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REVIEW

Lessons from a Low-Resource Country: A Narrative Review of Virtual Learning Adoption and Challenges in Medical Education in Iran During COVID-19

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Objective: The global COVID-19 pandemic has had a profound impact on the education system. Education shifted to virtual methods, while there was not enough time to plan and choose a proper educational platform. In this study, we present an up-to-date review of the most commonly used virtual education platforms in Iran during the COVID-19 pandemic.

Methods: This narrative review systematically searched Persian and English articles (2020–2024) in Medline, EMBASE, Scopus, Web of Science, ERIC, SID, CIVILICA, and PubMed using keywords: "COVID-19", "virtual learning", "online learning", "distance learning", "post-COVID infection", "real and virtual simulation", and "educational platforms".

Results: Virtual classes have become increasingly popular during the pandemic. Adobe Connect, Sky Room, Skype, Big Blue Button, Google Meet, Gharar, Zoom, and Navaid System were the most commonly used platforms during the COVID pandemic in Iran. The most frequently utilized systems included Shad (predominant in general education and training) and Navid (leading in medical sciences). Shad had excelled in scalability and institutional integration but faced connectivity issues in rural areas. Despite its technical strengths, Navid was criticized because of insufficient interactivity and misalignment with learner needs in medical English.

Discussion: During COVID-19, online medical education in Iran relied mainly on domestic platforms, which have some limitations. To ensure future equity and competency, a shift toward hybrid models incorporating offline-capable Learning Management Systems (LMS), simulation, and digital literacy training is essential.

Keywords: virtual education, Iranian medical universities, COVID-19 pandemic, educational platforms, educational technologies

Introduction

The COVID-19 pandemic in 2020 created a shift in the education paradigm and forced educators and institutions to adapt to virtual education methods and distance learning.[1] The World Health Organization and national directives want professors and students to adhere to the social distancing rules, self-isolation, and "staying at home". According to UNESCO reports, more than 91% of students worldwide (one and a half billion people) have been affected by the COVID-19 pandemic, leading to fundamental changes in their education systems.[2] In Iran, following the announcement of the national headquarters of coronavirus, and after the first report of COVID-19 on February 19, 2020, universities were obliged to conduct virtual classes.[3]

When schools and universities were forced to close due to social distancing and isolation measures aimed at stopping the virus from spreading, millions of students and teachers had to join virtual learning. This shift to virtual education has

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highlighted the importance of digital technology in education and raised questions about its effectiveness compared to traditional classroom-based learning.[4]

Throughout this pandemic, virtual platforms have enabled higher education to shift toward online learning across geographical boundaries. Their use has become increasingly important across all educational levels. Students and educators have become skilled in using various virtual platforms, including Google Classroom, Zoom, Meet, and Teams. Additionally, the integration of the Internet and mobile devices has played a vital role in supporting online education through these platforms.[5]

These platforms present both benefits and drawbacks that all participants in the learning process must consider when employing them. Nevertheless, they will acquire the skills necessary to navigate these challenges effectively, maximizing their advantages. A wide range of online platforms is available for learning, and educators must carefully evaluate which options best meet the needs of their students.[6]

However, the shift to online education varied across countries. In Iran, where educational technology infrastructure remains underdeveloped, this change faced specific challenges, including unreliable internet, limited bandwidth, and platform restrictions caused by international sanctions. Previous e-learning experience was low, with 67% of medical/nutrition students,[7] and only 58% of faculty members.[8] Digital literacy gaps, such as low IT skills among Iranian students,[9] requiring basic training, further constrained adoption. So, in addition to experiencing one of the largest coronavirus outbreaks in the world, the impact of the COVID-19 pandemic on its education system has been significant.[10] As a result of these conditions, the education system rearranged conventional teaching methods by prioritizing the use of domestic platforms and methods for distance learning.

Also, there are some other barriers, including unreliable internet (connection disruption, slow speeds; Iran ranks 113th globally for median download speed), as well as the infrastructure gaps (electricity shortages, costly devices), particularly in rural areas. Also, access to cloud services and educational content is restricted by filtering (eg, YouTube), limiting storage, and self-learning resources. National platforms with low quality and non-uniform further hinder synchronous/asynchronous delivery via LMS, exacerbating inequities compared to better-resourced systems.[11]

Similar infrastructure and access challenges have been reported in other developing countries, such as Pakistan (cost and planned approach, availability of personal computers at homes),[12] India (technical equipment deficiency, unreliable network infrastructure, and unstable electrical power),[13] and African nations (device access limitations, high internet access costs, and low interest among educators).[14]

Worldwide, numerous studies have examined the pedagogical effectiveness of virtual learning environments; however, a significant gap remains regarding the commonly used online platforms in Iran's higher education, especially in medical universities. Due to Iran's unique technological ecosystem and partial isolation from global online platforms, the international literature does not fully reflect the Iranian experience. Moreover, existing Iranian publications have mainly focused on user satisfaction or student performance, without providing a systematic overview of the types, accessibility, and institutional adoption of these platforms.

