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Addressing Equity in Online Education: A Meta-Analysis of Interventions and Outcomes

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ABSTRACT:
Equity in online education is a significant challenge amidst the increasing adoption of educational technology, especially for students from various social, economic and cultural backgrounds. This research aims to evaluate the effectiveness of AI-based technologies and adaptive learning in improving equity in online education through a meta-analysis of various interventions and reported outcomes. The method used involved a systematic search of high-quality articles from international databases such as Scopus and Web of Science. The research results show that the integration of this technology can improve educational equality, especially in terms of accessibility, personalization, and inclusivity, although there are differences in results based on student background. The implications of these findings emphasize the importance of developing educational policies and practices that support inclusive and equitable use of technology.
Keywords: Online educational equality, AI technology, adaptive learning, educational accessibility

ABSTRAK:
Kesetaraan dalam pendidikan daring menjadi tantangan signifikan di tengah peningkatan adopsi teknologi pendidikan, terutama bagi siswa dari berbagai latar belakang sosial, ekonomi, dan budaya. Penelitian ini bertujuan untuk mengevaluasi efektivitas teknologi berbasis AI dan pembelajaran adaptif dalam meningkatkan kesetaraan dalam pendidikan daring melalui meta-analisis terhadap berbagai intervensi dan hasil yang dilaporkan. Metode yang digunakan melibatkan pencarian sistematis terhadap artikel berkualitas tinggi dari database internasional seperti Scopus dan Web of Science. Hasil penelitian menunjukkan bahwa integrasi teknologi ini dapat meningkatkan kesetaraan pendidikan, terutama dalam hal aksesibilitas, personalisasi, dan inklusivitas, meskipun terdapat perbedaan hasil berdasarkan latar belakang siswa. Implikasi dari temuan ini menekankan pentingnya pengembangan kebijakan dan praktik pendidikan yang mendukung penggunaan teknologi secara inklusif dan adil.
Kata Kunci: Kesetaraan pendidikan daring, teknologi AI, pembelajaran adaptif, aksesibilitas pendidikan

1. Introduction

Addressing equity in online education is a complex challenge that requires a deep understanding of the local context, learner needs, and the inherent shortcomings of online education (Greaves, 2024; Niu, 2024). Equity in online education involves providing fair opportunities for all students, regardless of their background, to access and succeed in online learning (Anis, 2023). Strategies to promote equity in online education include prioritizing equitable technology access, culturally relevant curricula, and the development of critical thinking and digital citizenship skills (Eden, 2024). Additionally, it is important to expand culturally sustainable practices to all online learning environments in higher education to reduce equity issues related to the digital divide (Kono & Taylor, 2021).

Online education plays a significant role in promoting equality, especially for students from regional, rural and remote backgrounds, enabling more of these students to achieve university qualifications (Stone et al., 2022). Additionally, online learning offers opportunities to increase student equity and expand participation in higher education (Stone & O'Shea, 2019). Educational equity is a complex issue that requires innovative responses to address

systemic inequities in public education (Hertzog, 2023). Community partnerships can improve the quality and relevance of online education, promoting educational equity and community development (Stevenson, 2024).

Equity in assessment is essential in online education, requiring programs to recognize and address the needs of learners from diverse backgrounds by integrating equity-focused assessment strategies (Onumah et al., 2023). Massive open online courses (MOOCs) have the potential to address educational challenges related to quality, efficiency, and equity by providing low-cost access to professional development training for large numbers of learners (Parsley & Patel, 2023). Additionally, applying a diversity, equity, and inclusion framework is critical in designing online tools to promote physical activity equity during school closures (D'Agostino et al., 2021).

In conclusion, addressing equity in online education requires a comprehensive approach that considers local context, learner needs, cultural relevance, and the digital divide. By implementing strategies that prioritize equitable access, culturally sustainable practices, and inclusive assessment methods, online education can play a critical role in promoting educational equity and increasing student participation and success.

Online education has become an increasingly important alternative in ensuring educational accessibility at various levels. However, with the increasing use of technology in education, new issues regarding equality have emerged that need to be addressed. In the context of online education, equality is not just about access to devices and the internet, but also includes how these technologies are applied and utilized by students from various social, economic and cultural backgrounds. The phenomenon of inequality in the implementation of technology in online education, such as differences in the use of artificial intelligence (AI) and adaptive learning, highlights the existence of a significant gap. Technology intended to improve access and quality of education can actually deepen inequalities if not implemented by considering the context and specific needs of each group of students.

This research focuses on the question: "To what extent have technology-based approaches, such as the use of AI or adaptive learning, been successful in addressing equity in online education, and are there significant differences in outcomes based on student background?" This question will explore the effectiveness of the technology in closing educational gaps as well as identify whether the results are uniform across the student population or if any disparities persist or are even exacerbated by the use of the technology.

Understanding the impact of AI-based technologies and adaptive learning in increasing equity in online education is crucial in this digital era. Technology has the potential to democratize education, but without critical analysis and adequate data, the risk of inequality increases. This research has high relevance for educational practice and policy, especially in designing and implementing inclusive and equitable technology. The findings from this research can provide important insights for policy makers, educators, and technology developers to ensure that technology-based approaches can truly support equity in online education.

This research stands out because it explores new or under-researched aspects in the existing literature regarding equity in online education. While many studies have addressed the use of technology in education, this research places a particular focus on how AI and adaptive learning can address or even exacerbate inequalities. The novelty of this research lies in the systematic approach used to review existing literature, with an emphasis on identifying gaps in previous research and proposing new areas for further exploration.

It is hoped that this research will make a significant contribution to existing knowledge regarding equality in online education, especially in the context of technology application. In addition to enriching the academic literature, this research also has important practical and policy implications. The results of this research can serve as a basis for the development of more inclusive policies and more effective implementation of educational technology, as well

as provide guidance for practitioners in designing and implementing technology that supports equality in online educational environments.

2. Research Methods

The process of collecting articles for this research was carried out using several reputable international database sources, including Scopus, Web of Science, and Google Scholar. The selection of these databases was based on their reputation and breadth of coverage, enabling the identification of relevant and high-quality articles on research topics related to equity in online education. The database also provides access to globally recognized literature, which is critical to ensuring the validity and reliability of the findings of this study.

