Review Article

(Post-)pandemic online education in Algeria: A scoping review

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ARTICLE INFO	ABSTRACT
	The COVID-19 pandemic accelerated the adoption of online education in Algeria, where e-learning was previously limited. This scoping review synthesizes evidence on the implementation and challenges of online education in Algerian higher education, examining emergency remote teaching methods, perspectives on e-learning platforms, tools, and assessment, and factors influencing teachers' and students' attitudes toward online learning. A systematic research was conducted in Scopus, Web of Science, and ASJP databases for studies published between 2020-2025. Following preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews guidelines, 65 studies were included for analysis. The review identified major challenges related to infrastructure, technology, pedagogy, and motivation. Key themes emerged around emergency teaching methods, e-learning platforms and tools, e-assessment, and attitudes toward online learning. Studies revealed a preference for blended approaches and highlighted needs for improved digital infrastructure and skills training. This review provides a comprehensive overview of post-pandemic e-learning implementation and challenges in Algerian higher education, offering crucial insights for policymakers, educators, and researchers seeking to advance remote and blended learning in Algeria.

Keywords: e-learning, remote teaching, Algeria, higher education, scoping review

INTRODUCTION

The COVID-19 pandemic necessitated an abrupt shift to online learning worldwide. In Algeria, universities faced immense challenges in transitioning to remote teaching as e-learning infrastructure and policies were limited previously. Prior to the pandemic, e-learning methods were nascent in Algerian higher education. Few universities offered blended or fully online programs, with most adopting traditional face-to-face instruction (Kaid, 2021). E-learning policies emphasized supplementing classroom teaching with digital tools, yet systemic implementation was inadequate. Universities lacked robust platforms, equipment, training, and quality assurance mechanisms for online education.

When the pandemic hit, Algerian universities were compelled to deliver courses remotely with little preparation, revealing gaps and obstacles (Bara & Baghzou, 2022; Benabdallah, 2022; Ghobrini et al., 2022). This abrupt shift uncovered opportunities for enhancement and innovation in online teaching approaches, tools, and policies. However, existing literature predominantly focused on crisis-response, with limited extension to strategic planning for the post-pandemic future of e-learning (Benjelloun, 2022; Matsieli &

Mutula, 2024; Sato et al., 2024). Emerging scholarships from 2025 begins addressing this gap through systematic examinations of long-term emergency remote teaching outcomes. Notably, Berens and Hobert (2025) and Deng and Yang (2025) reveal a paradox: while students achieved unexpected cognitive gains during emergency transitions, they simultaneously experienced significant affective costs including isolation and fatigue. Building on these findings, Olawale et al. (2025) argue that moving beyond emergency measures requires strategic digital transform addressing both infrastructure gaps and comprehensive psychosocial support systems.

To address this gap, this paper provides a comprehensive scoping review synthesizing emerging evidence on online education in Algerian higher education from 2020-2025. It reviews 65 studies across journals, books, and conferences to illuminate key themes. The review delineates prevalent infrastructure, technical, pedagogical, and psychological challenges inhibiting effective online education (Bashitialshaaer et al., 2021). Next, it summarizes pandemic e-teaching methods and proposed innovations (Ghobrini, 2020). It also examines research on e-learning platforms, tools, motivation, and assessment (Yahiaoui et al., 2022). Finally, it

analyses studies on teacher and student experiences with remote learning (Khattala & Houichi, 2021).

This scoping review synthesizes current evidence on online education in Algeria, contributing a valuable consolidation of the literature. The aims are to:

(1) elucidate contemporary e-learning implementations in Algerian higher education,

(2) map the objectives and contexts of emergency remote teaching methods enacted during the COVID-19 pandemic,

(3) analyze researchers' perspectives on challenges in improving online learning conditions in Algerian universities, and

(4) consider future prospects for scaling e-learning post-pandemic.

The findings provide key insights for educators, researchers, and policymakers working to advance remote and blended learning modalities in Algeria and beyond. By compiling evidence and examining objectives, contexts, challenges, and future directions, this review serves as an important reference as stakeholders seek to expand access, improve quality, and increase the impact of online learning.

METHODS

To map existing literature in a retrospective process, a scoping review was conducted following the five-stage framework outlined by Arksey and O'Malley (2005): identifying the research question, identifying relevant studies, study selection, charting the data, and collating, summarizing and reporting the results. The review adhered to the preferred reporting items for systematic reviews and meta-analyses extension for scoping reviews guidelines.