Establishing this descriptive foundation is necessary before doing empirical effectiveness studies, as it gives us a baseline insight into the technological landscape and informs the development of sustainable, locally adapted e-learning strategies for the post-COVID.

A significant gap exists in the literature regarding the specific virtual platforms widely used in Iran during the COVID-19 pandemic. To address this, the present review systematically identifies the platforms most commonly used in Iranian medical universities and discusses the future trajectory of online learning in the post-pandemic era.

Materials and Methods

Ethical Approval

This study was approved by the Research Ethics Committee of Golestan University of Medical Sciences, Golestan, Iran, which follows the Helsinki Declaration of 1975 (IR.GOUMS.REC.1403.035).

Narrative Review Approach

This review used a narrative literature review approach to explore the research question: What were the most well-known virtual education platforms in Iran during the COVID-19 pandemic? The narrative review method was chosen because it offers flexibility in defining the literature that can be synthesized; thus, it can also provide a broad overview of topics that are not widely recognized. A narrative literature review is also very useful because it allows for the iterative development of our research question and search strategy, as new knowledge emerges during the review process. The review was conducted in 2024, and its goal was to identify the common virtual educational platforms used in Iranian universities during the pandemic.

Why Was This Methodology Selected?

A narrative review design was chosen because it can synthesize diverse literature from qualitative, quantitative, or mixed methods, and highlight alerts or nuances of changes and knowledge in an evolving concept, which in this case is virtual education platforms. The nature of a narrative literature review allows for addressing the complexity of many challenges and barriers to examining virtual education platforms when rigid systematic review protocols are used.

Inclusion Criteria

- Studies examining the various virtual education platforms and the obstacles and challenges faced by virtual education platforms in Iranian universities, using qualitative, quantitative, or mixed methods approaches.
- Articles published in either Persian or the English language, including descriptive studies, qualitative studies, reviews, and descriptive-analytical articles.
- Full-text articles that relate to virtual education platforms as a result of COVID-19 during the pandemic.

Exclusion Criteria

- Articles in languages other than English and Persian.
- Studies with no full-text access.
- Studies that do not seek to obtain the objectives of this review in regard to virtual platforms.

Search Strategy

A comprehensive search of relevant Persian and English articles was conducted through databases (ie, Medline, EMBASE, Scopus, Web of Science, ERIC, SID, CIVILICA, and PubMed) from 2020 to 2024. The following keywords were used: "COVID-19", "virtual learning", "online learning", "distance learning", "post-COVID infection", "real and virtual simulation", and "educational platforms". The goal was to examine the various types of virtual education implemented at Iranian universities since the start of the COVID-19 pandemic.

Selection and Review Process

We searched all the mentioned databases for the relevant studies. Then, we reviewed the two reviewers' evaluations of a relevant file with the articles' titles and abstracts, by two reviewers. We screened the study abstracts to select studies that met the review criteria for full review. Next, we obtained the full texts of the selected meta-studies and assessed them, then compiled our list of studies to include. We eliminated texts that were not fully relevant. If two reviewers disagreed on a study, a third reviewer was consulted. The article selection was not restricted by language. A broad search was conducted to cover potential articles related to the research questions including those referring to any part of the virtual platform used during the COVID-19 pandemic. After a systematic review of each database, we imported the identified items into EndNote X8 software.

We conducted a broad search to find potential articles related to the research question, and the reported articles were the best matches that referenced any aspect of the virtual platform during the COVID-19 pandemic.

After a thorough search of each database, the identified items were input into EndNote X8 software (Clarivate Analytics, PA, USA).

The main data collected included the name of the platforms, manufacturing country, and company, year of accessibility, advantages, and disadvantages.

Data Extraction and Analysis

Data points identified included: platform name, manufacturer (country and company), year of access, strengths, and limitations. We continuously analyzed the data using thematic synthesis to identify patterns and gaps in the literature. We maintained reflexivity throughout the process by recording decisions that influenced data interpretation.

Justification for Scope and Boundaries

The scope of this review was iteratively defined to balance comprehensiveness and feasibility while adhering to guiding principles. This review did not aim for an exhaustive account of everything related to this topic but sought thematic saturation by including studies that specifically addressed virtual platforms during the COVID era in Iran.