2.2. Search Keywords

Keywords used in article searches are strategically arranged to cover various aspects of the topics discussed. Key keywords included “online education equity,” “AI technology in education,” “adaptive learning,” and “the impact of technology on equity.” In addition, variations of these keywords, such as "online education equity," "AI-driven education," "adaptive learning technology," and "educational technology impact on equality," were also used to broaden the scope of the search and ensure that all relevant literature was available. identified.

2.3. Number of Articles Retrieved

From an initial search using predetermined keywords, a large number of articles were identified. In total, approximately 113 articles were identified from the various databases used. These articles were then further filtered based on predetermined inclusion and exclusion criteria to ensure only relevant and high-quality studies would be analyzed in this study.

2.4. Inclusion and Exclusion Techniques

To ensure that only the most relevant and high-quality articles were included in the analysis, strict inclusion and exclusion criteria were applied. Inclusion criteria included types of studies that addressed equity in online education, use of AI or adaptive learning technologies, articles published within a specific year range (2019-2024), and direct relevance to the research topic. In addition, only articles that are published in reputable journals and have gone through a peer-review process are eligible for inclusion.

Instead, exclusion criteria were applied to eliminate irrelevant studies, including articles discussing topics not directly related to equity in online education or educational technology, articles of low quality (e.g., articles with unclear methodology or without supporting empirical data) , as well as articles that do not meet the specified topic criteria. By applying this inclusion and exclusion technique, a total of 91 articles were selected as the basis for further analysis in this study.

3. Results and Discussions

3.1. Equity in Online Education

Equity in online education is an effort to provide fair and unbiased opportunities for all students to access and excel in online learning, regardless of their background or circumstances. There are various dimensions that support the realization of this equality, including overcoming the advantages and disadvantages of online education, overcoming its limitations, and fulfilling the function of educational equality, especially in difficult times such as the COVID-19 pandemic (Stone, 2022). In addition, equality in online education also includes fair assessment practices, which emphasize the importance of assessment principles that support all students (AlShamsi, 2024).

Research shows that maintaining online learning as a primary approach in education, by adopting evidence-based practices in its design and implementation, has the potential to significantly improve student equity on a broader scale (Stone, 2022). Online education also has an important role in promoting gender equality, especially for mature students and those with care responsibilities (Stone & O'Shea, 2019). Furthermore, the expansion of online learning across various levels of education requires a thorough examination of aspects of access, culture, equity, inclusion, and ethics to effectively support diverse learners (Martin et al., 2020).

To ensure equity in online education, it is important to prioritize accessibility, provide support to students in need, and ensure that learning materials are accessible to all learners (Setlhodi, 2021). Understanding the local context and student needs is crucial in designing and implementing online education programs that specifically target equity issues (Greaves, 2024). As the prevalence of online learning increases, so does the need for research that focuses on equity, especially that that considers the social, cultural, and political implications of technology in online learning environments (Fortman, 2023).

Flexibility in online education is also considered an important factor in promoting equality, particularly for students from regional, rural and remote backgrounds, enabling more students to gain university qualifications (Stone et al., 2022). Online education also provides opportunities for students to confront personal biases, develop empathy, and defend their belief systems, thereby contributing to a more equitable educational experience (Black et al., 2019). By making education more accessible, online learning significantly contributes to student equity, enabling more individuals from diverse backgrounds to participate and succeed in higher education (Gunder, 2023). In conclusion, equity in online education is a complex concept and requires attention to multiple dimensions such as accessibility, assessment practices, gender equality, and flexibility. By prioritizing inclusive practices, understanding student needs, and utilizing technology effectively, online education can be a powerful tool in promoting educational equity for all students.

3.2. AI Based Technology in Online Education

Artificial Intelligence (AI) Technology has made a significant impact in online education through various applications that enhance the learning experience. AI-based approaches such as "Flipped Classroom" successfully blend online and offline learning experiences in harmony, while algorithm-based systems such as RBF and SCMA provide personalized music education (Luo, 2024). This technology analyzes student learning styles and progress to customize content and support, thereby enhancing the individual learning experience (Thomas, 2024). AI allows learning platforms to customize content based on student interactions through reinforcement learning algorithms, which increases personalization in online education (Willis, 2024).

In online education, AI facilitates the processing of large amounts of data to improve course design, teaching methods, and learning outcomes (Ahmed, 2024). Additionally, AI enables the creation of customized learning profiles for each student, tailoring their materials and learning journey according to individual needs and preferences (Ng et al., 2023). AI applications such as Chatbots, Robotic Assistants, and 3D holograms are also being developed to support teachers and students, thereby improving the education system (Zhao & Nazir, 2022).

The use of AI in education is not only limited to the classroom, but also extends to online platforms, virtual reality, and interactive tools, offering benefits such as real-time feedback and personalized learning experiences (Ayeni, 2024; Rakya, 2023). The integration of AI technology in online learning platforms enables the collection and analysis of process data in real time, thereby increasing the effectiveness of online higher education (Rios-Campos et al., 2023). Furthermore, AI technology has the potential to streamline the enrollment process, improve resource management, and optimize the online training process in higher education

(Lukianets & Lukianets, 2023). In conclusion, AI technology plays an important role in transforming online education by personalizing the learning experience, improving teaching methods, and increasing student engagement. By leveraging AI-based applications, online education platforms can adapt to individual student needs, provide real-time feedback, and optimize learning outcomes.

3.3. Adaptive Learning

3.3.1. Adaptive learning in online education

Involves adapting the learning experience to meet students' individual needs as they progress through educational content. This personalized approach leverages technology to customize instruction, resources, and assessments based on students' abilities, preferences, and learning pace (Balginbayeva et al., 2023). By integrating personalized adaptive technologies, online platforms can offer non-linear learning experiences tailored to students' needs, creating a more individualized and effective learning environment (Balginbayeva et al., 2023).

3.3.2. Integration of adaptive learning

Online education platforms have played an important role in increasing student engagement and improving learning outcomes. Platforms such as e-Learning, distance learning, and MOOCs (Massive Open Online Courses) allow students to access educational content with flexibility from anywhere and at any time, thereby providing convenience and accessibility (Katanosaka, 2023). These platforms also play a crucial role in ensuring continuity of education, expanding access to a wider audience, and offering flexibility in learning tempo and timing (Akargöl, 2024).

