Socio Technical Perspectives on Implementing Artificial Intelligence for Formative Assessment in Culturally Diverse Educational Institutions

Rinna Rachmatika[1]*, Kecitaan Harefa[2]

[1] Universitas Pamulang, Indonesia; e-mail: rinnarachmatika@unpam.ac.id
[2] Universitas Pamulang, Indonesia; e-mail: dosen00842@unpam.ac.id
*   Corresponding Author: rinnarachmatika@unpam.ac.id

Abstract: The integration of Artificial Intelligence (AI) into educational settings, particularly in formative assessments, offers significant benefits in terms of personalized learning, real time feedback, and increased efficiency. However, the successful implementation of AI driven formative assessments depends not only on technological capabilities but also on socio cultural and organizational factors that shape its adoption. This study explores the socio technical factors influencing the use of AI in formative assessments, emphasizing the importance of considering cultural diversity, institutional culture, and educators' beliefs. AI technologies, while powerful in automating grading and providing personalized assessments, often face limitations in addressing complex student responses that require human judgment. Furthermore, cultural factors, such as students' prior exposure to technology and different cultural attitudes towards AI, play a critical role in the acceptance and effectiveness of these tools. Organizational factors, including leadership support, digital literacy, and the readiness of institutions to adopt AI, are also key determinants in the successful implementation of AI systems in education. Teachers' beliefs about assessment influence their acceptance and use of AI tools, highlighting the need for professional development and training to ensure that AI enhances pedagogical goals rather than replacing human expertise. The study concludes that the alignment of technology, culture, and assessment beliefs is essential for the effective use of AI driven formative assessments in educational settings. Recommendations for educational institutions include adopting a socio technical approach to AI integration, with a focus on providing resources, training, and fostering a culture of innovation. Future research directions should focus on expanding studies to diverse educational contexts, conducting longitudinal research on AI's impact on learning outcomes, and exploring additional socio technical frameworks to guide AI adoption in education.

Keywords: Artificial Intelligence; Cultural Diversity; Educational Technology; Formative Assessment; Socio Technical Factors.

1. Introduction

Artificial Intelligence (AI) is rapidly transforming various sectors, including education, where it plays a critical role in enhancing formative assessment practices. AI technologies enable personalized learning, provide real time feedback, automate grading, and enhance test security [1], [2]. These advancements reduce teachers' workload, streamline administrative tasks, and offer data driven insights that can significantly improve student learning outcomes [2]. AI driven formative assessments are particularly valuable as they allow continuous tracking of students' progress, enabling educators to adjust their teaching strategies in real time [3]. Moreover, AI tools help make assessments more equitable and unbiased by applying consistent evaluation criteria, thus minimizing human error and subjectivity in grading [2], [3].

Despite the promising potential of AI in educational assessments, there remains a notable gap in research concerning the socio cultural and organizational factors that impact AI's adoption and effectiveness in diverse educational contexts. While AI's technical capabilities have been extensively explored, less attention has been given to how the socio cultural environment and organizational readiness influence the success of AI powered formative assessments [4]. These factors, including educators' beliefs, institutional support, and cultural attitudes, are crucial for the integration of AI in education. Understanding how these elements shape the implementation of AI in formative assessments is key to maximizing its potential.

Socio cultural factors significantly impact the attitudes and perceptions of both students and teachers towards AI in education. For instance, students' familiarity with technology, their prior exposure to AI, and cultural attitudes toward technology can all influence their acceptance of AI based assessments [5], [6]. Gender and socio economic background are also important considerations that may affect students' attitudes toward AI, with some groups potentially experiencing more significant challenges in accessing or engaging with AI tools [5]. Furthermore, AI's effectiveness in educational settings depends on its cultural sensitivity. Educational institutions must ensure that AI tools are designed and implemented in a way that is inclusive, respects cultural diversity, and addresses the needs of all learners [4].

In addition to socio cultural factors, ethical concerns surrounding AI in education are critical. Issues such as data privacy, algorithmic bias, and the potential for AI to diminish teacher autonomy are ongoing challenges that need to be addressed. AI systems must be designed with ethical considerations in mind to ensure that they serve the best interests of students and educators alike [3], [7]. For example, AI algorithms must be transparent, and data privacy measures should be robust to prevent exploitation or misuse of sensitive student information [3]. Furthermore, educators must maintain agency in the assessment process, using AI tools as a supplement to their expertise rather than a replacement for their professional judgment [8].

Organizational factors also play a pivotal role in the successful implementation of AI driven formative assessments. Institutional readiness, including leadership support, resource allocation, and the availability of technological infrastructure, is crucial for AI adoption. Educational institutions must foster a culture that embraces innovation and provides teachers with the necessary tools and training to effectively integrate AI into their teaching practices [9], [10]. Teachers' competence in using AI tools and their ability to align AI generated feedback with pedagogical goals are essential for the success of AI powered formative assessments [11]. Without adequate support and training, AI tools may not be used to their full potential, limiting their impact on student learning.