Search Strategy

A systematic search was conducted across several databases including Scopus, Web of Science, and the Algerian Scientific Journal Platform. The search syntax included combinations of the following terms using Boolean operators: "e-learning", "online learning", "distance education", "remote teaching", "Algeria", "higher education". The search was limited to studies published between 2020-2025, with particular attention to experimental and critical publications examining post-pandemic strategic development and long-term outcomes of emergency remote teaching.

Inclusion and Exclusion Criteria

Studies were included if they:

(1) focused on online learning and teaching in the context of the pandemic,

(2) were conducted in Algerian higher education,

(3) were empirical studies using quantitative, qualitative, or mixed methods,

(4) were written in English, and

(5) were journal articles, book chapters, or conference papers.

Studies were excluded if they:

Figure 1. String of search keywords (Boolean operators "and/or") (Source: The authors' construct)

(1) did not involve tertiary or university teachers or students,

(2) related to distance learning in a pre-pandemic context, and

(3) were case reports, meta-analyses, systematic reviews, opinion pieces, commentaries, editorials, or grey literature.

Study Selection

Each researcher conducted an independent review of the citations, performed abstract screening, and conducted a thorough examination of the full-text materials. Any disparities or disagreements were addressed through open discussion and resolved by reaching a consensus among the team members.

Figure 1 shows the three-keyword string probabilities for all the search attempts. We collected 245 studies to be filtered and removed duplicates. Only 98 studies were identified for full-text review, of which 33 items were excluded for reasons related to study sample, educational level, research design, or not addressing e-learning directly as a variable. The preferred reporting items for systematic reviews and meta-analyses (PRISMA) flow diagram (see **Figure 2**) illustrates the selection process.

Charting, Collating, and Reporting

The research team systematically collected metadata in accordance with specific criteria, including the year of publication, the country in which the study was conducted (context), study design, assessment tools employed, key findings, and conclusions. This comprehensive review aims to provide an insightful overview of the available evidence concerning the state and effectiveness of e-teaching and e-learning in the context of Algeria.

All pertinent data were meticulously arranged and presented in tabular form, and their accuracy and relevance were collectively verified by all team members. Furthermore, the selected studies were subjected to a summarization process wherein the characteristics and outcomes reported in each study were succinctly outlined. Additionally, the quality of the studies was assessed by evaluating the soundness of their methodologies and the validity of their results to identify high-quality research contributions. The review data were pre-processed for categorization based on keywords in titles and abstracts (see **Figure 3** and **Figure 4**).
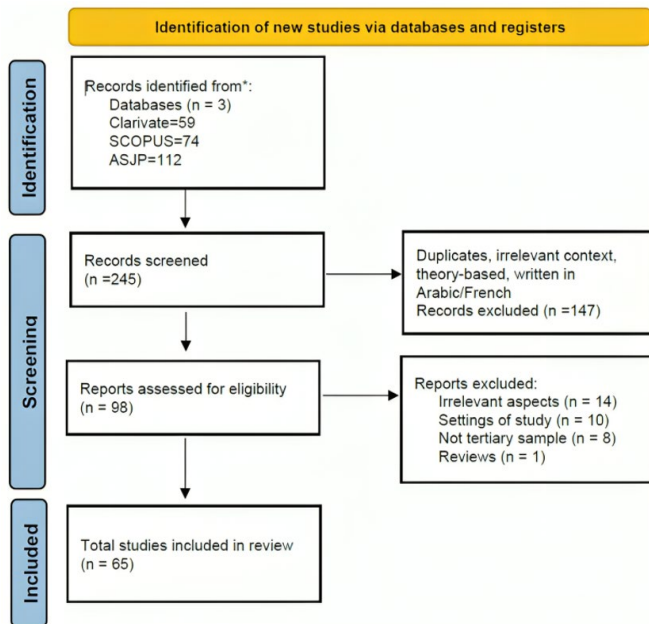
Figure 2. PRISMA Flow Chart of Data Selection Procedure (Source: The authors' construct)
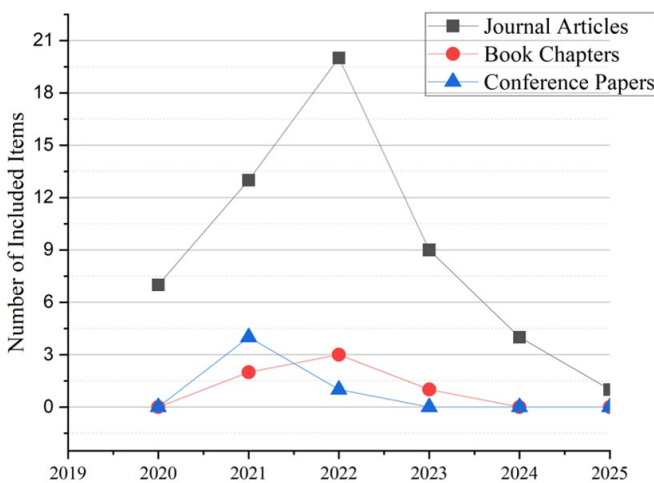

Figure 3. Distribution of included studies (type and year) (Source: The authors' construct)

Figure 4. Main-keyword distribution of included studies (Source: The authors' construct)

RESULTS

Challenges of Online Learning/Teaching

Online learning in Algeria presents a range of challenges for both teachers and students, as evidenced by multiple studies. These challenges can be categorized into several key areas as presented below.