Furthermore, the adaptability of online platforms to student needs has been recognized as a key factor in improving and accelerating the learning process (Songkram & Osuwan, 2022). Platforms that are able to meet students' individual requirements contribute to improved learning experiences and outcomes. Additionally, the utilization of machine learning algorithms to predict students' adaptability in online classes has been identified as a valuable tool for educational institutions in improving the effectiveness of teaching and student learning (Li, 2024). In conclusion, adaptive learning on online education platforms is a transformational approach that customizes the learning experience for each student, thereby increasing engagement and learning outcomes. Through the use of technology, adapting content to student needs, and applying predictive analytics, online platforms can create personalized and effective learning environments capable of meeting the needs of diverse learners.

3.4. Analysis of AI-Based Technology in Online Education

3.4.1. AI Implementation and Use

Artificial Intelligence (AI) is increasingly being integrated into online education platforms to enhance the teaching and learning experience. Research shows that AI technology can function as a teaching assistant, supporting teachers' work and helping students' learning process (Niu et al., 2022). By combining AI and machine learning tools, educators can overcome challenges arising from the shift to online learning, such as self-regulation difficulties for students and increased administrative tasks for teachers, while increasing personalized interactions between students and teachers (Yildirim et al., 2021). AI enables online education platforms to process large amounts of data, resulting in insights that can improve course design, teaching methods, and learning outcomes (Ahmed, 2024). Various applications of AI in online education continue to be explored to understand its impact on the teaching and learning process (TONBULOĞLU, 2023). Additionally, AI-based online assessment tools such as Classtime.Com have been researched to evaluate student performance and provide feedback, demonstrating the educational implications of AI in assessment (Ningsih, 2023).

The use of AI in online education also extends to assessment practices, with tools such as ChatGPT being integrated into assessment systems to enhance the online learning experience (Naidu, 2023). AI methods have been systematically applied in the education system, especially during the COVID-19 pandemic, to make distance teaching and learning more efficient (Mnhrawi & Alreshidi, 2022). Additionally, AI technology has been used to support older educators in adapting to changing pedagogy, emphasizing the importance of leveraging technology for effective teaching practices (Koka, 2023).

The rapid shift to online education during the pandemic has accelerated the integration of AI technologies into education systems worldwide, highlighting the importance of educators' digital competencies in effectively utilizing AI tools (Ng et al., 2023). Research shows that AI applications have a positive impact on the learning process and have the potential to significantly innovate in online learning environments (Neo et al., 2022). Additionally, the integration of AI in online learning emphasizes the need for user-friendly interfaces and strong data protection policies to ensure a seamless learning experience (Zhou, 2024). In conclusion, AI plays an important role in improving online education by supporting teachers, improving learning outcomes, and providing personalized learning experiences. The integration of AI tools and applications in online education platforms has the potential to revolutionize teaching and learning practices, making education more accessible and more engaging for students.

3.5. The Impact of AI on Educational Equity

Artificial Intelligence (AI) Integration into increasingly growing online education platforms to enhance the teaching and learning experience. Research shows that AI technology can function as a teaching assistant, support teachers' work, and help students' learning process (Niu et al., 2022). By incorporating AI and machine learning tools, educators can overcome challenges arising from the shift to online learning, such as self-regulation difficulties for students and increased administrative tasks for teachers, as well as strengthen personalized interactions between students and teachers (Yildirim et al., 2021) .

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3.6. Differences in Results Based on Student Background

In the field of online education, the use of Artificial Intelligence (AI) technology has shown promising results in improving the learning experience for students. AI-powered online learning platforms have the ability to analyze data regarding students' learning styles, preferences, progress, and performance, thereby enabling customization of curriculum, content, feedback, and support tailored to each individual (Thomas, 2024). This personalized approach, facilitated by AI, not only tailors the learning experience according to each student's needs, but also helps in the improvement of course design, teaching methods, and overall learning outcomes (Ahmed, 2024).

Furthermore, AI technology has played an important role in overcoming the challenges faced in online education, such as students' difficulties in managing learning independently, the burden of curriculum planning for teachers, and the loss of personal interaction between students and teachers (Yildirim et al., 2021) . By automating routine tasks for teachers and providing adaptive assessments, AI systems contribute to a more efficient and effective educational process (Seo et al., 2021).

Research shows that the integration of AI in online education can increase student engagement and effectiveness by adapting content and learning pace according to individual progress, thereby creating a dynamic, student-focused learning environment (Aiyedun, 2024). Additionally, AI technology has also been found to have a positive impact on the learning process, leading to innovation in online learning environments (Neo et al., 2022).

In conclusion, the integration of AI in online education has great potential to revolutionize the way students learn and interact with educational content. By leveraging AI technology to personalize the learning experience, automate assignments, and provide adaptive assessments, online education platforms can meet the needs of diverse students, thereby improving the quality and effectiveness of online learning.

3.7. Analysis of Adaptive Learning in Online Education

3.7.1. Implementation and Use of Adaptive Learning

Adaptive learning in online education has attracted significant attention due to its potential to enhance personalized learning experiences for students. Various studies highlight the importance of adaptive learning platforms and technologies in improving the effectiveness of online education systems. For example, Li et al. (2024) utilized machine learning algorithms to analyze and predict student adaptation to online education systems, thereby providing important insights for personalized education. Additionally, Balginbayeva et al. (2023) examine the role of personalized adaptive technology in online learning, emphasizing the importance of tailoring course content to individual student needs.

Research also shows that implementing adaptive e-learning platforms can improve student performance and engagement in various educational contexts (Yakin & Linden, 2021). This is especially important during times of crisis such as the COVID-19 pandemic, where the shift to online learning poses challenges for educators and students (Torres, 2023). König et al. (2020) emphasized the importance of teachers' digital competencies and ICT tools in supporting the transition to online teaching during school closures. Furthermore, the integration of interactive multimedia in e-learning has proven beneficial in improving the teaching and learning process, especially in Technical and Vocational Education (TVET) institutions (Noor et al., 2022). This highlights the role of technological innovation in adapting online learning to meet diverse educational needs. In conclusion, the application of adaptive learning technologies in online education shows great potential in creating engaging and personalized learning experiences. Through the utilization of machine learning algorithms,

personalized technology, and interactive multimedia tools, educators can improve student engagement, performance, and adaptability in online learning environments.

