

Cultural Adaptation in AI-Assisted Learning Environments

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ABSTRACT

There has been an increasing application of artificial intelligence-assisted learning environments in higher educational institutions, but there have been limited cultural adaptations to this functionality. The study aimed to investigate how cultural aspects affected learning experiences using artificial intelligence-assisted learning environments, thereby determining opportunities and challenges that arise. The study used a qualitative study design, where data were collected using face-to-face interview techniques involving fifteen participants majoring from different academic departments. The collected data were then retrieved using thematic analysis. Results indicated that artificial intelligence-assisted learning facilitates self-directed learning through flexible pacing, instant feedback, and dynamic instructional support. Culturally aligned learning environments facilitate increased engagement and inclusivity in learning by using culturally aligned language and illustrative examples. Nonetheless, difficulties such as language incongruities, inadequate cultural alignment, bias, and technical issues pose setbacks to learning. Culturally responsive learning environments enhance learner motivation, engagement, and inclusion by incorporating culturally relevant language and examples. Conversely, however, mismatches in language, a lack of cultural customization, algorithmic bias, and technical limitations resulted in disadvantages for several participants. The study concluded that artificial intelligence-assisted learning environments are more effective when developed using culturally responsive and human-centered design principles, and emphasis was laid on the fact that closer collaboration is needed between educators and developers.

Keywords: Artificial Intelligence In Education, Cultural Adaptation, Ai-Assisted Learning, Culturally Responsive Learning, Qualitative Study

1. INTRODUCTION

Over the last few years and continuing into the Future over the next continuing many years...The growth of Artificial Intelligence (AI) Technology has dramatically changed what teachers are doing. It has created new opportunities that provide students with the ability to learn and gain knowledge in an adaptive way and then give the opportunity to provide stimulating experiences to the student (AI/Adaptive Learning Tools). Educators can now take advantage of these AI tools while they create productive and engaging experiences for their students (Abbas et al., 2023). The potential innovations created by Artificial Intelligence (AI) technology continue to have a profound impact on the quality of education and adapt multiple educational platforms and instructional methods. However, there are multiple challenges created by AI Technology regarding access to cultural diversity when working with AI. Research studies show that the interaction between students and Artificial Intelligence (AI) tools is directly influenced by the student's cultural background, including the student's language, values, and learning tradition. Because of this, any AI Technology designed in one cultural environment will need to be adapted when attempting to use it in another cultural environment (Begum, 2024; Tan et al., 2025).

To ensure that AI systems developed for use in educational settings fit into the cultural context of students, they must be developed in accordance with both the students' culture and the way they learn. Until now, much of the research conducted regarding using AI technology in education has focused primarily on understanding how widespread its usage and effectiveness will be; therefore, there is still a gap in understanding how students with different types of educational backgrounds interact with AI technology on an individual basis; specifically, we have not captured enough data or provided adequate reflection on educators' experiences in developing culturally responsive educational technology-based tools. Additionally, while there are many areas from which we can look at the

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sociocultural aspects involved in integrating artificial intelligence across multiple disciplines from an educational perspective, we do not currently have enough information to determine how culture has influenced students' use of the technology (Alotaibi & Alshehri, 2023).

This research endeavors to address these important gaps by conducting the research on a multidisciplinary pool of participants from diverse fields of study, such as English Education, Islamic Education, and Biomedical Engineering. A pool of diverse participants ensures the coverage of all possible mechanisms of cultural adaptation across different settings (W. Li, 2024). Additionally, incorporating the perspectives of the practical application of research participants ensures the achievement of a well-rounded understanding of the adaptive AI-based learning process, through which the conventional education process would be enhanced. Conducting the research through the use of qualitative methods, the research underscores the importance of culturally-responsive education principles, which would greatly improve the efficiency of the learning process (Aydın & Sirkeci, 2024).

This research project is guided by three main questions that seek to understand the cultural adaptation experiences of students who use artificial intelligence-based educational technologies; to identify the obstacles and advantages encountered while adapting to incorporating AI into education; and to identify ways in which educators and app developers can support educators in developing culturally inclusive AI learning methods. The outcome of this work will be to develop knowledge for both the academic community and practitioners to promote equal and culturally aligned AI learning opportunities. The importance of this research is to help build a bridge between the fields of educational technology and intercultural pedagogy to create an educational environment using AI that respects the learners' cultural identity, experiences, and context, which will provide for a more responsive and effective educational environment (Alenezi, 2023).