Infrastructure and organizational challenges

A significant issue revolves around the inadequacy of infrastructure and institutional support for online education, as highlighted by recent studies conducted by Belkacemi and Belhocine (2023), Khattala and Houichi (2021), and Zitouni (2022). These research findings shed light on the substantial challenges confronting educational institutions in this context. Specifically, these challenges encompass the short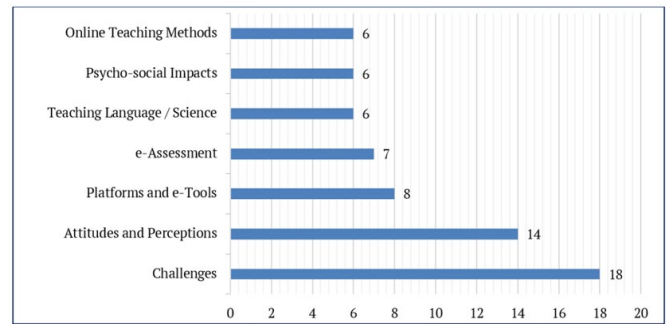age of essential equipment and the unreliability of internet connectivity. It is noteworthy that a considerable number of students do not have access to computers or smart devices, significantly hindering their capacity to engage meaningfully in online coursework.

It is noteworthy that a considerable number of students do not have access to computers or smart devices, significantly hindering their capacity to engage meaningfully in online coursework. Research examining inclusive and equitable access in higher education institutions confirms that digital transformation must address infrastructure gaps alongside pedagogical readiness to ensure marginalized communities are not further disadvantaged (Matsieli & Mutula, 2024). The scope of these challenges extends beyond simple technological access. Examining developing countries and sub-Saharan African contexts, Assefa et al. (2025) and Kumi-Yeboah et al. (2025) document how affordability barriers, limited digital literacy, and inadequate infrastructure create compounding disadvantages that perpetuate educational inequalities. Geographic disparities intensify these problems, with Gunter's (2025) research revealing that rural students face a 'double burden' of physical isolation compounded by unreliable internet connectivity, frequent power outages, and prohibitively high costs for devices and data.

Technical challenges

Alongside infrastructure issues, technical challenges have played a significant role in the online education landscape. Research by Belkacem and Mokeddem (2021), Boufalta and Touidjeni (2022), Bara and Baghzou (2022), and Benmansour (2022) reveals a range of technical hurdles that have hindered effective online learning and assessment. These challenges encompass issues like slow internet speeds, a lack of technological skills, device compatibility problems, and limited access to digital devices. These technical issues have led to frustration and anxiety, impacting the engagement and performance of both teachers and students in online learning. (Herzallah, 2021; Manseur, 2021; Zekri & Al Moussaoui, 2022).

Pedagogical challenges

The sudden shift to online education uncovered a gap in pedagogical readiness and adaptation. Studies highlight the struggles of teachers to align their teaching methods, materials, and assessments with the online context (Abdelhadi, 2022; Benabdallah, 2022; Miloudi, 2022). Many lacked prior experience in online teaching and were unfamiliar with online course design. This led to challenges in providing

clear online instruction and effective online assessment. Bouhidel (2022) argues that assessment is a difficult and complex task that requires fairness, validity, and feedback. He criticizes online assessment as less effective than traditional assessment, as it poses challenges such as cheating, plagiarism, technical issues, and the need for formal training. Inadequate pedagogical and technical support from educational institutions exacerbated these issues (Kerras & Salhi, 2021).

Psychological readiness and willingness

Beyond the technical and pedagogical challenges, psychological factors have played a significant role in online education. According to Yahiaoui et al. (2022), students' motivation is influenced by personal requirements and the perceived value of e-learning systems. Research by Bassou (2022), Abdelhadi (2022), and Zitouni (2022) found that students often expressed a preference for traditional face-to-face learning, citing feelings of isolation, boredom, decreased motivation, and dissatisfaction with online learning. Students and teachers exhibited varying levels of readiness for online teaching (Mouloudj et al., 2021), with some recognizing its potential while others faced resistance due to a perceived lack of confidence.