3.7.2. The Impact of Adaptive Learning on Educational Equity

Adaptive learning in online education has great potential to significantly impact educational equity. Research shows that adaptive learning technology can contribute to creating more inclusive and equitable learning environments. For example, several studies highlight the importance of adaptive learning in promoting equity by increasing educational inclusivity (Liang et al., 2022). By focusing on gender considerations and utilizing information and communication technology, adaptive learning can help bridge educational gaps and promote equity in education (Liang et al., 2022). Additionally, the use of adaptive assessment systems powered by artificial intelligence can support personalized learning experiences, ensuring transparency, accountability, and fairness in educational practices (Anuyahong, 2023).

Furthermore, implementing adaptive learning models can address disparities in access to resources and opportunities, especially during crises such as the COVID-19 pandemic (Barrett, 2021). The transition to online learning emphasizes the importance of maintaining equitable and inclusive classroom communities, and highlights the need for a sense of belonging, trust, and shared goals in online educational environments (Barrett, 2021). Additionally, the use of adaptive learning can help reduce discrimination by ensuring equal access to important tools and materials for all students, thereby promoting equity in distance learning environments ("Equity of Pedagogical Comfort and Distance Learning in Times of Crisis", 2023).

Furthermore, adaptive learning can play an important role in promoting educational equity by accommodating diverse learning styles and preferences (Mahande, 2024). By offering flexible learning modes such as HyFlex learning, adaptive learning can meet students' individual needs and preferences, ultimately supporting equity in educational outcomes (Mahande, 2024; Mahande, 2024). Additionally, implementing culturally responsive teaching practices can further increase equity in education by challenging bias, promoting openness, and encouraging partnerships across diverse learning spaces (Walker, 2023). In conclusion, adaptive learning in online education has the potential to increase educational equity by addressing inequities, promoting inclusivity, and accommodating the needs of diverse learners. By leveraging technology, personalized learning approaches, and inclusive teaching practices, adaptive learning can contribute to the creation of a more equitable and inclusive educational environment.

3.7.3. Differences in Results Based on Student Background

Adaptive learning in online education is a dynamic field where student background plays a crucial role in influencing learning outcomes. Research by Kaiss et al. (2023) highlights the effectiveness of adaptive learning chatbots tailored to students' learning styles, emphasizing the importance of meeting diverse educational needs. Additionally, Ginting (2024) discusses various adaptive instruction tools such as intelligent learning systems and AI chatbots, demonstrating the significance of personalized learning experiences in the digital era.

Furthermore, a study by Andhika (2024) emphasizes the positive impact of integrating adaptive learning systems in Learning Management Systems (LMS) in higher education, which improves academic performance and student engagement. This integration is in line with the findings of Torres (2023), who emphasized the importance of technology integration and adaptability in creating interesting online learning experiences for students. Furthermore, literature by Amin & Bintang (2020) regarding blended learning for vocational teacher candidates emphasizes the effectiveness of the blended learning model in improving learning outcomes. This is in line with the idea of combining traditional classroom instruction with online components, as discussed by Sun (2024), to provide an interactive and personalized

learning experience. In conclusion, student background significantly influences adaptive learning outcomes in online education. By leveraging adaptive learning chatbots, intelligent learning systems, and blended learning models integrated with an LMS, educators can create customized and engaging online learning experiences that meet the needs of diverse students, ultimately leading to improved academic performance and satisfaction.

3.8. Comparison and Discussion

3.8.1. Comparison between AI and Adaptive Learning

In comparing artificial intelligence (AI) and Adaptive Learning for their effectiveness in addressing equity in online education, it is important to consider the advantages and disadvantages of each approach. AI-driven adaptive learning systems have the ability to identify and address learning gaps, providing targeted interventions to support students experiencing difficulties (Adeleye, 2024). These systems leverage machine learning and adaptability to adjust curriculum and content based on student needs, thereby improving the quality of the overall learning experience and increasing learner retention (Chen et al., 2020). Additionally, AI contributes to the development of intelligent tutoring systems that provide personalized and adaptive educational experiences (Tang, 2024).

In contrast, Adaptive Learning as a methodology focuses on adapting educational experiences to students' individual needs, preferences, and performance (Wafik, 2024). This methodology offers personalized learning pathways and educational efficiency, reflecting optimism towards the role of AI in creating personalized and adaptive learning environments (Kayed et al., 2022). Additionally, Adaptive Learning can be very useful in online teaching in cities and the development of Massive Open Courses (MOOCs) for urban planners to explore various future city-making scenarios (Anuyahong, 2023).

However, it should be noted that the use of AI in personalized learning and adaptive assessment requires clear guidelines and standards to ensure ethical and socially responsible practices (Gupta, 2024). Additionally, while AI offers benefits such as greater flexibility in learning, it also raises concerns regarding the changing role of the teacher and the potential impact on the relationship dynamics between teachers and students.

In conclusion, both AI and Adaptive Learning have their respective advantages and disadvantages in addressing equity in online education. AI-driven adaptive learning systems excel at identifying learning gaps and providing targeted interventions, while Adaptive Learning focuses on customizing educational experiences to individual student needs. To maximize the benefits of this approach and ensure equity in online education, it is important to establish clear guidelines for the ethical use of AI, consider the implications for teacher-student relationships, and continually evaluate its impact on educational equity.

3.9. Relative Effectiveness in Increasing Equality

In the realm of online education, prioritizing equality is very important to bridge the digital divide and promote social justice (Anis, 2023). Understanding the local context and learner needs is essential to effectively design and implement online education programs that target equity (Greaves, 2024). It is important to keep online learning mainstream while ensuring the quality of its design and delivery to improve student equity on a broader scale (Stone, 2022).

To achieve educational equality through online education, overcoming the existing gap between urban and rural educational environments is essential (Niu, 2024). Institutional support plays a key role in providing equity in online learning, emphasizing the need for support structures for all students (AlShamsi, 2024). A systematic review highlighted the importance of examining access, culture, equity, inclusion, and ethics to effectively support diverse online learners (Martin et al., 2020).