Limitations of the Review

The review employed a broad search strategy, but limiting the inclusion to only English and Persian articles might have restricted the perspectives captured. Future reviews could be improved by attempting to include studies published in other journals or conducting a systematic review for comparison. Additionally, including only full-text articles may have excluded potentially relevant research that was inaccessible, which subsequently narrowed the review`s scope.

Results

Demographics of the Included Studies

A preliminary search identified 100 studies discussing virtual education during the COVID-19 pandemic. After applying the inclusion and exclusion criteria, 55 studies were selected for analysis. Of these, 33 focused on virtual education in Iranian universities, while the remaining studies included countries such as Sri Lanka, Pakistan, the United States, and others. The studies specific to Iran mainly examined the most commonly used process elements of virtual education platforms; in contrast, studies from other countries tended to be more comprehensive in covering knowledge and various elements.

Most (77%) of the studies in the review were published after 2020, indicating a recent increase in research on virtual education during the pandemic.

Virtual Educational Technologies

Educational technology (hardware and software) was crucial for enabling virtual learning during the pandemic.[15] In Iran, virtual education was carried out using various technology platforms tailored to the education levels of children and adolescents, ie:

- Elementary school education: Virtual education was delivered through television broadcasts and mobile learning platforms. Shad was the main mobile-based platform used throughout Iran.
- Higher education: NAVID, VESTA, and MOODLE became the main online platforms for universities, as WhatsApp became an official software application that was initially used for messaging during medical university education programs, and then for general education in higher education programs, but was later replaced by NAVID as the primary platform for medical education systems.[2,16]
- Virtual Classes: Virtual classes like Canvas, Blackboard, and Moodle are key for accessing course materials. They offer discussion boards and assignments, similar to traditional classrooms. This method boosts online communication and teamwork between students and instructors.[17,18]
- Augmented Reality (AR) and Virtual Reality (VR): AR and VR are increasingly used in fields like science, engineering, and healthcare. They create immersive experiences, allowing students to engage with virtual objects and visualize concepts.[19,20]
- VR uses hardware and software to create the feeling of being in another environment. Its main traits are immersion and interactivity, which enhance learning outcomes by boosting engagement and skill development.[21]
    - AR adds digital elements, like 3D objects, to the real world. This improves interaction and learning experiences in education.[22]

- Artificial Intelligence (AI): AI tools, such as chatbots and virtual assistants, now play a role in education. They provide personalized support, answer questions, and give feedback. AI also tracks student engagement and generates reports, helping instructors understand performance and adjust their teaching for better results.[23,24]

Virtual Education Platforms

A platform in technology is a place for speaking, performing, or using tools. It can be hardware or software that supports other technologies. Examples include computers, laptops, mobile phones, and operating systems like Android and Windows. A virtual platform is an online space that offers specific services.[25]

Online Learning Platforms

During the pandemic, online learning platforms became a key method for education. There is not a complete list of these platforms in our country. However, some common ones in Iran include Zoom, Google Classroom, SKY room, Big Blue Button, Skype, Google Meet, Navaid, and Gharar (Figure 1).

1. **Adobe Connect**: This commercial software from Adobe launched in 2018. It offers high-speed access for many users in training sessions. However, it has key drawbacks. First, it is not free. Second, sanctions may restrict access in Iran. Another issue is that users cannot type in Persian in the chat, which disrupts class interaction. Frequent sound disconnects are also a problem. Despite these issues, it has features like file sharing and desktop sharing in a reduced window mode[26,27] (Table 1).
2. **Sky Room**: This software is from Mahbang Pars Technology Company and Nasim Damavand Communications Company. Used since 2019, it is Iranian and well-supported. The software is in Persian and avoids the typing issues found in Adobe Connect. However, Sky Room has weak infrastructure, limiting simultaneous videos. Major problems include audio issues, frequent disconnects, hardware shortages, and installation difficulties. It offers desktop sharing, slideshows, whiteboards, audio-video communication, and audio-video file sharing (Table 1).[26,27]
3. **Skype**: A free software from Microsoft, available since 2014, is used for education, conferences, telemedicine, and telecommunications. Skype is popular due to its stable, high-quality communication. While it has a commercial version, the regular version lacks a whiteboard. Direct file presentation requires screen sharing. The commercial version operates as Microsoft Teams (Table 1).[26,28,29]
4. **Big Blue Button**: This is an open-source web conferencing platform from Big Blue Button Company. Available since 2020, it was designed for online education. Programmers can customize it by changing the code. It includes features like chat messaging, live audio, and video streaming for effective virtual classroom management. Some Iranian companies have installed it on their servers and offer it for free. The software supports online polls and tests, but needs a strong server for installation, costing at least 500,000 tomans a month. Audio disconnects are a major issue, along with other audio and microphone problems (Table 1).[26,30]
5. **Google Meet**: This is a freemium software from Google, available since 2017. It can host up to 100 people per session. A key benefit is its high privacy and security, making it very popular. Google Meet works on laptops, tablets, desktops, and phones. It's part of Google Workspace, so anyone with a Google account can use it for free. However, drawbacks include decreased image quality due to internet issues, audio and video delays, a one-hour session limit, and the 100-participant cap (Table 1).[31,32]
6. **Gharar**: This free software, from the Resid Pardazesh Hoshmand Company, has been available since 2020. It is the only Iranian video conferencing service with mobile software. Its advantages include a simple, high-quality, universal environment for online meetings, making it reliable for sessions. It also offers free online class hosting on the Gharar platform, with internet traffic use at half the normal rate. However, it only allows about 50 to 60 participants in a class. The video quality depends on internet speed, supporting an average of 15 clear images based on that speed (Table 1).[33]