In summary, the key challenges of online learning in Algeria encompass inadequate infrastructure and institutional support, technical hurdles like poor internet connectivity, gaps in pedagogical readiness and e-teaching skills, and psychological factors including demotivation, isolation, and preference for face-to-face learning. Overcoming these multifaceted challenges requires concerted efforts across infrastructure upgrades, technology access and training, pedagogical support, and addressing motivational issues.

E-Teaching Methods

In response to the challenges posed by the COVID-19 pandemic, Algerian teachers swiftly embraced e-learning methods to facilitate remote education. This section delves into the methods employed during the pandemic and their potential implications for the post-COVID-19 era.

E-teaching methods during the COVID-19 pandemic

In light of the COVID-19 pandemic, Algerian teachers promptly adopted a variety of e-teaching methods. Among these, an essential method involved utilizing Moodle, an educational platform, to disseminate course materials such as lectures, assignments, quizzes, and feedback to students (Dambri & Mehiri, 2021; Ghounane & Rabahi, 2023; Guemide & Maouche, 2020). Additionally, popular social media platforms such as Facebook, YouTube, Instagram, WhatsApp, and Telegram were employed to share educational content, facilitate online discussions, and conduct workshops (Ghobrini et al., 2022; Ghounane, 2020). Furthermore, Guemide and Maouche (2020) found that teachers also recorded classroom lectures, offering students the flexibility to access them at their convenience. Some teachers utilized media programs like *Altarbia*, supported by *Mobilis* (a phone network provider), to provide free educational resources. Nonetheless, it is imperative to study the long-term use and effectiveness of these methods beyond the pandemic period.

E-teaching methods post the COVID-19 pandemic

Scholars have proposed various strategies to enhance e-teaching post-COVID-19; however, it is important to note that these ideas have not seen widespread adoption, with many educational institutions reverting to traditional in-person teaching (Guessar, 2020, 2021). Nonetheless, these recommendations remain relevant for educators that are keen on integrating technology into conventional teaching practices. Ghobrini et al. (2022) advocate for the adoption of hybrid learning, which combines both in-person and online instruction to provide a more comprehensive learning experience. Another concept involves the development of interactive teaching modules. Ghobrini et al. (2022) assert that while these methods have not yet gained universal traction, they have the potential to revolutionize higher education. This highlights the importance of educators remaining flexible and open to blending technology with traditional teaching, thereby creating engaging learning environments that cater to the evolving needs of post-pandemic students. Comprehensive reviews of post-pandemic educational practices emphasize the importance of integrating educational technology with student wellbeing initiatives and ongoing teacher professional development to navigate this 'new normal' effectively (Sato et al., 2024)

As traditional teaching methods regain prominence in the post-pandemic era, the lessons drawn from e-learning strategies offer valuable insights for the future of education. They emphasize the significance of adaptability and dynamic learning environments within the realm of Algerian education (Guessabi, 2022; Zigh e al., 2022).

Platforms and E-Tools

In response to the shift towards online learning, Benmansour (2022), who investigated the perspectives and attitudes of EFL teachers about using Google Meet in online classes during the pandemic, found overall positive perspectives and attitudes towards using Google Meet, despite facing various challenges. Her research highlighted the importance of teachers' positive perceptions towards online education in facilitating a successful shift to virtual classes. In contrast, Benadla and Hadji (2021) explored EFL students' emotional responses and satisfaction with distance e-learning using the Moodle platform. Their findings revealed that both educators and students displayed a lack of readiness for online learning, and there was a prevailing perception of more drawbacks than benefits associated with this mode of education. Notably, master's students, in particular, exhibited unfavorable attitudes towards e-learning, expressing a preference for in-person classroom interactions and tangible handouts over virtual learning materials. This observation suggests that attitudes towards e-learning may be influenced by the specific platform or mode of delivery employed.

Maaziz and Ghendir (2023) discussed the impact of the COVID-19 pandemic on education and how Algerian universities brought the Moodle platform to the forefront of instruction. The study emphasized the need for attitude change and improved technological literacy among teachers. Similarly, Ghounane and Rabahi (2023) explored EFL students' attitudes towards Moodle in the Algerian context and revealed that difficulties in platform usage contributed to negative

attitudes. Challenges, such as internet connectivity issues and a lack of technical knowledge, were significant factors influencing these perceptions. However, the research also found that online lectures via Moodle positively impacted students' academic achievements.