Effective integration of AI in formative assessment also requires careful consideration of the resources available to educational institutions. Access to AI technologies must be equitable, ensuring that all students, regardless of their socio economic background, have the same opportunities to benefit from AI enhanced learning tools [11]. Educational institutions need to address technical limitations, provide ongoing professional development for teachers, and allocate resources to ensure the sustainability of AI initiatives [1]. As AI technologies continue to evolve, it is essential that institutions invest in ongoing research and infrastructure to ensure that these tools remain effective, equitable, and aligned with the needs of diverse educational contexts.

The integration of Artificial Intelligence (AI) in educational settings, particularly in formative assessments, represents a significant shift in how educators assess student progress. AI powered formative assessments offer a range of benefits, including personalized learning, real time feedback, automated grading, and enhanced test security. However, the successful implementation of AI in formative assessments requires more than just technological advancements; it requires an understanding of the socio technical factors that shape its adoption and effectiveness in diverse educational contexts. These factors encompass the interplay between technical elements, such as data quality and system scalability, and social factors, including user acceptance, cultural sensitivity, and human oversight [12], [13]. A socio technical approach ensures that both technological and social components are integrated, leading to more effective and sustainable AI solutions in education [14], [15].

A key socio technical factor that must be considered in the implementation of AI driven formative assessments is cultural sensitivity and inclusivity. AI systems can sometimes exhibit biases that marginalize students from different cultural backgrounds, which can undermine the effectiveness of assessments in culturally diverse educational settings [16], [17]. For AI powered formative assessments to be effective, they must be designed to recognize and

respect cultural differences, ensuring that all students, regardless of their background, are fairly assessed. Incorporating culturally responsive pedagogy into the design of AI systems can help mitigate cultural biases and improve the overall educational experience for diverse student populations [18]. By addressing these cultural factors, AI tools can better align with the needs of all students, fostering inclusivity and equity in educational assessments.

Human machine interaction is another crucial component in the successful implementation of AI in formative assessments. The interaction between teachers, students, and AI systems must be optimized to ensure that AI tools complement, rather than replace, human judgment. Teachers play a central role in mediating AI tools, ensuring that they align with pedagogical goals and enhance the learning experience [19], [20]. Effective implementation of AI in formative assessments involves designing user centered tools that facilitate meaningful interactions between teachers and students, supporting personalized learning and adaptive feedback. This approach ensures that AI tools are used as a supplement to, rather than a replacement for, the teacher's professional expertise.

The integration of socio technical factors into the AI implementation process also involves addressing organizational considerations. Institutional readiness, leadership support, and resource allocation are essential for the successful adoption of AI driven formative assessments [13]. Organizational culture and the degree of preparedness to adopt AI tools significantly impact how AI systems are received and used by educators and students. Leadership support plays a crucial role in fostering a conducive environment for AI adoption, and institutional policies must be in place to ensure that AI tools are effectively integrated into teaching and assessment practices [14]. Moreover, adequate training for educators is critical to ensure that teachers can effectively use AI systems to enhance formative assessments and support student learning [15], [19].

The primary objective of this study is to explore how socio technical factors influence the implementation of AI driven formative assessments in culturally diverse educational institutions. This includes identifying the critical success factors for AI adoption, such as technological infrastructure, user centered design, and organizational adaptability [15], [19]. Additionally, the study aims to address cultural and ethical considerations, exploring strategies to mitigate biases and promote inclusivity in AI systems [16], [17]. Ethical implications such as algorithmic bias, data privacy, and the need for human oversight will also be explored to ensure that AI in formative assessments is used responsibly and effectively.

Finally, enhancing human AI collaboration is essential to ensure that AI tools support, rather than undermine, educational goals. By promoting the use of AI for real time feedback and adaptive learning experiences, while maintaining the critical role of teachers in the assessment process, this study will contribute to the development of frameworks that integrate socio technical factors to enhance human AI collaboration in educational settings; [20]. The ultimate goal is to create a balanced, inclusive, and effective approach to AI implementation in formative assessments that benefits both students and educators.

2. Literature Review

Overview of AI in Educational Assessment Systems

Artificial Intelligence (AI) has brought significant advancements to educational assessment systems, enhancing their efficiency and personalization. AI powered assessment tools are used across various educational settings, including adaptive learning platforms, intelligent tutoring systems, and educational data mining. These tools enable real time feedback, personalized learning plans, and predictive analytics, which help educators tailor their instruction to meet the unique needs of each student [21], [22]. AI technologies not only streamline grading processes but also provide valuable data insights that can improve student outcomes. By analyzing large sets of student data, AI can offer customized learning paths, predict potential learning gaps, and adjust instruction accordingly.