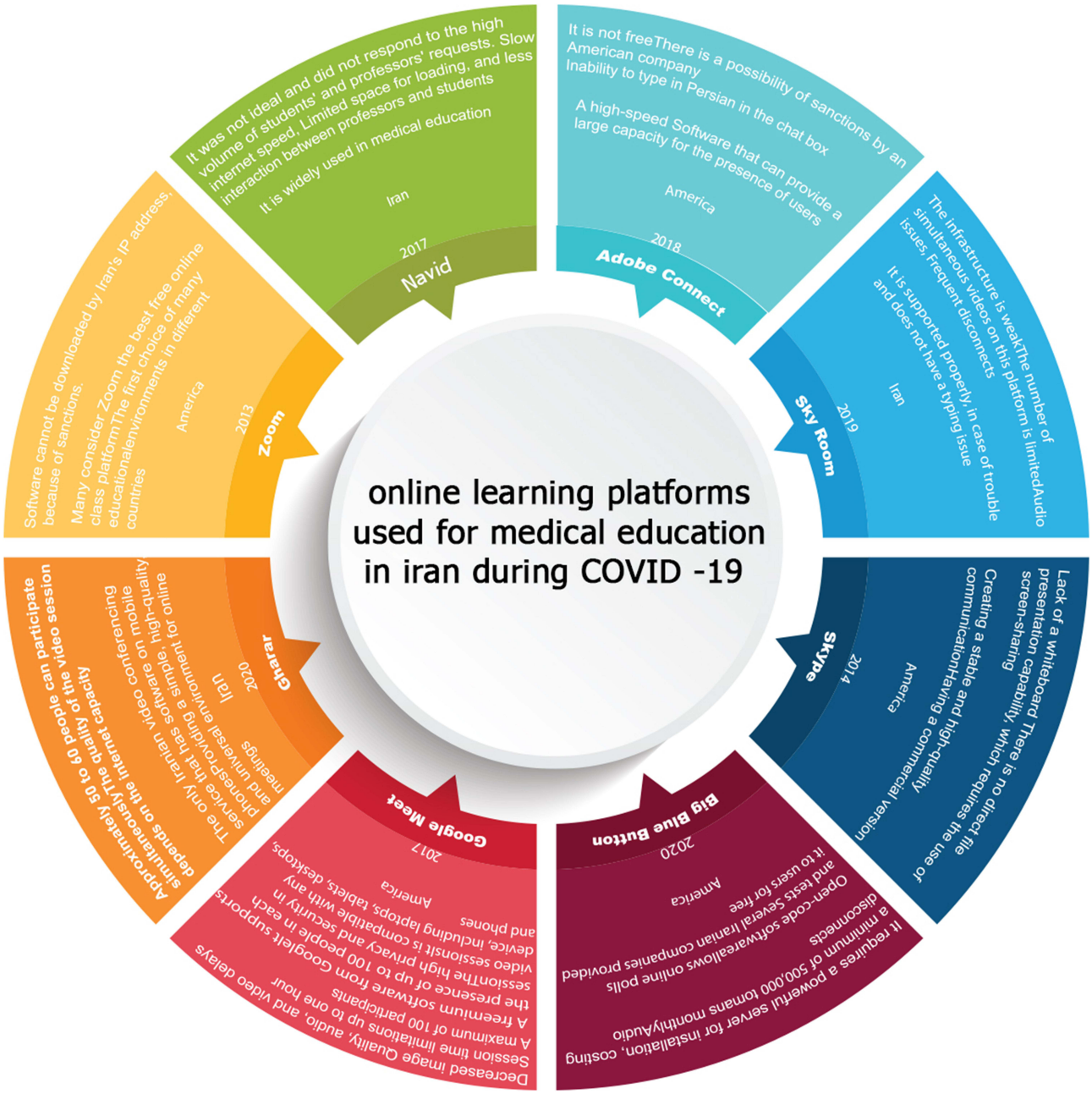

Figure 1 Comparative analysis of the e-learning platforms in Iranian medical education during the COVID-19 crisis.