In comparing social platforms like Facebook and educational platforms like Moodle during the pandemic, Ghounane (2020, 2021, 2022) discovered that Facebook was the most utilized tool for educational purposes, followed by Moodle. Despite this popularity, students expressed a preference for face-to-face interactions and physical handouts over virtual learning materials. To address this, Ghounane (2020) proposed strategies for effectively incorporating Facebook into the teaching and learning process post-pandemic while other studies proposed synergizing social media platforms such as Facebook, YouTube, and Instagram to enhance e-teaching (Ghobrini, 2020; Ghobrini et al., 2022).

To adapt to the pandemic's challenges, Sarnou and Sarnou (2021) explored educators' and students' adaptability to various online platforms like Zoom, Google Meet, and Facebook as alternatives to Moodle for English learning. In similar Arab higher education contexts, Alkandari et al. (2024) examined digital transformation effectiveness in Kuwait, highlighting the importance of digital citizenship behavior and technology adoption strategies applicable to regional educational settings. Throughout these studies, technical challenges and digital literacy emerged as critical factors contributing to negative perceptions of Moodle and other e-learning platforms (Bengueddach et al., 2023).

It became evident that enhancing technological skills and knowledge among both teachers and students was essential to overcoming these challenges and effectively supporting e-learning. Moreover, diversifying digital tools and exploring multiple platforms beyond Moodle were seen as potential strategies to cater to students' preferences and ensure a successful transition to online education. This was further confirmed by Bouhezam (2021) who conducted a study investigating the use of e-learning in Algerian universities during the COVID-19 pandemic, focusing on the opinions of teachers and students. The findings revealed that most students felt e-learning was not adequately utilized during the pandemic, and both teachers and students believed that it should not be restricted solely to the Moodle platform. Additionally, the study highlighted that many teachers did not receive pre-training to effectively use e-learning techniques, indicating the need for more comprehensive support and training for educators in the digital realm. Moreover, reliable and regular internet access was also found to have an impact on teachers' professional satisfaction.

With such challenges, remote learning can present pedagogical and technical difficulties that may demotivate students. Benmansour (2021) conducted a study to explore the use of Zoom and Google Meet as asynchronous learning approaches during the COVID-19 pandemic. The study focused on Algerian EFL students' motivation towards the use of Zoom to bridge gaps and cope with changes in online learning. In this case study, a total of twenty EFL students from Oran University in Algeria participated. The research methodology employed a combination of informal and structured interviews, along with semi-structured questionnaires. The outcomes of the study unveiled generally favorable viewpoints regarding the utilization of Zoom for educational purposes, albeit with certain limitations. The recommendations stemming from these findings emphasized the importance of providing ICT training for students and cultivating positive perceptions regarding online educational platforms.

In the realm of language learning and digital literacy, Assassi and Chenini (2023) directed their focus towards Computer-Assisted Language Learning (CALL) with the aim of exploring practical strategies to enhance the learning process on the multilingual platform EL@N. Their research shed light on the challenges faced by Algerian EFL course designers when developing online materials and proposed effective approaches to elevate the professional experience. In the midst of the challenges brought about by the pandemic, researchers such as Amara et al. (2021) have been actively seeking innovative solutions to transform the landscape of e-learning. Their groundbreaking work introduced the I-DERASSA e-learning platform, which integrates augmented reality (AR) and virtual reality (VR) interactions. This platform provides students with a rich and immersive learning experience, effectively addressing the limitations associated with traditional online education and offering a more engaging and immersive learning environment. By harnessing the potential of AR and VR technologies, this pioneering platform represents a promising avenue for future e-learning initiatives. It caters to diverse learning needs and significantly enhances the overall educational experience, both during and beyond the challenges posed by the COVID-19 pandemic.

In short, the studies on e-learning platforms and tools in Algeria reveal that Moodle has been the central focus, yet challenges like technical difficulties and digital literacy have contributed to negative perceptions among teachers and students. Diversifying platforms beyond Moodle and enhancing skills training emerge as key recommendations, such as harnessing social media and exploring innovative technologies like AR/VR to improve interactivity, engagement and motivation.

E-Assessment

In the realm of e-assessment, the digital transformation accelerated by the pandemic has brought about significant changes to assessment methodologies in Algerian higher education. These shifts have given rise to both opportunities and challenges (Boukhaloua & Djaileb, 2022). This overview delves into studies aimed at understanding the effectiveness and perceptions of e-assessment within this evolving landscape.