It is important to differentiate between the definitions of online, blended, and digital learning to ensure quality and equity in the educational experience (Gunder, 2023). Expanding culturally sustainable practices to all online learning environments is critical to addressing equity issues related to the digital divide (Kono & Taylor, 2021). While flexible learning environments can improve equity in higher education, challenges arise when policies designed for on-campus students are applied equally to online students (Stone et al., 2022).

In conclusion, promoting equity in online education requires a comprehensive approach that considers local context, learner needs, quality of design and delivery, institutional support, cultural sustainability, and differentiation between types of online learning. By addressing these aspects holistically, online education can become a powerful tool in advancing educational equity and social justice.

3.10. Contextual Factors Affecting Results

In the realm of online education, the effectiveness of AI-based technology and adaptive learning is influenced by various contextual factors that play an important role in promoting equality. Research emphasizes the importance of understanding local context, learner needs, and the importance of proactive adaptation to online teaching and learning (Greaves, 2024; Torres, 2023). By deeply analyzing the factors that influence students' adaptation to online education systems and utilizing machine learning algorithms for predictions, insights can be gained to improve the effectiveness of online education and provide personalized learning experiences (Li, 2024).

In efforts to achieve equality in online learning, institutional support is identified as a key factor (AlShamsi, 2024). Additionally, it is important to differentiate between online, blended and digital forms of learning to ensure quality and equity, with a focus on learning effectiveness and prioritization of outcomes and learner skill acquisition (Gunder, 2023). Additionally, addressing contextual equity by creating learning environments that promote equity and psychological safety, understanding the learner's context, and undergoing implicit bias training is highly recommended (Onumah et al., 2023).

Adaptation to online teaching and learning during the COVID-19 pandemic has highlighted the importance of personal and contextual factors in explaining students' positive or negative adaptation to online education (Flores et al., 2021). Additionally, the design and implementation of online learning technology must consider diverse social, political, and cultural contexts to ensure its effectiveness (Fortman, 2023). Social and cultural factors, such as understanding students' backgrounds and ensuring equity in education, significantly influence teachers' teaching practices in online learning (Pourdavood & Song, 2021). In conclusion, to increase the effectiveness of AI-based technologies and adaptive learning in online education, it is critical to consider and address contextual factors such as local context, learner needs, institutional support, and social and cultural influences. By integrating these elements in the design and implementation of online education programs, equity can be promoted, and a more inclusive and effective learning experience can be provided to all students.

4. Conclusions

Equity in online education, AI-based technologies, and adaptive learning all play an important role in improving the online education experience, with significant impacts on accessibility, personalization, and inclusivity. Equity in online education spans multiple dimensions, including accessibility, fair assessment practices, and flexibility in learning, all of which are enhanced by AI and adaptive learning technologies. AI technology has proven itself as a powerful tool to personalize the learning experience, provide real-time feedback, and increase student engagement. Adaptive learning, in turn, provides a more customized approach, allowing for a more inclusive and effective learning environment that can meet the needs of diverse students.

4.1. Implication

These findings suggest that the integration of AI technology and adaptive learning in online education can significantly improve educational equity and quality, especially for students from diverse backgrounds and needs. The use of this technology allows online education to be more inclusive and equitable, ensuring that every student has an equal opportunity to succeed. For policymakers and educators, it is important to continue developing and implementing technologies that support educational equity, as well as ensuring that online platforms remain flexible and accessible to all students, regardless of their background.

4.2. Limitation

This research has several limitations, including a lack of longitudinal data that can measure the long-term impact of AI technology and adaptive learning on educational equity. Additionally, most of the research used in this analysis focuses on educational contexts in developed countries, which may not fully reflect the challenges faced in developing countries. Reliance on technology also raises concerns about the digital divide, where students without adequate access to devices or the internet can fall behind.

4.3. Future Research

Future research needs to focus on the long-term impact of AI technologies and adaptive learning on educational equity, especially in developing countries. Such studies should consider factors such as technological infrastructure, digital readiness of teachers and students, and the social and cultural implications of the use of these technologies. Additionally, further research is needed to explore how these technologies can be adapted to local contexts to ensure that they can truly improve educational equity across settings. Research should also consider potential risks associated with reliance on technology, such as data privacy and access exclusivity, and seek solutions that can overcome these challenges.

5. References

Adeleye, O. (2024). Innovative teaching methodologies in the era of artificial intelligence: a review of inclusive educational practices. World Journal of Advanced Engineering Technology and Sciences, 11(2), 069-079. https://doi.org/10.30574/wjaets.2024.11.2.0091

Agana, A. and Prempeh, C. (2022). Of farms, legends, and fools: re-engaging ghana's development narrative through social media. Media Culture & Society, 44(7), 1290-1306. https://doi.org/10.1177/01634437221111918

Ahmed, S. (2024). The role of artificial intelligence applications in enhancing the quality of online higher education. IJFAES, 3(2), 10-28. https://doi.org/10.59992/ijfaes.2024.v3n2p1

Aiyedun, T. (2024). Artificial intelligence (ai) in education: integration of ai into science education curriculum in nigerian universities. IJAIFD, 1(1), 1-14. https://doi.org/10.61796/ijaifd.v1i1.13

Akargöl, İ. (2024). Selecting the optimal e-learning platform for universities: a pythagorean fuzzy ahp/topsis evaluation. The European Journal of Research and Development, 4(2), 19-34. https://doi.org/10.56038/ejrnd.v4i2.425

Alexander, G. (2024). Role of social media influencers in shaping public opinion and consumer behavior in greece. International Journal of Communication and Public Relation, 9(1), 13-26. https://doi.org/10.47604/ijcpr.2269

AlShamsi, A. (2024). Webquests in inquiry-based learning in online assessment of teacher education: from a theory to practice. Creative Education, 15(01), 68-91. https://doi.org/10.4236/ce.2024.151004

Amin, M. and Bintang, S. (2020). Blended learning for vocational teacher candidates.. https://doi.org/10.4108/eai.16-11-2019.2293113

