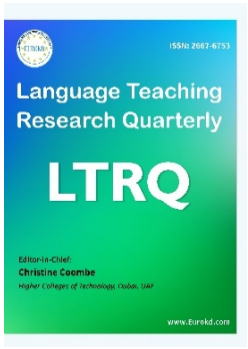

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Thematic Collection[1]

The Impact of AI on Enhancing Students' Intercultural Communication Competence at the University Level: A Review Study

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Abstract

This systematic review explores the transformative role of Artificial Intelligence (AI) and Information and Communication Technologies (ICT) in enhancing intercultural communication competence (ICC) at the university level. As AI increasingly integrates into educational settings, its potential to revolutionize student learning and cultural interactions is profound. The review synthesizes findings from 11 empirical studies conducted globally, assessing the impact of AI-driven tools, such as chatbots and virtual reality simulations, on students' ability to handle cultural differences. While AI offers significant benefits in personalizing learning and fostering immersive cultural experiences, challenges remain, particularly in ensuring cultural sensitivity and addressing inequalities in technology access. The review stresses the need for careful integration of AI in education, cautioning the audience about potential pitfalls and emphasizing the importance of human oversight to reduce biases and enhance cultural understanding. The pedagogical implications stress the importance of blending AI with traditional teaching methods to create inclusive learning environments that prepare students for globalized society's demands. The review also identifies areas for future research, including the long-term impact of AI on ICC and the ethical considerations surrounding AI use in education. In the end, this study contributes to the ongoing discourse on AI's role in shaping the future of intercultural education.

Keywords: *Artificial Intelligence (AI), Intercultural Communication Competence (ICC), Educational Technology, Cultural Sensitivity, Higher Education*

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Introduction

In an increasingly globalized world, the ability to communicate across cultures has become more critical than ever. As societies become more interconnected, the demand for individuals who can manage cultural differences effectively has surged dramatically. Effective cultural communication is now essential for students, who are expected to engage in diverse environments within their local communities or on the global stage. This skill set, often called intercultural communication competence (ICC), encompasses the ability to communicate across language barriers and understand and navigate cultural norms, values, and practices that may differ from one's own. In this context, the rise of digital technology and the introduction of artificial intelligence (AI) have opened new avenues for enhancing this critical competence. With its diverse applications, AI has established itself as a powerful tool that can bridge cultural gaps, promote understanding, and foster global citizenship among students. This paper examines the effectiveness of AI tools in fostering ICC among university students and provides insights into the pedagogical implications of integrating AI into university-level education (Rahiman & Kodikal, 2023).

The Need for Cultural Communication Competence in a Globalized World

In today's globalized society, cultural communication competence is essential for interacting effectively with people from diverse backgrounds. This competence encompasses more than just language skills; it also includes cultural awareness, empathy, adaptability, and the ability to understand and interpret cultural subtleties (Nair & Adetayo, 2019). As globalization increases, interactions with people from various cultures are inevitable, making these skills indispensable. Therefore, students must develop both the knowledge and sensitivity required to successfully engage in cross-cultural interactions. Achieving cultural communication competence involves cognitive understanding, emotional sensitivity towards cultural differences, and the practical application of this knowledge in real-world situations (Ilie, 2019).

ICC has been explored extensively in communication studies, sociology, and education. Scholars such as Byram (2021) have proposed models that integrate linguistic proficiency with cultural knowledge and attitudes, suggesting that actual competence arises from the interplay of these factors. These models emphasize that ICC is not merely about acquiring factual knowledge about other cultures but involves a transformative process where individuals develop an awareness of their own cultural biases and learn to engage with others respectfully and effectively.

Fostering ICC in educational contexts is particularly challenging because it requires moving beyond traditional pedagogical approaches, focusing solely on language acquisition or cultural facts. Instead, it necessitates immersive and interactive experiences that allow students to practice communication in diverse cultural contexts. This is where AI's potential becomes particularly relevant.

The Advent of AI and its Impact on Education

The advent of AI has introduced transformative tools that significantly enhance this type of communication by bridging linguistic and cultural gaps (Khasawneh, 2023). AI tools, particularly those designed for language learning and translation, have revolutionized how individuals from different cultural backgrounds interact (Sintawati et al., 2024). Traditional

language learning frameworks often fail to address the unique needs of learners from diverse cultural contexts. However, AI-driven systems, such as the Cross-Cultural Intelligent Language Learning System (CILS), offer adaptive, personalized learning experiences that cater to these varied needs. CILS utilizes advanced AI technologies to adjust content and teaching methodologies dynamically, significantly improving linguistic proficiency and cultural understanding (Akdere et al., 2021; Xia et al., 2024).