Despite the potential benefits, AI driven educational assessments face several challenges, such as algorithmic bias and concerns related to data privacy. These challenges can undermine the effectiveness of AI systems if not properly addressed [23]. Algorithmic bias, for example, can result in unfair assessments that disproportionately affect students from certain demographic groups, which highlights the need for more transparent, culturally sensitive AI designs. Additionally, issues related to data privacy, particularly in the collection and processing of sensitive student data, must be carefully managed to protect students' rights.

Addressing these challenges is crucial for the ethical implementation of AI in educational assessments, ensuring that AI tools are used responsibly and equitably.

The Role of Formative Assessment in Student Learning and Development

Formative assessment plays a crucial role in enhancing student learning and development by providing continuous feedback during the learning process. Unlike summative assessments, which evaluate students' final performance, formative assessments offer real time insights into student progress, allowing educators to adjust their teaching strategies accordingly [24]. These assessments are integrated into daily classroom activities and provide valuable information on students' understanding, enabling teachers to identify areas of improvement and intervene when necessary. Formative assessment is particularly effective in fostering the development of cognitive and metacognitive skills, as it encourages students to reflect on their learning, set goals, and monitor their progress [25].

In addition to cognitive development, formative assessments also support students' behavioral and affective growth. By providing frequent feedback, formative assessments help students develop self regulation, self efficacy, and metacognitive awareness, which are essential for their academic success [24]. Moreover, formative assessments promote a collaborative learning environment where students and teachers engage in meaningful dialogue about learning goals and challenges. This continuous feedback loop enhances the learning experience, making students more active participants in their education. By supporting the development of both academic and personal skills, formative assessment is a vital component of student growth.

Socio Technical Systems Theory: Definition and Application to Educational Technologies

Socio Technical Systems (STS) Theory is a framework that examines the interaction between social and technical elements within an organization. It emphasizes the importance of optimizing both the social components, such as people, structures, and culture, and the technical components, such as tools, tasks, and technologies, to improve system performance and user satisfaction [26]. In educational contexts, STS Theory helps understand how educational technologies, such as AI based assessment systems, interact with the social environment, including teachers, students, and institutional policies. By applying STS Theory, educators and researchers can ensure that AI tools are not only technically effective but also socially relevant and aligned with the educational goals of the institution.

The application of STS Theory to educational technologies, particularly AI in formative assessments, highlights the importance of balancing technological capabilities with social factors. For example, learning analytics powered by AI can provide valuable data to inform teaching practices, but these technologies must be designed and implemented in ways that align with the cultural and pedagogical needs of the institution [21]. Additionally, teacher training and professional development are key elements in the successful integration of AI tools into the classroom. STS Theory can guide the design of teacher training programs that combine technical skills with pedagogical strategies, ensuring that teachers are equipped to use AI tools effectively in their instructional practices [26]. By focusing on the interplay between technology and social factors, STS Theory offers valuable insights into the successful implementation of AI in educational assessments.

Previous Studies on the Implementation of AI in Education

The integration of Artificial Intelligence (AI) into educational systems has been a topic of increasing research in recent years. One critical factor influencing AI adoption in educational institutions is organizational culture and change management. Successful implementation of AI requires effective leadership, transparent communication, and significant investment in skills development. Without these elements, resistance to change can hinder AI adoption [27], [28]. Organizational culture plays a key role in determining how ready an institution is to embrace new technologies. Institutions that foster a culture of innovation and adaptability are more likely to successfully integrate AI into their operations. Moreover, AI adoption is not only about technology but also about ensuring that educational institutions are equipped to manage the organizational shifts that accompany these changes.

In addition to organizational culture, cross cultural differences also play a significant role in AI adoption. Studies have highlighted how national culture influences the readiness of institutions to adopt AI technologies. For instance, a comparison between Germany and the United States using Hofstede's cultural dimensions showed that cultural factors such as power distance, individualism, and uncertainty avoidance can shape how organizations perceive and adopt AI [29]. This underscores the importance of considering cultural context when implementing AI, as educational institutions in different countries or regions may face distinct challenges and opportunities. AI tools must therefore be designed and implemented with an awareness of these cultural differences to ensure they are effective and widely accepted across diverse educational environments [30].

Identified Gaps in Current Literature

While there has been substantial research on the adoption of AI in various sectors, there is a notable gap in understanding how cultural and institutional contexts specifically influence AI implementation in education. Although similar studies have been conducted in fields like healthcare and business [31], there is limited research focused on educational settings. The intersection of technology, culture, and institutional context remains underexplored in the field of AI adoption in education [28], [29]. This gap highlights the need for more research to investigate how cultural and institutional factors interact with technological advancements in education to shape the success of AI driven assessments and learning tools.