2. LITERATURE REVIEW

2.1 AI Enhances Personalization and Engagement

Artificial intelligence (AI) has transformed learning processes in the educational sector by supporting personalized learning, adaptive learning, and improved levels of learner engagement. AI-enabled learning platforms such as intelligent learning systems, adaptive learning platforms, and automated feedback systems allow for personalized learning according to the needs of the learners. For example, studies have revealed that automated learning platforms using AI can lead to a remarkable improvement in learning competence as well as self-directed learning skills among learners, which ultimately results in adaptive learning experiences beyond the limitations of conventional learning approaches (Bozkurt et al., 2021; Cheng et al., 2020; Ifraheem et al., 2024). In this regard, a study has revealed that personalized learning platforms using AI-enabled technologies help in achieving greater learner motivation and satisfaction levels, retention of learners from institutions, as well as maximized learning outcomes (Abbas et al., 2023).

2.2 Cultural Dimensions Are Often Overlooked

Although the benefits accrued by AI technology in learning are apparent, the process and strategy for adopting such technology sometimes fail to consider the cultural aspect of knowledge attainment. Cultural patterns and practices include language, social norms, values, and ways of acquiring knowledge. The cultural orientation of learners influences their interaction and response to technology such as AI. A study indicates that a technology designed and developed from one cultural orientation might not effectively serve learners from a different cultural environment. This might reduce learners' engagement and lead to poor interpretation of content (Cheng et al., 2020; Zhai et al., 2021)

2.3 Cultural Adaptation is Critical for Effective AI Learning

Cultural adaptation is described as "the process of matching AI systems, educational strategies, and interactions with specific cultural settings. Incorporating indigenous themes, examples, and illustrations into AI-supported educational settings is proven to have tremendous potential in improving participation, understandability, and motivation of learners in an educational setting (Abbas et al., 2023; Prof, 2024). The effectiveness of strategies that promote cultural adaptability in digital educational platforms has been proven to have positive outcomes in encouraging participation and

satisfaction of learners, consequently leading to improved educational experiences (Cheng et al., 2020; Tuomi, 2022). The integration of cultural adaptability in AI development is ensured to provide educational support that exceeds the simple supply of knowledge to learners by reaching out to their identities and expectations in an educational setting (Konyrova, 2024).

2.4 Ethical, Inclusivity, and Bias Considerations

Without considering the aspect of culture when using AI or artificial intelligence technology in education, some challenges of ethics or inclusivity could result. Research has shown that despite the use of algorithmic learning in the development of these technologies, some learners are favored over others based on their learning styles or backgrounds (Tuomi, 2022). Key policy debates show how these AI systems used in higher institutions of learning are designed to favor institutional performance rather than being able to accommodate different cultures (Pack & Maloney, 2024). Therefore, developing these technologies to accommodate different cultures requires a strong framework that incorporates different ethics of learning (Cheng et al., 2020; Prof, 2024).

2.5 Research Gaps

While AI in education continues to gain momentum, there remain huge research gaps. For example, empirical investigations into the experiences cross-disciplinary learners have with AI-assisted learning in culturally diverse settings are limited in number (Triansyah et al., 2023). Secondly, there is a need for research that incorporates both student and practitioner inputs, which would provide insights leading to better design and implementation of adaptive AI tools that are culturally responsive. Furthermore, qualitative inquiries into the living experiences and adaptation strategies of learners, particularly in the multidisciplinary and multicultural contexts, are noticeably scanty (Bation & Pudan, 2024; Gökoğlu, 2024). The aforementioned research studies are very much central to understanding the development of AI-assisted learning environments that are not just effective but also culturally inclusive and responsive to the needs of diverse learners.

In conclusion, AI technology has a great deal to offer in terms of revolutionizing the world of education and enabling improved adaptive and interesting means of education for students. The impact of AI technology is greatly dependent on cultural adaptation. The idea of a culturally adapted approach is widely accepted in existing research and has proved to be greatly beneficial for engaging students. The need for a comprehensive study is being realized to a great extent as current research fails to consider the issue of varied disciplines as well as qualitative views related to the matter. The aim of this study will be to gain deep insight into the impact of cultural adaptation in AI-assisted learning environments.