The use of AI in education is not a recent phenomenon, but its applications have expanded rapidly in recent years. AI has the potential to transform education in several key areas, including personalized learning (Seo et al., 2021), assessment, and the development of soft skills such as intercultural communication. According to Luckin et al. (2016), AI can provide tailored learning experiences by analyzing students' learning patterns and adjusting content to meet their needs. This transformative potential is particularly beneficial in multicultural classrooms, where students may come from diverse cultural backgrounds and have different learning preferences.

Moreover, AI's ability to analyze large datasets and provide real-time feedback has made it an invaluable tool for language learning. Applications like Duolingo and Rosetta Stone use AI to adapt lessons based on user performance, offering more personalized and compelling learning experiences. These platforms focus on language proficiency and incorporate cultural content, helping users understand the cultural contexts in which the language is used (Korte et al., 2024; O'Dowd, 2017; Yuen & Schlote, 2024).

AI and the Enhancement of ICC

AI tools like ChatGPT have been integrated into educational platforms to facilitate telecollaboration tasks focusing on cultural competence. These tools enable students to communicate in a culturally appropriate manner, thereby enhancing their ICC. By simulating AI-generated tasks, students can explore different cultural contexts and develop a deeper understanding of cultural nuances (McCallum, 2024). One of the most direct and practical applications of AI in cross-cultural communication is in the realm of language translation. AI-powered translation tools, such as Google Translate, DeepL, and various AI-based language models, provide real-time, accurate translations that facilitate communication between individuals who speak different languages. These tools are crucial in breaking down language barriers, enabling people to interact and collaborate globally (Ghafar et al., 2023; Mohamed et al., 2024). Moreover, AI's ability to learn and adapt to different linguistic patterns and cultural contexts means that these translation tools are continually improving. This adaptability ensures that translations are linguistically accurate and culturally appropriate, essential for meaningful cross-cultural communication (Mohamed et al., 2024).

Conceptual Frameworks in Intercultural Communication and AI

Understanding the impact of AI on ICC requires a closer look at the theoretical and conceptual frameworks that underpin this area of study. Two key frameworks are particularly relevant: Deardorff's (2006) process model of intercultural competence and Bennett's (1986) developmental model of intercultural sensitivity.

Deardorff's process model emphasizes that intercultural competence is a dynamic and continuous process involving the development of specific attitudes (such as openness and

curiosity), knowledge (including cultural self-awareness and deep cultural knowledge), and skills (such as listening, observing, and interpreting). These elements contribute to both internal outcomes (such as an informed frame of reference) and external outcomes (such as practical and appropriate communication and behavior in intercultural situations). AI can play a significant role in facilitating the development of these competencies by providing students with diverse, immersive experiences that challenge their cultural assumptions and encourage reflective thinking.

Bennett's developmental model of intercultural sensitivity (DMIS) outlines a continuum in which individuals move along as they become more culturally competent. The continuum ranges from ethnocentric (denial, defense, minimization) to ethnorelative (acceptance, adaptation, integration). AI can assist in this progression by exposing students to different cultural perspectives through simulations, virtual exchanges, and personalized learning experiences that encourage movement from an ethnocentric to an ethnorelative worldview. For example, AI-driven platforms like Google Expeditions allow students to "travel" to various parts of the world, interact with different cultural artifacts, and gain insights into the daily lives of people from diverse backgrounds. These experiences can help students move towards the ethnorelative stages of Bennett's model, where they readily accept and adapt to cultural differences.

Vygotsky's (1978) social constructivist theory also offers insights into how AI can enhance ICC. Vygotsky posited that social interaction plays a fundamental role in the development of cognition. In the context of ICC, AI can facilitate social interactions across cultural boundaries, enabling students to learn from and with others in a collaborative environment. AI tools like virtual language partners or intercultural chatbots can simulate real-life interactions, allowing students to practice communication skills in various cultural settings. This is consistent with the social constructivist view that knowledge is co-constructed through interaction with others and that learning is a social process.

Current Discussions and Ethical Considerations in AI

Integrating AI into education, particularly in ICC, has challenges and controversies. Current discussions around AI in education often focus on the potential for these technologies to enhance and disrupt traditional educational practices. On the one hand, AI has the potential to personalize learning, automate routine tasks, and provide real-time feedback, which can significantly enhance the learning experience. On the other hand, there are concerns about the ethical implications of AI, particularly regarding data privacy, the reinforcement of cultural biases, and the potential for AI to dehumanize education by reducing face-to-face interactions.