7. **Zoom**: Many people regard Zoom as the premier free platform for online classes. Launched in 2013, this software started as an online teaching tool and has evolved into a fully web-based application for video conferencing. It offers various features, including meetings, webinars, audio conferencing, and live chat, which enhance interaction between teachers and students. Moreover, a range of benefits and tools allows students to engage in diverse learning methods. As a result, the Zoom platform has become the preferred choice in many educational settings across different countries, enabling integration with other software like Skype and Google Calendar. However, it is important to note that the software is geographically restricted and cannot be downloaded in Iran due to sanctions (Table 1).[34–36]

Table 1 Comparison of Online Learning Platforms Used for Medical Education in Iran During COVID-19

Name of Platforms	Company	Manufacturer Country	Access Since the Year	Challenges	Prominent Features
Adobe Connect	Adobe Company	America	2018	It is not free There is a possibility of sanctions by an American company Inability to type in Persian in the chat box	A high-speed Software that can provide a large capacity for the presence of users
Sky Room	Mahbang Pars Technology Company and Nasim Damavand Communications Company	Iran	2019	The infrastructure is weak The number of simultaneous videos on this platform is limited Audio issues, frequent disconnects	It is supported properly in case of trouble and does not have a typing issue
Skype	Microsoft	America	2014	Lack of a whiteboard There is no direct file presentation capability, which requires the use of screen-sharing	Creating a stable and high-quality communication Having a commercial version
Big Blue Button	Big Blue Button Company	America	2020	It requires a powerful server for installation, costing a minimum of 500,000 tomans monthly Audio disconnects	Open-code software allows online polls and tests Several Iranian companies provided it to users for free
Google Meet	Google	America	2017	Decreased image quality, audio, and video delays Session time limitations up to one hour A maximum of 100 participants	A freemium software from Google It supports the presence of up to 100 people in each session The high privacy and security in video sessions It is compatible with any device, including laptops, tablets, desktops, and phones
Gharar	Resid Pardazesh Hoshmand	Iran	2020	Approximately 50 to 60 people can participate simultaneously The quality of the video session depends on the internet capacity An average of 15 clear images is supported based on the participants' internet capacity.	The only Iranian video conferencing service that has software on mobile phones Providing a simple, high-quality, and universal environment for online meetings Internet traffic consumption is also calculated at half the rate
Zoom	Zoom	America	2013	Software cannot be downloaded by Iran's IP address because of sanctions.	Many consider Zoom the best free online class platform The first choice of many educational environments in different countries Allows establishing a connection between it and other software such as Skype, Google Calendar, etc
Navaid System (LMS)	Virtual University of Medical Sciences	Iran	2017	It was not ideal and did not respond to the high volume of students' and professors' requests. Slow internet speed, limited space for loading, and less interaction between professors and students	It is widely used in medical education

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8. **Navaid System (A Learning Management System, LMS)**: This system was developed before the coronavirus outbreak and was utilized in a limited capacity. However, following the widespread impact of COVID-19, it became extensively employed in medical education. The primary features of the Navid system encompass course content, user management, course offerings, instructors, facilities, reporting tools, course calendars, learning paths, and discussion forums. This platform enables users to submit assignments on time and provides a mechanism for receiving prompt feedback from instructors regarding assignments and other resources. Despite its capabilities, the system was not fully adequate, especially in accommodating the high volume of requests from students and professors nationwide. Some of the challenges included slow internet speeds, limited storage capacity, and reduced interaction between instructors and students (Table 1).[37–39] During the COVID-19 pandemic, users rated NAVID positively for its comprehensive e-learning features, the quality of student and educational services, overall usability, and the flexibility to learn anytime and anywhere, which were its main advantages. However, despite these favorable ratings, NAVID did not fully meet students' expectations for practical learning in medical English. Notable drawbacks included a lack of face-to-face interaction, absence of real-time communication, and diminished engagement and personalization, which were cited as primary concerns.[40]

In a study, the "Shad" system was identified as the most widely utilized platform in education and training, while the "Navaid" system emerged as the predominant choice in medical science education.[16] However, it remains unclear which educational platforms were the most popular in Iran during the coronavirus pandemic.