3. METHOD

The research study used a qualitative research design to investigate cultural adaptation in AI-supported learning contexts. Using a qualitative research study was specifically chosen for the study because of its capability to offer a profound understanding of learners' experiences and challenges in a complex learning context, as mentioned by (Jiang et al., 2024). The qualitative research study was chosen for its capability to focus on rich information as opposed to using numbers, as used in a quantitative study. The primary focus of a qualitative study is not just on what happens to learners but the way they interpret these events, as mentioned by (Altınay et al., 2024).

Participants included 15 student volunteers from different academic departments. The selection of these participants from different departments was done to ensure this study can examine adaptation in different subject areas (Seneviratne et al., 2025). In addition to these student respondents, this study aims to obtain data from people who engage in AI-assisted learning in different ways, ensuring it is possible to analyze both perspectives (Wei, 2023).

Data gathering was performed through face-to-face semi-structured interviews, allowing for flexibility in exploring participants' experiences and ensuring that data is gathered within the framework of study goals (Galán et al., 2021). Interview guides were prepared to explore students' views on cultural adaptation, difficulties and barriers encountered, opportunities identified, and recommendations for bettering AI-facilitated learning systems. Likewise, educational and professional views on design principles, educational approaches, and cultural responsiveness in AI-supported

learning contexts were gathered through similar face-to-face interactive interviews (Ingale et al., 2023). All conversation sessions were recorded after seeking participants' permission, and systematic observation notes were written to allow for understanding and insight during data analysis.

In this way, the validity and trustworthiness of the research were supported using several strategies. These strategies included, first, the use of triangulation of the data, whereby information for the study had to be gathered from several sources, both students and professionals, and in this way, the whole topic of cultural adaptation can be understood comprehensively (Friatin, 2023). Secondly, the study aimed to perform member checking, whereby the interpretations of the interviews were considered to be congruent with the perceptions of the members. That is, the researcher sought to Summary the results of the interviews with the members to ensure that the results are clear and free from ambiguities found during the accounts told by the members (Maphoto et al., 2024). Thirdly, the study aimed to perform a reflective audit trail whereby the whole process of the research, whether the decisions made or the way the results have been analyzed, can be comprehensively understood (Poquet, 2024).

The ethical concerns were carefully attended to throughout the entire process of the study. The study is voluntary, with all participants giving consent to take part in the study. The confidentiality and anonymity of the study were ensured through the use of pseudonyms for the participants, in which the participants' details were eliminated from the transcripts (Cao & Abdullah, 2025). The study also paid attention to the ethical considerations in dealing with the sensitive study of culture, upholding the participants' values, beliefs, and experiences throughout the study process (W. Li, 2024).

Data were analyzed through the process of thematic analysis. In this process, the coding of the raw interview transcripts took place. In particular, the process aimed at the systematic coding of the raw interviews to observe recurring patterns throughout the dataset. Upon this process, there were three key themes considered for the research. These themes included (1) the experiences of the students acclimating to AI-assisted learning from the AI systems from the perspectives of the students, (2) the opportunities and benefits that come along with the culturally responsive AI systems to the students, and (3) the challenges faced by the students in implementing the culturally adaptive practices (Järvelä et al., 2023). Through the process of thematic analysis, there was the availability of flexibility while interpreting the raw results from the study.

In sum, the approach used here offers a rigorous, transparent, and ethical way to explore cultural adaptability within the context of AI-supported learning. The research explores insights from both student and professional perspectives using a type of qualitative, transdisciplinary interview technique that offers a nuanced understanding of the context in which culture intersects with AI technologies within the learning environment. This ensures that the research outcome will help to enhance the development of culturally supportive AI-enabled learning systems.

Contains how data is collected, data sources and ways of data analysis.

4. RESULT AND DISCUSSION

Result

Through the analysis of the unstructured interviews carried out amongst 15 participants, a number of important findings regarding cultural adaptability in environments of AI-assisted learning were unearthed. These results are categorized into three themes, which are experiences, opportunities, and challenges.

4.1 Participants' Experiences of AI-Assisted Learning

The participants have also reported diverse experiences in their engagement with AI-supported learning systems. Quite a number of them pointed out that these AI-based systems have improved personal learning experiences by providing them with information adjusted to cater to their different skill levels. For example, both Participant 1 and Participant 3 indicated that their grasp of challenging concepts was improved by AI-supported educational responses, as well as exercises. This is in line with past studies that have demonstrated that personal learning achieved via intelligent tutoring systems is very successful (Abbas et al., 2023; Wang et al., 2020).

In addition to a better understanding, some students have reported that AI has enabled them to learn independently. This is supported by previous literature that has established that AI-based technologies enable students to learn autonomously and at their own convenience (Abbas et al., 2023).