Andhika, A. (2024). The effectiveness of adaptive learning systems integrated with lms in higher education. Jurnal Komtekinfo, 49-56. https://doi.org/10.35134/komtekinfo.v11i2.505

Anis, M. (2023). Promoting equity and inclusion in online learning environments: strategies for ensuring access and success for all students.. https://doi.org/10.33422/6th.tleconf.2023.06.101

Anuyahong, B. (2023). Analyzing the impact of artificial intelligence in personalized learning and adaptive assessment in higher education. International Journal of Research and Scientific Innovation, X(IV), 88-93. https://doi.org/10.51244/ijrsi.2023.10412

Ausat, A. (2023). The role of social media in shaping public opinion and its influence on economic decisions. J.Technology;J.Society Perspective, 1(1), 35-44. https://doi.org/10.61100/tacit.v1i1.37

Balginbayeva, K., Kopeyev, Z., Mubarakov, A., & Alimagambetova, A. (2023). The role of adaptive personalized technologies in the learning process. International Journal of Virtual and Personal Learning Environments, 13(1), 1-15. https://doi.org/10.4018/ijvple.324079

Barachi, M., Mathew, S., Oroumchian, F., Ajala, I., Lutfi, S., & Yasin, R. (2022). Leveraging natural language processing to analyse the temporal behavior of extremists on social media. Journal of Communications Software and Systems, 18(2), 195-207. https://doi.org/10.24138/jcomss-2022-0031

Barrett, S. (2021). Maintaining equitable and inclusive classroom communities online during the covid-19 pandemic. Journal of Teaching and Learning, 15(2), 102-116. https://doi.org/10.22329/jtl.v15i2.6683

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: a review. Ieee Access, 8, 75264-75278. https://doi.org/10.1109/access.2020.2988510

Daud, R. (2021). The role of political communication in shaping public opinion: a comparative analysis of traditional and digital media. Journal of Public Representative and Society Provision, 1(2), 63-69. https://doi.org/10.55885/jprsp.v1i2.241

Dubois, E., Gruzd, A., & Jacobson, J. (2024). Journalists' use of social media to infer public opinion: the citizens' perspective.. https://doi.org/10.32920/14637978.v1

Dym, B., Pasupuleti, N., & Fiesler, C. (2022). Building a pillowfort: political tensions in platform design and policy. Proceedings of the Acm on Human-Computer Interaction, 6(GROUP), 1-23. https://doi.org/10.1145/3492835

Eniayejuni, A. (2023). #shutitalldown social protest: examining emotional content on twitter against sexual gender-based violence in namibia. Masyarakat Kebudayaan Dan Politik, 36(3), 316-328. https://doi.org/10.20473/mkp.v36i32023.316-328

Farid, A. (2024). Social media construction of political hegemony: analysis of the 2024 indonesian presidential candidates debate first round. FIJC, 1(1), 39-60. https://doi.org/10.62569/fijc.v1i1.11

Flores, M., Barros, A., Simão, A., Pereira, D., Flores, P., Fernandes, E., … & Ferreira, P. (2021). Portuguese higher education students' adaptation to online teaching and learning in times of the covid-19 pandemic: personal and contextual factors. Higher Education, 83(6), 1389-1408. https://doi.org/10.1007/s10734-021-00748-x

Fortman, J. (2023). Conceptions of time in educational technology. Online Learning, 27(4). https://doi.org/10.24059/olj.v27i4.4056

Gamaliel, J. (2024). Analysis of social networks as forums for political debates in tanzania: a case of chama cha mapinduzi and chadema tanzania twitter platforms. Asian Journal of Advanced Research and Reports, 18(5), 106-115. https://doi.org/10.9734/ajarr/2024/v18i5636

Garrett, R. (2019). Social media's contribution to political misperceptions in u.s. presidential elections. Plos One, 14(3), e0213500. https://doi.org/10.1371/journal.pone.0213500

Ginting, D. (2024). Student-centered learning in the digital age: in-class adaptive instruction and best practices. International Journal of Evaluation and Research in Education (Ijere), 13(3), 2006. https://doi.org/10.11591/ijere.v13i3.27497

Greaves, D. (2024). Bridging the digital divide: the role of online education in promoting equity. International Journal of Contemporary Education, 7(2), 1. https://doi.org/10.11114/ijce.v7i2.6768

Gunder, A. (2023). Centering equity and quality in online, blended, and digital learning. Ubiquity Proceedings. https://doi.org/10.5334/uproc.107

Gupta, D. (2024). Navigating the future of education: the impact of artificial intelligence on teacher-student dynamics. EATP, 6006-6013. https://doi.org/10.53555/kuey.v30i4.2332

Haqqi, H., Putro, D., & Murdani, A. (2022). Role of political memes on social media in criticizing political policy in the united states 2016-2019. Husnayain Business Review, 2(2). https://doi.org/10.54099/hbr.v2i2.285

Jafari, Z. (2022). Social media as a political arena: a qualitative analysis of online activism. ISSLP, 1(2), 19-25. https://doi.org/10.61838/kman.isslp.1.2.4

Jha, A. (2023). Media and public policy advocacy in india. Ijpmonline, 2(2), 19-24. https://doi.org/10.26524/ijpm.2.11

Kaiss, W., Mansouri, K., & Poirier, F. (2023). Effectiveness of an adaptive learning chatbot on students' learning outcomes based on learning styles. International Journal of Emerging Technologies in Learning (Ijet), 18(13), 250-261. https://doi.org/10.3991/ijet.v18i13.39329

Karami, A. and Mackenzie, A. (2020). Social media and covid‐19: characterizing anti‐quarantine comments on twitter. Proceedings of the Association for Information Science and Technology, 57(1). https://doi.org/10.1002/pra2.349

Katanosaka, T. (2023). Design and implementation of a gamified online education platform for teaching and learning secondary-school physics. Information Engineering Express, 9(2), 1. https://doi.org/10.52731/iee.v9.i2.781

Katz, Y. (2020). The impact of social revolutions on the arab-israeli conflict. Economics Politics and Regional Development, 1(1), p17. https://doi.org/10.22158/eprd.v1n1p17