The Shad system, recognized as a national platform for distance learning, offers a free and centralized resource for virtual classrooms, examinations, and interactions between teachers and students. It is estimated that over 15 million students in Iran utilize the SHAD platform. Nevertheless, the system faces challenges such as inaccessibility, low adoption in rural provinces due to inadequate internet infrastructure, a lack of smartphones or tablets, and unreliable network connectivity.[41]

A recent study assessed the accessibility indices of various educational platforms according to an international standard list. The findings revealed that, in terms of compliance with general accessibility guidelines, Skype, Skyroom, Big Blue Button, Adobe Connect, Google Meet, and Gharar achieved the highest rankings, placed 1st to 6th, respectively. When specifically evaluating accessibility, Skype, Adobe Connect, Big Blue Button, and Gharar were ranked collectively in the top position, followed by Google Meet and Skyroom in 4th and 5th place, respectively.[33]

Teacher Readiness and Pedagogical Shifting in Virtual Medical Skills Training

When COVID-19 pushed schools to go virtual, learning changed drastically. This shift exposed serious gaps in teaching and learning. Medical skills training, which relies on active learning, faced unique challenges. Educators were expected to adapt quickly without preparation.[42] Virtual learning platforms stepped in as a temporary solution. However, many students struggled because faculty could not adjust their teaching methods for online learning.[43,44] These issues highlight three major challenges in teacher education at Iranian medical universities:

The pedagogical gap: Many medical educators lacked training in creating digital learning experiences for skills training, like patient assessment and surgical procedures. They found it hard to translate these into a virtual format.

Assessment gap: Many virtual learning platforms did not support competency-based assessments. Educators often relied on indirect assessments rather than directly observing practices. This issue has been noted in previous international teacher education research.

Equity and access gap: Access to reliable technology varied greatly among teachers and schools. This disparity created inequalities for both educators and students, affecting their experiences in teacher training, both locally and globally.[45–47]

This study shows that simply adopting platforms is not enough for virtual medical education. Sustainable digital medical education needs:

- Professional development for faculty in digital pedagogy.
- A redesigned curriculum that blends asynchronous theory with synchronous practice for skills.
- Policy guidelines to build institutional infrastructure and support teacher training.

Effectiveness of Virtual Education During the Pandemic and Teachers' Satisfaction

The effectiveness of virtual education was mixed, with benefits and challenges identified during the pandemic.

- Benefits:
  - Flexibility and accessibility of learning.
  - Continued education during lockdowns and social distancing measures.
  - Students appreciated time savings, reduced costs, and flexibility.
- Challenges:
  - Technological issues (eg, Slow internet, platform glitches).
  - Low student participation and unequal access to resources.
  - Limited face-to-face interaction and low engagement in some cases.
- Teacher's satisfaction:

Teacher job satisfaction is different from other fields. It relies less on measurable incentives, like salary, and more on student relationships and long-term impact. During the COVID-19 pandemic, teacher job satisfaction and online teaching effectiveness both declined. This change was linked to stress from income loss and disrupted routines. The only factor that improved teaching effectiveness, without affecting job satisfaction, was learning new digital skills. Institutional support and access to mental health services were crucial during crises.[48]

Factors influencing teachers' satisfaction include:

- Confirming expectations (whether or not online instruction fulfilled expectations).
- Computer self-efficacy (teachers' perceptions of confidence in their digital skill level).[49]

Iran is a Model for Low-Resource Medical Education

Iran faces many structural challenges in medical education, similar to low- and middle-income countries (LMICs). This makes it a valuable case study for other low-resource settings, especially during the sudden shift to virtual learning in COVID-19. Three main challenges include limited broadband access, international sanctions, and lack of devices. Lessons from Iran can be adapted with minimal changes.