It is important to note that outcomes have varied for students, especially based on their experience and exposure to technology and AI-based systems. While some students reported positive experiences, others expressed concerns about the availability and learning curve associated with AI-based systems.

4.2 Opportunities in Culturally Adaptive AI Learning

Indeed, participants identified several advantages of culturally adaptive AI-assisted learning environments. Most of the participants said that AI tools enabled flexible learning opportunities to accommodate different learning preferences and styles. For instance, Participant 2 mentioned that artificial intelligence systems with multiple cultural examples successfully increased students' interest and motivation. This finding confirms several studies calling for embedding culture within AI to enable culturally responsive educational services in response to the diverse needs of learners (Sharma & Harkishan, 2022).

Moreover, the participants felt that culturally relevant AI could improve academic outcomes, particularly when the study material is connected with the learner's existing knowledge as well as learner preferences. The findings were in agreement with other research, as culturally relevant study material increases levels of engagement, thereby creating a more welcoming environment for students in the classroom (Kowitlawakul et al., 2024).

4.3 Challenges and Barriers

Despite the many benefits, the participants also mentioned some of the challenges encountered while using AI-assisted learning systems. One of the most common challenges mentioned is the lack of alignment of the language and culture, as the AI system may present an explanation that does not match the learners' culture. This is illustrated in the view of participant 5, who said that some AI systems seem to lean towards a certain approach to learning, which could just be the inherent biases that such systems have when presenting content to the learners. This aligns with the view in previous literature that the biases in AI are potential perpetuators of inequalities in society as mentioned in (Eysenbach, 2023).

The lack of technical capabilities was mentioned as one of the difficulties, mentioning a lack of customization capabilities. But to tackle such difficulties, a lot of design work will have to be done, and a great deal of sensitivity regarding cultural issues in AI systems will have to be exhibited. The need to make improvements in AI tools is seen in a call to make responsive systems, which will be in consideration of the learners' varied backgrounds (Rida et al., 2023).

4.4 Summary of Findings

In general, findings from this study tend to show that AI-assisted learning environments afford many opportunities for personalized, inclusive, and flexible learning processes while also providing significant opportunities to create culturally adapted AI-assisted learning environments to foster effective learning processes among students from diverse cultural settings. These findings offer a strong foundation to address improve AI-assisted learning systems and develop effective cultural adaptation strategies to succeed within AI-assisted learning environments to create effective learning processes for students from various cultural settings.

Discussion

4.1 Interpretation of Participants' Experiences

The results indicate that respondents generally view AI-supported learning as a learning tool that complements personalized learning. The result is in sync with the views of researchers who highlighted that AI has the capability of differently teaching learners based on their personal needs, learning rate, and skills (Bozkurt et al., 2021; Cheng et al., 2020; Ifraheem et al., 2024). The personal experiences of respondents included learning increases that were characteristic of greater learning autonomy, as highlighted by literature that emphasizes AI-supported learning increases learners' learning motivation (Abbas et al., 2023).

In addition, the participants pointed out the importance of being familiar with technology to effectively benefit from AI technology. This finding is consistent with previous research, which claimed that the readiness of the learner and digital literacy play a vital role in understanding the level of success the students will see when navigating AI-based learning platforms (Cheng et al., 2020). In this context, the importance of digital literacy again comes to the forefront by requiring educators to equip all students with the necessary tools to efficiently use AI technology (Ifraheem et al., 2024).

4.2 Opportunities of Culturally Adaptive AI Learning

The participants shared different opportunities that come with the use of culturally adaptive AI tools, such as gaining motivation, being engaged, or feeling included when they used cultural examples

or content. The study's findings were comparable to the existing literature that suggested embedding culturally relevant content to increase the level of learners' engagement, understanding, and level of satisfaction (Abbas et al., 2023; Gökoğlu, 2024).

Moreover, the findings are supported by literature which found that culturally adaptive AI has a role in facilitating meaningful learning experiences through recognizing learners' identities, values, and backgrounds (Prof, 2024; Tuomi, 2022). The learners agreed that learning became meaningful when it was done in a way that was related to their cultures, supporting the claim that being culturally responsive in learning is important when using AI (Li & Huang, 2025).

