findings from Kazakhstan revealed that urban students have better digital gadgets (laptops, smartphones, etc.), are more digitally literate, and have more reliable access to LMS and university-specific platforms, compared to their rural counterparts. Consequently, they report higher level of academic performance and educational access, as reinforced by evidence from the work of [59] and [43]. Rural students, on the other hand experienced poorer digital literacy, owned fewer laptops, and exhibited less confidence in using online platforms. They were also more likely to rely heavily on social media as an educational learning tool, such as YouTube, TikTok, and other platforms to meet their learning needs, which is in agreement with the reference [65]. This indicates a disconnect between institution offerings and real students' experiences, prompting learners to seek more accessible, engaging, and user-friendly alternatives due to limited access to formal academic resources. These findings highlight the need for targeted infrastructure progress and inclusive strategies should be offered to rural or less privileged populations. Furthermore, students from both areas reported challenges related to institutional system, financial constraints, language barriers, and technological limitation, however, these challenges were experienced more by rural students. Financial constraints, in particular, prevent many from having access to reliable high-speed internet and appropriate learning devices [51]. These realities reveal a huge gap between the objectives of educational programs in Kazakhstan, like "Digital Kazakhstan", and the actual realities of students, especially those in remote institutions. While such programs aim to ensure universal access to digital education, many students in less affluent areas sometimes lack the necessary digital infrastructure that enables them to rely on smartphones and social media, which are often inadequate for challenging academic assignments [58].

The study admits a number of limitations in spite of its insights. Generalizability is limited by the very small sample size and the focus of only English-language sources may have left local insights for better understanding of digital education in Kazakhstan. These findings carry important implications for education policy and digital learning design. To create a more inclusive and effective digital learning environment, education policymakers must address the dual challenges of infrastructure inequality and gaps in digital competence, indicating that online educational platforms if not carefully design can further widen the existing educational inequalities rather than closing them. To prevent escalating inequality, providing training in essential digital skills like the ability to manage digital documents (e.g., Word, Excel, Pdf), efficient internet searching/browsing educational content, using email, video conferencing tools (e.g., Zoom, MS Teams), PowerPoint and video presentation among others and resource access are emphasized [58]. The study emphasizes the importance of promoting equity, digital inclusion, and student well-being in the implementation of digital learning platforms, highlighting the need for sustainable and inclusive expansion of digital education. Future studies can use larger sample size to explore the perspectives of student on how online educational platforms increase educational assessment in higher education.

4. Conclusions

The study highlights the crucial role of online educational platforms in Kazakhstan's higher education. These tools, through versatility, independence in learning, digital advancement of digital skills, equitable access, time management, and self-directed learning, bring expanding access to higher learning in Kazakhstan by reducing

barriers related to distance and location particularly during COVID-19. These benefits align with Kazakhstan's efforts to meet Sustainable Development Goal 4 (SDG 4), which advocates for inclusive and equitable quality education. However, there are challenges that hinder the full potential of online education. These include limited interaction and students' engagement, urban-rural disparities in connectivity and infrastructure, and socioeconomic factors affecting device and internet access. Mental health and motivation issues further complicate the learning experience in underserved areas. Moreover, the digital divide remains particularly, reinforcing existing inequalities rather than bridging them. Ultimately, the study concluded that online learning platforms play a significant role in expanding access to higher learning in Kazakhstan. Their success depends on deliberate and inclusive policy interventions. Effective implementation requires attention not only to technological access but also to the pedagogical, emotional, and institutional support system surrounding digital education.

Declaration of competing interest

The authors declare that they have no known financial or non-financial competing interests in any material discussed in this paper.

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Author contribution

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