- Infrastructure and Affordability: Limited broadband access affects 42.1% of rural areas. The national average speed is only 18.4 Mbps. In underserved regions, expensive mobile data is a barrier.[50] So, low-bandwidth options like offline content caching and SMS assessments were needed. These strategies create a model for other middle-income countries (LMICs) where similar cost barriers (data costs >5% of income) impede digital learning.
- Sanction and Local Solutions: Full international sanctions block access to global cloud and software systems. Iran has developed local, open-source solutions hosted on national servers (Navid LMS, BigBlueButton on Apache servers). This approach serves as a model for areas with sanctions or currency issues where foreign Software as a Service (SaaS) solutions cannot be used.
- Device Accessibility: The digital divide is clear when students lack personal computers and devices. Universities are responding with innovative solutions like device lending schemes and mobile-first learning platforms. These actions address the unfair access to digital learning seen in many low-resource settings during the pandemic.[51]

Discussion

All countries recognized the need to improve their online education systems during the coronavirus crisis. This is especially crucial for developing nations to enhance their infrastructure.[52,53]

Iranian universities faced a major challenge. They had no time to choose the right platform, so they focused on building the necessary infrastructure and finding suitable educational tools.[54]

This study examined popular virtual platforms for distance learning during COVID-19. These included Adobe Connect, Sky Room, Skype, Big Blue Button, Google Meet, Gharar, Zoom, and the Navid System. We discussed their advantages and disadvantages. It became clear that Navid, Adobe Connect, and Sky Room were the top choices in medical universities during the pandemic.[38] Other studies also noted the Navid System as a leading online teaching tool in medical education.[16] One key limitation of this platform is its asynchronous education capability. Over time, many medical universities shifted to other platforms like Adobe Connect.[39] Some restrictions of the Navid system make it less ideal. It struggles to handle the high volume of requests from students and professors nationwide. Other issues include slow internet speed, limited loading space, and less interaction between professors and students.[16]

In one study, researchers compared communication anxiety and oral skills among English as a Foreign Language (EFL) learners. They looked at internet-based applications like Big Blue Button and Skype for online instruction. The results showed that the Skype group performed better than the Big Blue Button group.[30]

Users of Google Meet found it easy to use and helpful. This ease and usefulness greatly influence user attitudes. The adoption of Google Meet came before a decline in student numbers at universities. After using it, users developed a new, positive view of the platform.[32]

The two Iranian platforms showed that Gharar ranked lower in general guidelines, online documentation, and support services than others like Adobe Connect, Big Blue Button, and Sky Room. Sky Room also struggled in inputs, guides, and support services.[33]

Data on the most used platforms in medical education is limited. However, one study found that during the COVID-19 pandemic, Navid, Adobe Connect, and SkyRoom were the top choices in Iranian medical universities. The authors noted major challenges: unequal access to technology, low digital literacy among students and faculty, and a lack of meaningful student-teacher interaction. They also pointed out that online systems did not provide enough training for practical clinical skills and internships. The study concluded that integrating educational simulations and strong online support is essential for teaching clinical courses and enhancing interaction in digital learning.[38]

The COVID-19 pandemic was a significant challenge for universities and educational institutions. Virtual education, as a powerful and flexible tool with great potential, in the future will play a big role in education.[55] However, virtual education has been adopted to continue education during the COVID-19 crisis. We believe that the crucial benefits of this type of learning make it a complement to traditional classroom lectures in the future.

E-learning and virtual education were growing before the pandemic. The crisis strengthened their acceptance and usage.[56] Despite challenges, virtual education offers clear advantages. These include distance learning, attending classes from anywhere, reduced costs, and easier access for faculty. Users can also take special courses regardless of location.[57]

This study focuses on Iran's unique socio-technical issues, but similar challenges exist worldwide. The UNESCO GEM Report 2023 highlights ongoing digital divides in LMICs. Only 40% of primary, 50% of lower secondary, and 65% of upper secondary schools have internet access. This leaves at least half a billion learners without stable online platforms during crises like COVID-19. Research shows that the digital divide in education is not just about devices. It also depends on teacher skills and infrastructure—issues that reflect Iran's internal disparities.[58] For contexts with limited bandwidth, evidence supports the use of offline digital learning platforms as a viable solution, providing a strategic model for low-resource countries such as Tanzania.[59]

Education cannot rely only on face-to-face methods. Despite recent pushes, we still lack the necessary infrastructure. We need to expand the national internet network, boost its speed, and create new educational platforms. These platforms should support interactive and student-centered teaching in universities. Before we can measure the impact of virtual education, we must first establish this infrastructure. We must complete these projects before making decisions to achieve our educational goals. While we have made progress in virtual education and many are moving in this direction, we must not overlook its importance in universities after the COVID-19 pandemic.

Sanctions as a Double-Edged Sword for Iran's Digital Ecosystem

The sanctions on Iran act as a double-edged sword, pushing a shift to domestic digital platforms. However, these platforms face challenges, like limited global integration and tech lag. These pressures have sparked investment and innovation in local technologies, boosting self-reliance.

These challenges may also present future opportunities. By focusing on and enhancing its own tech capabilities, Iran can grow these platforms into stronger, competitive entities. This shift could turn a defensive need into a foundation for lasting digital resilience and growth.