4.3 Challenges and Barriers

Particular challenges in following this adaptation in AI-assisted learning based on cultural background were also brought out. Examples included differences in language, unknown examples, lack of algorithmic equity, and irrelevance to context. These have been consistent with previous works in pointing out the weaknesses in using AI designed in another cultural setting for people from different backgrounds (Cheng et al., 2020; Zhai et al., 2021).

The biases in algorithms voiced by the respondents reflect the observations in current literature on the inequality that could arise from the lack of consideration for different cultures on the part of AI systems (Li & Huang, 2025; Tuomi, 2022). In addition, the experiences voiced by the respondents on the lack of cultural customization are supported by observations on the fact that AI systems lack consideration for cultures in their designs due to the pursuit of efficiency (Prof, 2024).

It ought to be noted that the issues faced by the participants only seem to validate rather than dispute any existing literature. The key takeaway from the viewpoints of the participants seems to further validate the need for human-centric AI development that incorporates cultural feedback (Prof, 2024).

4.4 Pedagogical and Technological Implications

This study implies that knowledgeable and prudent use of AI tools should be facilitated and aided by educators when learners encounter challenges due to mismatches of culture and language. The current study supports existing views that human intervention is crucial for assisting students in comprehending and deciphering AI responses (Abbas et al., 2023; Cheng et al., 2020).

From a technical perspective, participant feedback circles around the importance for AI developers to implement cultural sensitivity and related concepts for reducing bias into their models. This requirement serves to support previous literature that indicates culturally responsive practices create substantial improvements for learners regarding engagement, motivation, and performance outcomes (Prof, 2024; Tuomi, 2022).

Moreover, these findings support the claim that culturally adaptive content and iterative feedback should be considered in AI-based learning platforms to mitigate any adverse consequences stemming from cultural mismatches. This corresponds with Gökoğlu (2024) and Li & Huang (2025) arguing that ignoring cultural sensitivity in AI can result in decreased engagement and unfair access to education.

4.5 Summary of Findings

In conclusion, the implications of findings that emerge from this study provide insight into the different ways that AI is used to improve personal and culturally responsive learning. Although there are many opportunities presented through AI learning, it is important that there is recognition of the challenges and that there is taken into consideration the different needs of learners that are involved.

5. CONCLUSION

In this study, the cultural adaptability of AI-assisted learning systems is analyzed through interviews of 15 students. The results of this study have found that the use of AI-assisted learning systems has immense possibilities to improve the adaptive learning of the students to learn at their own pace. The key benefits of AI-assisted learning systems that the students have experienced are the availability of immediate feedback, practice exercises, and adaptability of the systems to the individual needs of the students. These results support the existing studies conducted to acknowledge the capability of AI-assisted systems to support adaptive learning while incorporating the culture of the students into the technological systems.

The research also found that culturally adaptive AI has the potential to promote inclusivity and engagement in the learning process. The aspect where the AI systems use culture-responsive examples,

language, and pedagogy will help the students relate to them, hence creating a motivated learning process. This observation is supported by a study that found a culturally adaptive AI approach to be successful in improving the achievement of students in the learning process. The culturally adaptive AI approach ensures that the AI-assisted learning process goes beyond traditional content delivery, thus creating a new approach that is fair.

However, it has also identified certain challenges and limitations associated with it. Students felt that there were instances where language incompatibility, misspellings, and less customized systems obstructed the way to learning effectively. Another concern expressed was the possibility of biased algorithms, where AI systems were inclined to one method and content over others. This not only throws grave emphasis on people-centric AI but also indicates the need for alignment between technology and the way students prefer to learn. Moreover, AI could create gaps and not enable inclusive learning.

The significance of this study is that it fills a gap that exists in educational technology and intercultural pedagogy. Even though AI in educational settings has received attention from various scholars, very little literature has been devoted to students' experiences in adjusting to a new culture within AI-assisted learning settings. By shedding light on both sides' challenges and opportunities from a learning point of view, this study is essential.

In practical application terms, a collaboration between educators and designers of AI learning solutions would help in developing a flexible and adaptive learning solution using AI that would be able to accommodate a particular culture. Scaffolding or guidance from educators would help in partnering with AI solutions to help learners reach their fullest potential. Developers can use elements of adaptive learning.

AI-assisted learning offers the possibility of complete transformation in the improvement of the educational process, but it is dependent on the ability to adapt to the culture in the implementation process. In conclusion, the future AI-assisted learning systems will be more inclusive and successful based on the identified opportunities and challenges in the above research. In general, this research proves that in the implementation of AI-assisted learning in the educational field, technology alone is insufficient.

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