Furthermore, current literature often lacks systematic frameworks for AI implementation in education that integrate technological, cultural, and organizational factors. Research has highlighted the need for comprehensive models that guide the deployment of AI in educational contexts [32], [33]. These frameworks would address not only the technical aspects of AI tools but also the cultural and organizational readiness necessary for successful implementation. Additionally, ethical considerations, such as algorithmic bias, data privacy, and the pedagogical implications of AI, remain underexplored. As AI continues to play a larger role in education, it is essential to develop frameworks that ensure its ethical and effective use, addressing both its benefits and challenges [27], [33].

3. Materials and Method

This qualitative case study aims to explore the socio technical factors influencing the implementation of AI driven formative assessments in culturally diverse educational institutions. Data will be collected through semi structured interviews with key stakeholders educators, administrators, and students to gather insights into their perceptions, experiences, and attitudes towards AI in assessments. Additionally, institutional documents will be analyzed to understand the policies and frameworks guiding AI integration, while classroom observations will provide a practical understanding of how AI tools are used in real world teaching environments. Thematic analysis will be applied to the collected data to identify key socio technical themes, focusing on technological, cultural, and organizational factors affecting AI adoption. Ethical considerations, including confidentiality, informed consent, and participant rights, will be prioritized to ensure that the study adheres to ethical standards and protects participant privacy. This approach aims to uncover the complex dynamics that shape AI integration in educational settings, offering valuable insights into its effective implementation.
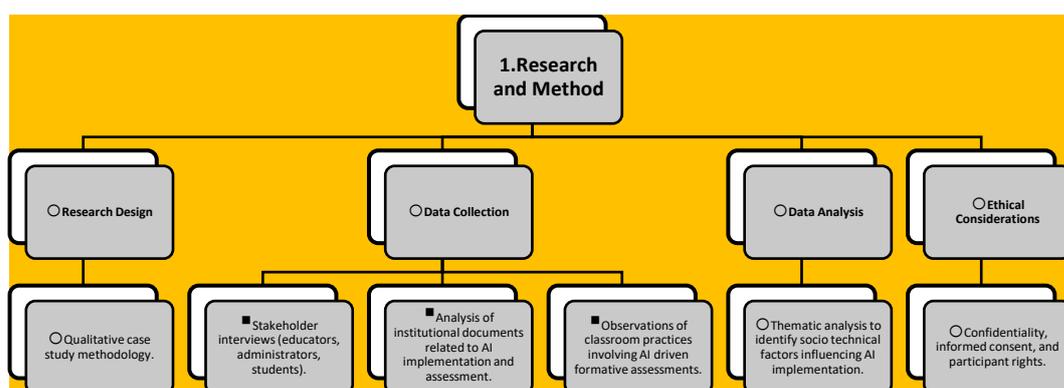

Figure 1. Research Methodology Flowchart Structure.

Research Design

This study will utilize a qualitative case study methodology to examine the socio technical factors that influence the implementation of AI driven formative assessments in culturally diverse educational institutions. Case study research is particularly suited for exploring complex phenomena within their real life contexts, which is crucial when investigating how AI is integrated into educational settings. By focusing on specific cases, this approach allows for an in depth analysis of the various factors both social and technical that shape AI adoption in educational institutions. The case study methodology provides a detailed understanding of the experiences of educators, administrators, and students as they interact with AI tools in the classroom.

Data Collection

Data will be gathered through three primary methods: stakeholder interviews, institutional document analysis, and classroom observations.

Stakeholder Interviews

Semi structured interviews will be conducted with key stakeholders involved in the AI implementation process, including educators, administrators, and students. These interviews will provide insights into the attitudes, perceptions, and experiences of those directly affected by AI driven formative assessments. The interviews will explore topics such as the level of institutional support, cultural influences on AI adoption, and how AI tools are perceived by different stakeholders.

Analysis of Institutional Documents

Institutional documents related to AI implementation and assessment practices will be analyzed to understand the formal policies, strategies, and frameworks guiding the use of AI in educational assessments. Documents such as training materials, institutional reports, and policy papers will provide a comprehensive view of the institutional support mechanisms in place for AI adoption. This analysis will help identify how AI tools are positioned within the broader educational and organizational context.

Classroom Observations

Observations of classroom practices involving AI driven formative assessments will be conducted to examine how AI tools are used in practice. These observations will focus on teacher student interactions with AI tools, the integration of AI assessments into daily teaching activities, and how the technology supports or hinders student learning. Observational data will offer valuable insights into the practical challenges and benefits of using AI in formative assessments.