Kayed, S., Ghoz, L., Elbehairy, F., Ghonim, A., & Hendawy, M. (2022). Setting an agenda for urban ai adaptivity in urban planning and architecture e-learning. Journal of Engineering Research, 6(4), 88-96. https://doi.org/10.21608/erjeng.2022.265385

Keller, F., Schoch, D., Stier, S., & Yang, J. (2019). Political astroturfing on twitter: how to coordinate a disinformation campaign. Political Communication, 37(2), 256-280. https://doi.org/10.1080/10584609.2019.1661888

Kharel, A. (2024). Cyber-politics: social media's influence on political mobilization. Journal of Political Science, 103-115. https://doi.org/10.3126/jps.v24i1.62857

Koka, N. (2023). The integration and utilization of artificial intelligence (ai) in supporting older/senior lecturers to adapt to the changing landscape in translation pedagogy. Migration Letters, 21(S1), 59-71. https://doi.org/10.59670/ml.v21is1.5939

König, J., Jäger-Biela, D., & Glutsch, N. (2020). Adapting to online teaching during covid-19 school closure: teacher education and teacher competence effects among early career teachers in germany. European Journal of Teacher Education, 43(4), 608-622. https://doi.org/10.1080/02619768.2020.1809650

Kono, K. and Taylor, S. (2021). Using an ethos of care to bridge the digital divide: exploring faculty narratives during a global pandemic. Online Learning, 25(1). https://doi.org/10.24059/olj.v25i1.2484

Li, Y. (2024). Analysis and prediction of students' adaptation to online education systems based on data analysis and decision tree machine learning algorithms. Advances in Social Behavior Research, 7(1), 15-19. https://doi.org/10.54254/2753-7102/7/2024053

Li, Y. (2024). Comparison and analysis of multiple machine learning algorithms for predicting student adaptation levels in online education. Lecture Notes in Education Psychology and Public Media, 40(1), 30-37. https://doi.org/10.54254/2753-7048/40/20240691

Liang, M., Lim, C., Park, J., & Mendoza, N. (2022). A review of ict-enabled learning for schoolgirls in asia and its impacts on education equity. Educational Technology Research and Development, 71(2), 267-293. https://doi.org/10.1007/s11423-022-10178-w

Liçenji, L. (2023). The role of social media on electoral strategy: an examination of the 2023 municipal elections in tirana, albania. Academic Journal of Interdisciplinary Studies, 12(6), 238. https://doi.org/10.36941/ajis-2023-0166

Macharia, A. (2024). Social media political communication and misinformation: a case study of the youth in kiambu county, kenya. African Journal of Empirical Research, 5(2), 894-904. https://doi.org/10.51867/ajernet.5.2.78

Mahande, R. (2024). Exploring hyflex learning modality through adaption-innovation theory for student learning equity. Online Journal of Communication and Media Technologies, 14(1), e202410. https://doi.org/10.30935/ojcmt/14170

Mahande, R. (2024). Investigating the effect of learning styles on hyflex learning towards equity of learning in higher education. Interactive Technology and Smart Education, 21(3), 442-460. https://doi.org/10.1108/itse-10-2023-0203

Martin, F., Sun, T., & Westine, C. (2020). A systematic review of research on online teaching and learning from 2009 to 2018. Computers & Education, 159, 104009. https://doi.org/10.1016/j.compedu.2020.104009

McGregor, S. (2019). Social media as public opinion: how journalists use social media to represent public opinion. Journalism, 20(8), 1070-1086. https://doi.org/10.1177/1464884919845458

Mnhrawi, D. and Alreshidi, H. (2022). A systemic approach for implementing ai methods in education during covid-19 pandemic: higher education in saudi arabia. World Journal of Engineering, 20(5), 808-814. https://doi.org/10.1108/wje-11-2021-0623

Musa, H. (2023). Social media as a political platform in africa: a bibliometric analysis. Komunikator, 15(2), 129-141. https://doi.org/10.18196/jkm.20062

Musasia, O. (2019). New media, political discourse and public opinion: a theoretical analysis of social media intertextuality and discursivity and its effect on governance in devolved political units in kenya. Journal of Media and Communication, 1(1), 9-16. https://doi.org/10.51317/ecjmcs.v1i1.48

Naidu, K. (2023). Chatgpt: an ever-increasing encroachment of artificial intelligence in online assessment in distance education. Online Journal of Communication and Media Technologies, 13(3), e202336. https://doi.org/10.30935/ojcmt/13291

Neo, M., Lee, C., Tan, H., Neo, T., Tan, Y., Mahendru, N., … & Ismat, Z. (2022). Enhancing students' online learning experiences with artificial intelligence (ai): the merlin project. International Journal of Technology, 13(5), 1023. https://doi.org/10.14716/ijtech.v13i5.5843

Ng, D., Leung, J., Su, J., Ng, R., & Chu, S. (2023). Teachers' ai digital competencies and twenty-first century skills in the post-pandemic world. Educational Technology Research and Development, 71(1), 137-161. https://doi.org/10.1007/s11423-023-10203-6

Ningsih, F. (2023). Classtime.com as an ai-based testing platform: analysing esp students' performances and feedback. Journal of Languages and Language Teaching, 11(3), 390. https://doi.org/10.33394/jollt.v11i3.8286

Niu, S., Luo, J., Niemi, H., Li, X., & Lu, Y. (2022). Teachers' and students' views of using an ai-aided educational platform for supporting teaching and learning at chinese schools. Education Sciences, 12(12), 858. https://doi.org/10.3390/educsci12120858

Niu, X. (2024). Promotion of urban and rural educational equity through online education: a case study on three schools. SHS Web of Conferences, 190, 01007. https://doi.org/10.1051/shsconf/202419001007

Noor, S., Mohamed, H., Zaini, N., & Daiman, D. (2022). Use of interactive multimedia e-learning in tvet education. International Journal of Advanced Computer Science and Applications, 13(9). https://doi.org/10.14569/ijacsa.2022.0130929

Onumah, C., Pincavage, A., Lai, C., Levine, D., Ismail, N., Alexandraki, I., … & Osman, N. (2023). Strategies for advancing equity in frontline clinical assessment. Academic Medicine, 98(8S), S57-S63. https://doi.org/10.1097/acm.0000000000005246