Challenges Ahead

Virtual education has many benefits, but also faces challenges for teachers and learners. Transitioning to online learning has revealed issues like the digital divide, hardware and software problems, limited social connections, and low student motivation. Solving these challenges requires teamwork. Teachers, policymakers, and tech providers must work together to ensure everyone has fair access to quality education.

The rapid growth of virtual learning platforms (VLP) in medical schools across Iran during the COVID-19 pandemic shows both technological progress and significant challenges. These include issues with pedagogy and educational policy in teacher training. While virtual platforms allowed for emergency remote teaching, developing structured faculty programs to improve digital teaching skills is crucial. This remains a key topic in educational literature about teacher preparation.

The limits of platform features, like low interactivity and assessment, show a gap between technology and effective medical education. We must also think about the policy effects of this shift. The uneven use of VLPs in Iran reflects a wider trend. Institutions often focus on quick fixes for measurable issues instead of teaching quality. Future teacher training should include digital literacy. This will help educators use VLPs effectively. JET has long pushed for evidence-based policy changes in this area.

Future Implications

The need for virtual teaching during the COVID-19 pandemic sped up online learning in traditional education. This shift could reshape education, leading to a hybrid model. This model combines traditional classes with online elements.[60] Literature suggests that, despite issues in virtual education, universities should harness the positives and address student concerns to boost satisfaction.[61] Educators need to adapt their methods for this mixed model and use new technology to enhance student learning. This was a chance for teachers to foster significant growth and improvement.[62]

The pandemic has sped up changes in education. It introduced virtual methods as effective ways to keep learning going during disruptions.[62] Despite the challenges, acceptance of virtual teaching has led to new and creative approaches. Moving forward, universities, researchers, businesses, and policymakers must collaborate to tackle issues in online learning. Together, they can build a stronger and more efficient educational framework.[63]

More effort is needed to boost teachers' motivation and create a positive view of this new technology. Given the ongoing challenges in distance learning, it's crucial to fully use these tools. We should explore their potential to enhance the educational experience.

Evidence-Based Recommendations

1. Platform selection and technological adaptation: Successful distance education in low-bandwidth areas relies on lightweight, mobile, and open-access platforms. Using apps that require minimal technology supports learning continuity and reduces the digital divide for students with limited connections.
2. Capacity building of the faculty: Studies show that faculty digital literacy and teaching methods are more important than the platforms used. Structured ongoing education is essential for developing learning design, student engagement, and digital assessment methods. This ensures quality distance learning.
3. Institutional and normative support: Research highlights the need for institutions to provide stable technical support for equitable access. Platforms should adapt to academic needs. Recommendations include integrating established Learning Management Systems with existing ones, considering university culture and available tech resources.
4. Student Engagement and Equity: Structural issues like poor connectivity and lack of exposure to online learning hurt students in underserved areas. However, asynchronous learning with offline materials can help reduce inequities and improve overall student participation.

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5. Research and Evaluation: Descriptive studies have gathered data on digital platforms, but more empirical research is needed. This should focus on the acceptability and effectiveness of various virtual learning methods. Future studies should explore learning gains, user satisfaction, and the cost-effectiveness of these technologies. This data will guide evidence-based decisions in digital education. It will also help create recommendations for policy-makers and institutions to support resilience, equity, and sustainability in virtual education within under-resourced systems.

Conclusion

This study looked at virtual learning platforms for medical education in Iran during COVID-19. Our findings show that the top choices platforms like Navid, Adobe Connect, and SkyRoom faced soe challenges. These issues stemmed from technical limitations, economic barriers, and international sanctions.

The main problems were not just about teaching but also about infrastructure and geopolitics. Weak internet connections caused audio and video issues. Restrictions on platform features, such as session time limits and missing tools, added to the difficulties. High server costs worsened the situation. Most importantly, these platforms could not support practical clinical skills or direct interaction, which are essential for medical training. International sanctions made matters worse by blocking software downloads and posing a threat of service termination from US companies. While these platforms offered some theoretical instruction, they were not enough.

The Iranian experience teaches a vital lesson for low-resource settings: survival is possible, but not enough. Future readiness requires moving beyond basic online models. With ongoing investment in technology, Iran can turn current challenges into a foundation for long-term digital growth.

We suggest shifting to resilient hybrid education. This includes offline-capable LMS to avoid connectivity issues, high-fidelity simulations for practical skills, and targeted digital literacy training. Without this focused integration, online medical education may continue to reinforce the skill gaps and inequities highlighted by the pandemic.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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