Data Analysis

The data collected through interviews, document analysis, and observations will be analyzed using thematic analysis. Thematic analysis is a method for identifying, analyzing, and reporting patterns or themes within qualitative data. This approach allows for a detailed exploration of the socio technical factors that influence AI implementation. The analysis will focus on identifying key themes related to technological, cultural, and organizational factors that affect AI adoption. Thematic analysis will be conducted inductively, meaning themes will be developed from the data itself, ensuring that the analysis reflects the actual experiences and perspectives of the participants.

Ethical Considerations

Ethical considerations will be a central aspect of this study. To ensure the protection of participants' rights and confidentiality, all participants will be fully informed about the purpose of the study, the voluntary nature of their participation, and their right to withdraw at any time without consequence. Informed consent will be obtained from all participants prior to interviews and observations. Additionally, care will be taken to anonymize all data to protect the identities of participants and institutions. The study will adhere to ethical research guidelines, ensuring that participants' privacy is maintained and that their involvement is conducted in an ethical and respectful manner.

4. Results and Discussion

The implementation of AI driven formative assessments offers significant benefits, such as real time feedback, personalized learning pathways, and efficient grading systems. These tools help track student progress and identify learning gaps. However, they also face limitations, particularly in assessing complex responses that require human judgment, like essays or creative projects. Cultural diversity within educational settings also plays a crucial role in AI adoption, with varying levels of acceptance and interaction based on students' backgrounds and prior experiences with technology. AI tools need to be culturally sensitive and adaptable to ensure inclusivity and fairness. Additionally, organizational factors such as leadership support, institutional policies, and resources are critical for successful AI implementation. Institutions with strong support and a culture of innovation are better equipped to integrate AI tools effectively, whereas those with resistance or limited resources face challenges. Successful AI adoption requires alignment between technology, culture, and organizational readiness.

Results

The implementation of AI driven formative assessments revealed a combination of strengths and limitations. Technologically, AI tools demonstrated their ability to provide real time feedback, personalized learning pathways, and efficient grading systems. These systems were particularly effective in offering tailored assessments based on individual student needs, which helped track progress and identify gaps in understanding. However, the tools faced limitations, particularly in assessing complex or nuanced student responses that require human judgment. For instance, while AI could efficiently handle multiple choice questions or basic assessments, it struggled to assess more subjective responses, such as essays or creative projects, which require deeper contextual understanding.
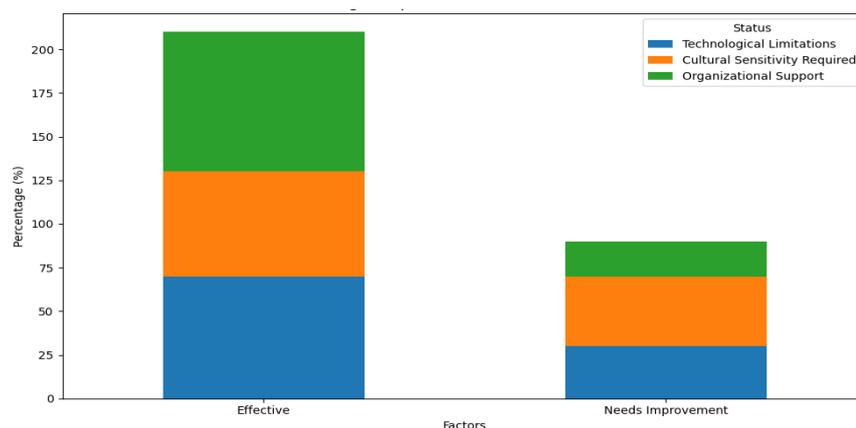

Figure 2. Factors Affecting AI Implementation in Formative Assessments.

The bar chart above highlights the key factors influencing the implementation of AI in formative assessments. It shows that technological limitations are still a significant barrier, with 70% of implementations being effective, but 30% needing improvements, especially in handling complex or subjective assessments that require human judgment. Cultural sensitivity plays a crucial role, with 60% of AI adoption requiring further cultural adaptation to meet the diverse needs of students, while 40% of tools lack sufficient flexibility in this area. Finally, organizational support is critical for successful AI integration, as evidenced by 80% of institutions with strong leadership and resources reporting effective implementation. This indicates that AI adoption is more likely to succeed in environments that emphasize innovation, provide adequate support, and ensure tools are tailored to the cultural and technical needs of the students. Therefore, technological improvements, cultural responsiveness, and robust organizational backing are essential for AI driven formative assessments to thrive.

Culturally, the adoption of AI tools in formative assessments was influenced by the diversity of the educational environments. In institutions with a highly diverse student body, AI tools were found to be effective in offering personalized experiences. However, cultural differences sometimes led to challenges in the acceptance and use of these technologies. For example, students from different cultural backgrounds interacted with AI systems in varied

ways, influenced by their previous exposure to technology, educational practices, and attitudes toward AI. These cultural differences highlighted the importance of ensuring that AI tools are culturally sensitive and adaptable to meet the needs of diverse learners.