Guemide and Maouche (2020, 2021) provided critical insights into the online learning electronic systems utilized by Algerian universities during the pandemic. Their studies revealed shortcomings, such as technical issues accessing online platforms and lack of guidance, that necessitated recommendations for more effective implementation, reflecting the ongoing process of refining the digital education landscape. Building upon this exploration, Abdelhadi (2022) delved into the impact of transitioning to electronic assessment and online learning on EFL teaching and learning. The study uncovered teachers and students' experiences

during this transition, highlighting the challenges of slow internet connections and unfamiliarity with online platforms. Yet, this shift presented opportunities for teachers and students to acquire new teaching and ICT skills. Turning to the intricacies of e-exams, Bashitialshaaer et al. (2021) conducted an extensive study across various Arab countries, including Algeria, to identify 27 barriers faced by professors and students. These barriers included personal, pedagogical, technical, and financial. The research yielded valuable insights that informed recommendations to enhance the effectiveness of distance learning and electronic exams, such as improving university infrastructure with technical supervisors, providing diverse e-learning tools, and ensuring reliable internet access.

Perceptions of e-assessment emerged as pivotal influences in its successful implementation. As evidenced by many studies, attitudes towards e-assessment exhibited a range of responses, encompassing both positive and negative viewpoints. Bouhidel (2022) delved into educators' perceptions of online assessment, revealing a mixture of attitudes among teachers. This variation underscored the need for effective implementation strategies that can leverage the potential of online assessment tools. Thus, attitudes towards e-assessment encompassed negative sentiments that resonated with the broader challenges encountered during the transition to online learning platforms, emphasizing the importance of addressing these issues to foster a conducive assessment environment.

In a related vein, Benabed (2022) investigated Algerian EFL teachers' and students' attitudes towards online assessment feasibility and impediments. The study highlighted a recognition of online assessment's importance and efficiency, suggesting a shift in attitude towards this mode of assessment. Similarly, Hichour (2022) delved into teachers' experiences in e-assessment, revealing predominantly positive attitudes despite challenges. These findings collectively hint at the changing perceptions and attitudes of educators and students towards e-assessment.

Moreover, Blizak et al. (2023) provided insights into students' perceptions of e-assessment at Algerian universities, utilizing an exploratory quantitative methodology. The study examined students' perception in areas such as awareness, perceived usefulness, and self-efficacy. This approach, while distinct, mirrors the shift in perceptions seen in other studies, underlining the importance of students' viewpoints in the assessment landscape. It reveals that Algerian students' perceptions of e-assessment are generally positive, with a moderate trend. The perception is influenced by factors like behavior control and awareness. It also indicates that students' perceptions are affected by their field of study, where humanities and social science students tend to have more positive attitudes compared to technical science students.

The differences in attitudes revealed in these studies can be attributed to a variety of factors. Individual technological proficiency and familiarity with online learning platforms can play a significant role; those comfortable with technology might hold more positive attitudes, while those less tech-savvy may express skepticism. Previous experiences with online learning and assessment, whether positive or negative, also shape perceptions. Additionally, perceived benefits of e-assessment, such as flexibility and improved feedback, can influence attitudes positively. Conversely, challenges like technical difficulties and inadequate training might lead to apprehension. Cultural norms, contextual factors, and institutional support further contribute to the spectrum of attitudes. Educational institutions can foster more positive attitudes through effective communication, comprehensive training, and addressing challenges head-on.

An intricate interplay is highlighted among learners and teachers' attitudes towards e-assessment and underscore the importance of a holistic approach in promoting its successful integration. This was evident in the study of Laifa et al. (2023) which cantered on blended learning in Algeria and examined student satisfaction and preferences, it was apparent that they employed structural equation modelling and sentiment analysis to explore the interplay of variables influencing student satisfaction and future preferences. The research aimed to provide insights into curriculum planning and development within the context of blended learning.

The study underscored that in order for blended learning to effectively achieve its goal of providing equal access to education for all eligible students, it must be perceived as a supportive learning environment. The array of challenges faced by students emphasized the need for a blended learning approach tailored to the specific context. Drawing from both qualitative and quantitative analyses, the study recommended that future implementations of blended learning align with the fundamental objective of expanding educational opportunities, ensuring equity, and facilitating easy access to essential technologies. Consequently, addressing challenges and fostering positive attitudes become crucial for the successful integration of technology-enhanced education, including e-assessment.

In a nutshell, studies on e-assessment in Algeria reveal a spectrum of attitudes ranging from apprehension to recognition of its potential advantages. Technical challenges and inadequate training contribute to negative perceptions, while flexibility, improved feedback and alignment with blended learning elicit more positive viewpoints. A holistic approach addressing infrastructure, skills training and support is vital to foster greater acceptance and enable the integration of e-assessment.

Teachers' and Students' Attitudes and Perceptions

The COVID-19 pandemic has prompted a rapid and unprecedented shift to online education worldwide, eliciting diverse reactions from teachers and learners. This section explores the perceptions and experiences of teachers and students in Algeria regarding online education, revealing a complex and multifaceted picture influenced by various factors.