Otieno, P. (2024). The impact of social media on political polarization. Journal of Communication, 4(1), 56-68. https://doi.org/10.47941/jcomm.1686

Pinto, S., Albanese, F., Dorso, C., & Balenzuela, P. (2019). Quantifying time-dependent media agenda and public opinion by topic modeling. Physica a Statistical Mechanics and Its Applications, 524, 614-624. https://doi.org/10.1016/j.physa.2019.04.108

Pourdavood, R. and Song, X. (2021). Engaging pre-service and in-service teachers in online mathematics teaching and learning: problems and possibilities. International Journal of Learning Teaching and Educational Research, 20(11), 96-114. https://doi.org/10.26803/ijlter.20.11.6

Riyanto, D., Priyanto, P., & Midhio, I. (2023). The role of social media in building public opinion on the covid-19 pandemic and its impact on national defense. European Journal of Humanities and Social Sciences, 3(3), 132-138. https://doi.org/10.24018/ejsocial.2023.3.3.461

Salam, R. (2021). men will be men?: masculinities on display in the facebook communication practices of pakistani men. Norma, 16(1), 38-56. https://doi.org/10.1080/18902138.2021.1875640

Sapar, N. (2024). Instruments for investigating user engagement in politics on social media. International Journal of Academic Research in Business and Social Sciences, 14(1). https://doi.org/10.6007/ijarbss/v14-i1/20565

Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The impact of artificial intelligence on learner–instructor interaction in online learning. International Journal of Educational Technology in Higher Education, 18(1). https://doi.org/10.1186/s41239-021-00292-9

Sharma, N. and Sivakumar, G. (2023). Social media, political discourse and the 2019 elections in india: journalists' perspectives on the changing role of the mainstream media in setting the political agenda. Global Media and Communication, 19(2), 185-205. https://doi.org/10.1177/17427665231186252

Sjoraida, D. (2024). Public opinion formation in the digital age : a review of literature. IJEET, 2(2), 290-297. https://doi.org/10.61991/ijeet.v2i2.52

Songkram, N. and Osuwan, H. (2022). Applying the technology acceptance model to elucidate k-12 teachers' use of digital learning platforms in thailand during the covid-19 pandemic. Sustainability, 14(10), 6027. https://doi.org/10.3390/su14106027

Stone, C., Freeman, E., Dyment, J., Muir, T., & Milthorpe, N. (2022). Equal or equitable? the role of flexibility within online education. Australian and International Journal of Rural Education, 29(2), 26-40. https://doi.org/10.47381/aijre.v29i2.221

Stone, C. (2022). From the margins to the mainstream: the online learning rethink and its implications for enhancing student equity. Australasian Journal of Educational Technology, 38(6), 139-149. https://doi.org/10.14742/ajet.8136

Sun, Y. (2024). Evaluating the learning effectiveness of a blended teaching model of college english using a decision tree algorithm. jes, 20(6s), 1845-1856. https://doi.org/10.52783/jes.3101

Tang, K. (2024). Implications of artificial intelligence for teaching and learning. Acta Pedagogia Asiana, 3(2), 65-79. https://doi.org/10.53623/apga.v3i2.404

Tayer, K. (2023). The impact of social media networks on public opinion in the united arab emirates. International Journal of Academic Research in Business and Social Sciences, 13(9). https://doi.org/10.6007/ijarbss/v13-i9/18503

Thomas, T. (2024). The role of artificial intelligence in formal and informal education for students. International Journal for Research in Applied Science and Engineering Technology, 12(3), 69-71. https://doi.org/10.22214/ijraset.2024.58738

Tomas, C., Pozo, S., Tagliazucchi, E., & Balenzuela, P. (2021). News-sharing on twitter reveals emergent fragmentation of media agenda and persistent polarization.. https://doi.org/10.48550/arxiv.2112.09763

TONBULOĞLU, B. (2023). An evaluation of the use of artificial intelligence applications in online education. Journal of Educational Technology and Online Learning, 6(4), 866-884. https://doi.org/10.31681/jetol.1335906

Torres, A. (2023). Online teaching strategies: lessons learned from the transition to virtual classroom. Asia-Pacific Journal of Convergent Research Interchange, 9(6), 619-628. https://doi.org/10.47116/apjcri.2023.06.48

Uthirapathy, S. and Domnic, S. (2022). Predicting opinion evolution based on information diffusion in social networks using a hybrid fuzzy based approach. International Journal of Information Technology, 15(1), 87-100. https://doi.org/10.1007/s41870-022-01109-2

Varis, P. (2020). Trump tweets the truth: metric populism and media conspiracy. Trabalhos Em Linguística Aplicada, 59(1), 428-443. https://doi.org/10.1590/010318136834116202004 06

Wafik, H. (2024). Academicians' perspectives on ai integration in bangladesh's education: balancing promise and ethical realities. Cognizance Journal of Multidisciplinary Studies, 4(2), 139-158. https://doi.org/10.47760/cognizance.2024.v04i02.014

Walker, A. (2023). Transformative potential of culturally responsive teaching: examining preservice teachers' collaboration practices centering refugee youth. Education Sciences, 13(6), 621. https://doi.org/10.3390/educsci13060621

Xinyue, D. (2023). Social media as a tool for political mobilization: a case study of the 2020 hong kong protests. Journal of Public Representative and Society Provision, 3(1), 9-12. https://doi.org/10.55885/jprsp.v3i1.199

Xu, L. (2023). Research on work strategies and workflow of social bots., 535-546. https://doi.org/10.2991/978-94-6463-200-2_55

Yakin, M. and Linden, K. (2021). Adaptive e‐learning platforms can improve student performance and engagement in dental education. Journal of Dental Education, 85(7), 1309-1315. https://doi.org/10.1002/jdd.12609

Yildirim, Y., Arslan, E., Yildirim, K., & Bisen, I. (2021). Reimagining education with artificial intelligence. Eurasian Journal of Higher Education, 2(4), 32-46. https://doi.org/10.31039/ejohe.2021.4.52

Zhou, B. (2024). The comprehensive investigation of the role related to artificial intelligence in education. Applied and Computational Engineering, 36(1), 215-219. https://doi.org/10.54254/2755-2721/36/20230449