Discussion

The results underscore the significant potential of AI driven formative assessments to enhance educational practices, especially through personalized learning and real time feedback. However, the technological limitations, particularly in evaluating complex or creative responses, suggest that AI should be seen as a complementary tool to human judgment rather than a replacement for it. Teachers still play a crucial role in interpreting and contextualizing AI generated feedback to ensure it aligns with pedagogical goals. As AI tools evolve, addressing these limitations through more advanced natural language processing capabilities and adaptive learning algorithms will be essential to improving their effectiveness in diverse assessment contexts.

Culturally, the findings emphasize the importance of designing AI tools that are sensitive to the diversity of student backgrounds. In culturally diverse classrooms, AI systems must be able to account for the different ways students interact with technology and assess their performance. This requires integrating culturally responsive pedagogy into the design of AI tools, ensuring that assessments are fair and inclusive. AI systems that fail to consider cultural nuances may inadvertently disadvantage students from underrepresented groups, leading to inequitable learning outcomes. Therefore, educational institutions must prioritize cultural sensitivity in the development and implementation of AI powered assessment systems.

Organizational factors, such as institutional support and leadership, were also found to be crucial in the successful implementation of AI driven formative assessments. Institutions that had strong leadership support, clear policies, and a culture of innovation were better able to integrate AI tools into their teaching practices. In contrast, institutions with limited resources or resistance to change struggled to adopt AI technologies effectively. The successful implementation of AI in education requires a coordinated effort across multiple levels of the institution, including leadership, teachers, and support staff. Furthermore, ensuring that educators receive adequate training in using AI tools is essential for maximizing their potential in improving student learning outcomes.

5. Comparison

When comparing technology centric approaches to socio technical perspectives in AI implementation, the primary contrast lies in the focus on either the technology itself or the broader context in which it is used. Technology centric approaches prioritize the development and deployment of AI tools, emphasizing efficiency, automation, and technical capabilities such as real time feedback and adaptive learning systems. While these approaches are effective in addressing technical needs, they often overlook the social, cultural, and organizational factors that influence how these tools are adopted and used in educational settings. In contrast, a socio technical perspective recognizes that AI tools must be integrated with the social context, including the culture, beliefs, and practices of both educators and students, as well as the policies and structures of the institutions implementing them. This approach ensures that the technology aligns with educational goals and addresses the needs of all stakeholders, providing a more comprehensive and sustainable solution.

A deeper understanding is provided by the socio technical perspective because it considers not only the capabilities of AI but also the cultural and institutional influences that shape its implementation. For instance, while technology centric approaches might focus on the functionality of AI tools, a socio technical approach takes into account how these tools interact with the educational environment, including the diversity of the student body, the organizational culture, and the readiness of educators to adopt new technologies. This perspective highlights that successful AI adoption is not just about the technology but also about creating a supportive environment that fosters trust and collaboration among all stakeholders. For example, AI tools that are culturally insensitive or fail to align with local educational practices may face resistance, leading to ineffective implementations. On the other hand, tools that consider cultural diversity and institutional readiness tend to be more widely accepted and impactful.

In comparing successful and less successful AI implementations in educational settings, several examples can be drawn. Successful implementations often feature strong institutional support, clear policies, and a culture of innovation that encourages teachers to integrate AI

tools into their practices. These institutions typically provide training and resources to ensure that educators can use AI tools effectively. In contrast, less successful implementations are characterized by a lack of leadership support, insufficient training for educators, and resistance to change within the institution. For instance, in institutions where AI adoption was not accompanied by adequate teacher training or institutional support, the technology was underutilized or faced pushback, resulting in limited impact on student learning outcomes. These examples demonstrate that while AI has significant potential to enhance formative assessments, its success largely depends on the socio cultural and organizational context in which it is implemented.

From comparing these AI implementation strategies, several lessons can be learned. One of the key takeaways is the importance of aligning technological innovations with the social and cultural context of the educational institution. Institutions that prioritize both technological development and the preparation of their social environment through leadership support, teacher training, and fostering a culture of innovation tend to have more successful AI implementations. Additionally, the comparison highlights the need for continuous evaluation and adaptation of AI tools to ensure that they meet the evolving needs of students and educators. Successful AI implementation is not a one time effort but requires ongoing support and adjustments based on feedback from all stakeholders involved. These lessons emphasize that a socio technical approach, which considers both the technical and social dimensions, is essential for ensuring the sustainable and effective use of AI in educational settings.