Teachers' attitudes and perceptions of online learning in Algeria

Teachers in Algeria faced significant challenges in adapting to online teaching, as many lacked prior training and experience in using online platforms (Hadjeris, 2021; Khattala & Houichi, 2021). This initial unpreparedness affected their attitudes and confidence in delivering online instruction. However, some teachers demonstrated remarkable optimism and flexibility in embracing online education, exploring

various tools and methods to engage their students effectively (Rahmani & Zitouni, 2022). According to Bassou (2022) and Hichour (2022), these teachers recognized the potential and opportunities of online education for enhancing learning outcomes. Moreover, the effectiveness of online teaching varied across different disciplines, as some courses required more technical and practical skills that were difficult to convey online. Therefore, teachers' perceptions and attitudes were context-dependent and influenced by the nature of their subject matter (Hamida et al., 2022). Furthermore, some teachers expressed frustration and dissatisfaction with online teaching, feeling that it was imposed on them without adequate support and resources (Bouhidel, 2022; Lassoued et al., 2020; Sarnou & Sarnou, 2021). They perceived online education as inferior to face-to-face instruction in meeting their students' needs and expectations. Nevertheless, Meziani (2022), Sellam (2023), and Zermane and Aitouche (2020) found that many teachers showed resilience and adaptability in rethinking online education, advocating for more diversified and innovative pedagogical approaches to align with the changing educational landscape.

Students' attitudes and perceptions of online learning in Algeria

Students in Algeria also had mixed responses to the transition to online education (Blizak et al., 2020). Many students reported dissatisfaction and reluctance with online learning, citing various obstacles such as internet connectivity, technical issues, lack of interaction, feedback, and support (Arabeche & Soudani, 2021; Khattala & Houichi, 2021; Zaghar, 2022). These obstacles hindered their learning experience and motivation. However, Yahiaoui et al. (2022) found that students' attitudes and outcomes were not only determined by external factors but also by their own self-efficacy and enjoyment of online learning. Students who had higher self-efficacy and found online learning more usable and enjoyable tended to be more motivated and satisfied with their online learning experience.

Additionally, students exhibited a preference for self-paced learning, utilizing various online resources according to their needs and preferences (Ghaouar, 2022; Rahmani & Zitouni, 2022; Sarnou & Sarnou, 2021). They also developed critical thinking and problem-solving skills in the online environment. Furthermore, students expressed a strong preference for blended learning, combining online and face-to-face instruction (Laila et al., 2023; Meziani, 2022). They also offered constructive suggestions for improving online learning experiences, such as enhancing system features, providing more interactive and personalized content, and improving service quality.

The interconnected nature of engagement dimensions emerges as particularly significant in post-pandemic contexts, with Deng and Yang (2025) demonstrating how behavioral, cognitive, and affective engagement mutually reinforce one another when teachers provide adequate cognitive and emotional support. Communication modality proves equally critical: Deep et al. (2025) found synchronous methods substantially outperform asynchronous approaches in promoting motivation and engagement, primarily through immediate feedback and community building that real-time interaction enables.

The studies highlight the complexities inherent in teachers' and students' varied attitudes towards online education in Algeria. Challenges like lack of training, support and infrastructure contribute to negative perceptions, while recognizing opportunities leads to greater willingness to adapt. Customizing training and support to disciplines and needs, enhancing infrastructure, and allowing flexibility can help cultivate more positive attitudes towards online modalities.

Psycho-Social Impacts

The psychological and social aspects of online teaching during the pandemic have not been widely studied in the Algerian context. However, Bouchareb et al. (2023) provided some insights by examining the impact on introverted EFL students' motivation and attitudes. Their study revealed that despite two years of online learning, group work and participation remained challenging for introverts. This highlights that the abrupt shift online may not adequately address diverse student needs. Further research is required to fully understand the pandemic's psychosocial impacts on students and teachers, including isolation, anxiety, stress, relationships, and overall wellbeing (Abdelhadi, 2022; Khattala & Houichi, 2021; Zigh et al., 2022). In this respect, Berens and Hobert (2025) documented what they term 'three-fold isolation': physical, social, and learning with 65.6% of students reporting high burden from lack of social contact and 58.3% experiencing motivation difficulties, even while quiz completion improved 22% and exam scores increased significantly. Extending beyond the emergency period, Wittayapun et al. (2025) identified persistent fatigue across all modalities (online, face-to-face, and hybrid), strongly associated with mental health concerns, musculoskeletal complaints, and compromised academic outcomes. Assessing these critical aspects can provide appropriate support to foster engaging and inclusive online learning environments.