6. Conclusion

The implementation of AI driven formative assessments in educational settings underscores the importance of integrating socio cultural and organizational factors to ensure success. While AI technologies offer significant benefits in terms of personalized learning, real time feedback, and efficiency, their effectiveness is heavily influenced by the social, cultural, and institutional contexts in which they are deployed. It is clear that AI tools cannot be viewed in isolation; they must be considered within the broader environment that includes institutional culture, teacher readiness, and cultural diversity among students. Successful AI adoption requires an alignment between technological capabilities and the educational goals of the institution, with a focus on cultural sensitivity and institutional support. Thus, understanding and addressing these socio technical factors is crucial for achieving meaningful outcomes from AI powered assessments.

Based on these findings, it is recommended that educational institutions adopt a socio technical approach when implementing AI in formative assessments. This approach should focus on the integration of AI tools with the existing cultural and organizational structures within the institution. Institutions should provide adequate resources and training to educators, ensuring that they are equipped with the skills and knowledge necessary to effectively use AI tools. Additionally, institutional leaders should foster a culture of innovation and openness to technology, creating an environment where AI adoption is supported at all levels. Culturally responsive pedagogy should also be incorporated into AI tools to ensure that they are inclusive and meet the diverse needs of students. By taking a holistic approach, institutions can ensure that AI tools enhance the learning experience while promoting equity and fairness.

Future research in this area should expand to include diverse educational settings, examining how AI driven formative assessments function across different cultural, geographic, and institutional contexts. Longitudinal studies are needed to assess the long term impact of AI on student learning outcomes and how these tools evolve over time. Furthermore, future studies should explore additional socio technical frameworks that can provide deeper insights into the interactions between technology, culture, and organizational structures in education. Such research will help refine the understanding of AI's role in education and provide valuable guidance for institutions seeking to adopt and implement AI driven formative assessments in a way that benefits all stakeholders.

References

Aldaghri, A. A., & Alshraah, S. M. (2025). Sociocultural perspectives on artificial intelligence in English language learning: Insights from Saudi university students. *World Journal of English Language, 15*(8), 110–121. https://doi.org/10.5430/wjel.v15n8p110

Ali, R., & Bahrami, M. R. (2025). AI in educational assessment, applications, and implications: A survey. *Smart Innovation, Systems and Technologies, 406*, 383–390. https://doi.org/10.1007/978-981-97-6469-3_33

Amjad, A. I. (2025). Redesigning AI for inclusion: University students' experiences with cultural exclusion in AI learning systems. https://doi.org/10.4018/979-8-3373-4217-7.ch006

Barrot, J. S. (2026). Generative artificial intelligence for automated essay scoring: Exploring teacher agency through an ecological perspective. *Assessing Writing, 67*. https://doi.org/10.1016/j.asw.2025.100990

Bonito-Caimiñague, G., Apolo-Buenaño, D., & Hermann-Acosta, A. (2025). Artificial, collective, and connected intelligence in education: A review of criticisms of its dynamics in the context of posthumanity. *Izquierdas, 54*.

Deroncele-Acosta, A., Bellido-Valdiviezo, O., Sánchez-Trujillo, M. de los Á., Palacios-Núñez, M. L., Rueda-Garcés, H., & Brito-Garcías, J. G. (2024). Ten essential pillars in artificial intelligence for university science education: A scoping review. *SAGE Open, 14*(3). https://doi.org/10.1177/21582440241272016

Dockens, A. L., & Shelton, K. (2025). AI for formative and summative assessment: A balanced approach. https://doi.org/10.4018/979-8-3373-5102-5.ch013

Donovan, S. J. (2025). *Humanizing assessment foundations and framework*. https://doi.org/10.4324/9781003587262-1

Dubey, P. K., Crevar, A. R., & Rischard, M. K. (2025). Relevance of artificial intelligence in assessment: A balanced approach. https://doi.org/10.4018/979-8-3373-2397-8.ch016

Ghannam, Y. P. (2024). Crafting a winning workplace culture: Understanding organizational dynamics using AI tools. https://doi.org/10.4018/979-8-3693-6447-5.ch002

Hopfenbeck, T. N., Zhang, Z., Sun, S. Z., Robertson, P., & McGrane, J. A. (2023). Challenges and opportunities for classroom-based formative assessment and AI: A perspective article. *Frontiers in Education, 8*. https://doi.org/10.3389/feduc.2023.1270700

Ivanović, M., et al. (2022). Current trends in AI-based educational processes—An overview. *Learning Analytics and Intelligent Systems, 29*, 1–15. https://doi.org/10.1007/978-3-031-04662-9_1

Khlaif, Z., Odeh, A., & Bsharat, T. R. K. (2024). Generative AI-powered adaptive assessment. https://doi.org/10.4018/979-8-3693-6397-3.ch007

Kim, S.-W., & Lee, Y. (2024). Investigation into the influence of socio-cultural factors on attitudes toward artificial intelligence. *Education and Information Technologies, 29*(8), 9907–9935. https://doi.org/10.1007/s10639-023-12172-y

Kumar, P., & Kumar, S. (2025). Influence of socio-technical factors of AI-enabled ICTs in governance. *Smart Innovation, Systems and Technologies, 121*, 359–369. https://doi.org/10.1007/978-981-96-6254-8_27

Leuba, V., & Piricz, N. (2024). AI adoption in healthcare: Addressing challenges and change management. In *Proceedings of the IEEE 24th International Symposium on Computational Intelligence and Informatics (CINTI 2024)* (pp. 283–288). https://doi.org/10.1109/CINTI63048.2024.10830852

López-Pastor, V., & Sicilia-Camacho, A. (2017). Formative and shared assessment in higher education: Lessons learned and challenges for the future. *Assessment & Evaluation in Higher Education, 42*(1), 77–97. https://doi.org/10.1080/02602938.2015.1083535

Lu, W., & Lin, C. (2025). Meta-analysis of influencing factors on the use of artificial intelligence in education. *Asia-Pacific Education Researcher, 34*(2), 617–627. https://doi.org/10.1007/s40299-024-00883-w

Mamane, A., & Naidoo, R. (2026). AI-enabled cybersecurity implementation: A case study of critical success factors in a South African state-owned entity. *Communications in Computer and Information Science, 2784*, 405–420. https://doi.org/10.1007/978-3-032-11733-5_25

Merhi, M. I. (2023). An evaluation of the critical success factors impacting artificial intelligence implementation. *International Journal of Information Management, 69*. https://doi.org/10.1016/j.ijinfomgt.2022.102545

Murire, O. T. (2024). Artificial intelligence and its role in shaping organizational work practices and culture. *Administrative Sciences, 14*(12). https://doi.org/10.3390/admsci14120316

Naidu, K., & Sevnarayan, K. (2025). Culturally relevant assessment and generative AI: A co-creation framework for pre-service teachers. *Journal of Applied Learning and Teaching, 8*(2), 132–142. https://doi.org/10.37074/jalt.2025.8.2.20

Nguyen, T. A. (2025). Cultural considerations in AI-based ELT assessments: A case study of Van Lang University. https://doi.org/10.4018/979-8-3693-8317-9.ch005

Pan, Y., Wang, L., & Zhu, Y. (2024). Strategic questioning for formative assessment in TEFL: Insights from blended synchronous learning environments. *Humanities and Social Sciences Communications, 11*(1). https://doi.org/10.1057/s41599-024-04086-y

Qian, Z. (2021). Applications, risks and countermeasures of artificial intelligence in education. In *Proceedings of the 2nd International Conference on Artificial Intelligence and Education (ICAIE 2021)* (pp. 89–92). https://doi.org/10.1109/ICAIE53562.2021.00026

Sultana, S. K. S., Renugadevi, R., Bhargavi, M., & Biyabani, S. A. (2025). AI-driven evaluation techniques: Revolutionizing student practices. https://doi.org/10.1201/9781003470304-1

Tao, W. (2024). Fostering inspirational learning through AI-enhanced formative assessment: Strategies and challenges in higher education. https://doi.org/10.4018/979-8-3693-6351-5.ch008

Tomaževič, N., Murko, E., & Aristovnik, A. (2024). Organisational enablers of artificial intelligence adoption in public institutions: A systematic literature review. *Central European Public Administration Review, 22*(1), 109–138. https://doi.org/10.17573/cepar.2024.1.05

Tuncer, T. T., & Varoglu, A. K. (2025). Empowering organizations with AI: Strategies, challenges, and future directions. https://doi.org/10.4018/979-8-3373-2523-1.ch002

Tvenge, N., Martinsen, K., & Holtskog, H. (2019). Learning factories as laboratories for socio-technical experiments. In *Procedia Manufacturing* (pp. 337–342). https://doi.org/10.1016/j.promfg.2019.03.053

Ul Haq, F., Asim, M., Suki, N. M., Zakaria, N., & Hussain, S. (2025). AI adoption and educational effectiveness in emerging higher education institutions: The moderating role of digital literacy and institutional support. *Journal of Information and Knowledge Management*. https://doi.org/10.1142/S021964922550090X

Yavuz, M., & Kayali, B. (2025). Artificial intelligence-supported formative and summative assessment approaches in blended learning environments. https://doi.org/10.4018/979-8-3373-3815-6.ch006

Zöll, A., Eitle, V., & Hendriks, P. (2024). Uncovering cultural differences in organizational readiness for artificial intelligence: A comparison between Germany and the United States. In *Proceedings of the Annual Hawaii International Conference on System Sciences* (pp. 787–796).