Implications, Limitations, and Directions for Future Research

The COVID-19 pandemic necessitated a rapid shift to distance and blended learning across Algerian universities, sparking significant research into this digital transformation. Studies confirm that digitalization and e-learning were critical to sustaining the academic process during movement restrictions (Ameur et al., 2024; Bakhtaoui & Hachem, 2024; Belaid, 2024). While recognized for its flexibility, this shift exposed numerous challenges, including the need for widespread teacher training to ensure effective delivery (Aouissi, 2024; Belaid, 2024) and addressing student satisfaction and material/moral difficulties associated with the sudden change (Bakhtaoui & Hachem, 2024). Despite its utility during the crisis, some argue that distance learning's continued prioritization could degrade the academic experience, underscoring a call for balanced implementation and supportive infrastructure (Ali Talha, 2025; Aouissi, 2024).

This scoping review offers valuable insights into the state of online education in Algerian higher education, both during the COVID-19 pandemic and in its continuing evolution. The

challenges highlighted across infrastructure, technology, pedagogy, and psychological factors underscore the gaps that require addressing for Algeria to sustain and optimize online modalities. Recent studies demonstrate that institutions prioritizing systematic digital transformation achieve better learning outcomes and student satisfaction when infrastructure investment is coupled with comprehensive faculty training and psychosocial support systems (Alamr et al., 2025; Aldabbas et al., 2025). Additionally, the move towards University 4.0 in Algeria reflects the pressing need for institutions to embrace advanced digital strategies to foster innovative learning environments (Dou, 2025).

Research examining developing countries reveals that the digital divide represents not merely a technological gap but a social justice issue requiring sustained, multifaceted intervention addressing affordability, digital literacy, and equitable access (Assefa et al., 2025; Gunter, 2025). This is particularly relevant to the recent calls for raising teachers' artificial intelligence literacy, ensuring educators are equipped to effectively navigate and teach within these evolving technological frameworks (Dou & Rim, 2025). This also highlighted emergency remote teaching methods employed during the pandemic as well as promising innovations and recommendations for enhancing online education post-COVID-19. The predominance of studies focusing on crisis response rather than strategic development of e-learning points to an area requiring further research.

The review has some limitations. The search was restricted to English language publications and did not include potentially relevant studies in French or Arabic. The focus was on peer-reviewed literature, excluding grey literature. Publication bias may have excluded studies with non-significant or unfavorable findings. The included studies relied heavily on self-reported data from teachers and students, which can introduce subjectivity.

Nonetheless, this scoping review contributes an important foundation synthesizing the status, objectives, contexts, challenges, and future directions of online education implementation in Algeria during a pivotal time. The findings of this scoping review have implications for policymakers, educators, and researchers seeking to advance remote and blended learning in Algeria. For policymakers, highlighting the need for greater infrastructure investment, training programs, and quality assurance mechanisms, with attention to inclusive and equitable access as emphasized in global digital transformation frameworks (Matsieli & Mutula, 2024). For educators, it emphasizes the importance of flexibility, diversification of tools, and pedagogical support to ensure the effectiveness of online modalities.

For researchers, it illuminates important gaps, especially regarding strategic planning and innovative technologies for the future of e-learning in Algeria, particularly in adapting to the 'new normal' of post-pandemic educational practices (Sato et al., 2024). This review illuminates important gaps, especially regarding strategic planning and innovative technologies for the future of e-learning in Algeria. Artificial intelligence integration represents a particularly promising frontier, with Merino-Campos' (2025) systematic review demonstrating transformative potential for personalized learning through adaptive content delivery, enhanced engagement, and streamlined administrative processes. However, successful implementation demands careful attention to academic integrity concerns, data privacy protections, algorithmic bias mitigation, and robust ethical frameworks. Future Algerian research should investigate how AI-driven solutions might address persistent infrastructure and pedagogical challenges while ensuring equitable access and maintaining educational quality standards.

CONCLUSION

This scoping review analyzed 65 studies on online education in Algerian higher education during and after the COVID-19 pandemic, spanning publications from 2020 through 2025 to capture both emergency responses and emerging strategic frameworks for post-pandemic digital transformation. It revealed major challenges across infrastructure, technology, pedagogy, and motivational barriers. The studies also highlighted emergency remote teaching methods employed, insights into e-learning platforms and tools, perspectives on e-assessment, and the complex factors influencing teachers' and students' attitudes. While the literature has focused significantly on pandemic response, there remains a need for research on strategic development of quality e-learning post-COVID-19. This review contributes a valuable synthesis of the current state, objectives, contexts, challenges, and future directions of online education in Algeria. The findings offer insights for policymakers, educators, and researchers seeking to advance remote and blended learning to expand access and enhance quality in Algerian higher education.

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