One of the critical ethical considerations is the potential for AI to continue cultural biases. AI algorithms are trained on large datasets that may contain inherent biases reflecting societal prejudices. AI tools could reinforce stereotypes rather than promote cultural understanding if these biases are not addressed. This is particularly concerning in intercultural communication, where the goal is to foster empathy and respect for cultural diversity. To reduce this risk, it is essential to ensure that AI tools are designed and applied to promote cultural sensitivity and inclusivity. This includes training AI algorithms on diverse and representative datasets and regularly auditing AI systems to identify and correct any biases that may arise.

Another ethical issue is the potential for AI to widen the digital gap. Access to AI technologies is unequal, and students from disadvantaged backgrounds may have different opportunities to benefit from AI-enhanced learning experiences. This could exacerbate educational inequalities and hinder efforts to promote ICC across diverse student populations. Addressing this issue requires a concerted effort from educators, policymakers, and technology developers to ensure that AI tools are accessible to all students, regardless of their socioeconomic background.

Research Questions and Study Objectives

Given the significant potential of AI to enhance ICC, this study aims to explore the effectiveness of AI tools in fostering ICC among university students. The urgency and importance of this research cannot be overlooked, as educators are seeking innovative solutions to prepare students for the challenges of a globalized world. To achieve this, the following research questions have been proposed:

RQ_1: What are the potential benefits and drawbacks of the use of AI for enhancing students' cultural communication competence at the university level?

RQ_2: What are the pedagogical implications for the use of AI for enhancing students' cultural communication competence at the university level?

By addressing these questions, this study seeks to contribute to the ongoing conversation about AI's role in education and its potential to shape the future of cultural communication competence in a globalized world. The findings of this research will have implications for curriculum design, teacher training, and educational policy, offering insights into how AI can be used to prepare students for the intercultural challenges they will face in their personal and professional lives.

Methodology

The authors followed the PRISMA methodology, which stands for Preferred Reporting Items for Systematic Reviews and Meta-analysis to detect the key empirical studies that dealt with the impact of AI on enhancing students' cultural communication competence. All other studies, such as theoretical studies, conceptual studies, or case studies, were excluded. Only peer-reviewed journal articles that were indexed in Scopus and Web of Science databases were considered, as they provide a comprehensive and reliable coverage of literature. The identified research studies covered the period from January 1, 2020, till July 30, 2024, so that the authors could discuss the latest findings in this research field. Only open-access articles written in English were considered, however, the L2 did not need to be in English. Grey literature was excluded as it does not guarantee a rigorous review process, and it cannot be considered reliable enough to be included in this study. To ensure the quality assessment of the included studies both authors participated in the search, as well as in the evaluation of the detected articles. The inclusion and exclusion criteria are provided in Table 1 below.

Table 1

Exclusion and Inclusion Criteria

Inclusion Criteria	Exclusion Criteria
• empirical studies dealing with the topic of AI and cultural communication competence • peer-reviewed journal articles • Scopus and Web of Science • studies written in English • studies published between 1 January 2020 and 31 July 2024 • open-access articles	• non-empirical research studies, such as theoretical studies, conceptual studies, case studies, or descriptive studies dealing with the development of applications (e.g., Miraz et al., 2022) • grey literature, e.g., conference proceedings • other databases than Scopus or Web of Science • studies written in other languages than English

Search String

("artificial intelligence" OR "AI") AND ("cultural communication competence" OR "cross-cultural communication" OR "intercultural communication") AND ("university")

After all search criteria were applied, the search in Web of Science generated 48 research studies and in Scopus 21. These studies were later analyzed for their relevance to the topic and 8 studies were retained. Referential backtracking (which involved identifying additional studies that may be relevant) was also conducted to verify if any relevant studies could have been omitted from the search. This search generated three more studies. After applying the relevant inclusion and exclusion criteria, 11 studies were identified as eligible for inclusion in this systematic review.

Results

This section presents a comprehensive overview of the key findings from the 11 studies, organized according to the themes and methodologies outlined in the three tables. These findings offer insights into how AI and ICT tools have been integrated into educational practices across various countries, focusing on their impact on ICC among university students.

Studies Information and Objectives

Table 2 provides a comprehensive overview of the objectives of various studies that explore the integration of AI and ICT in educational settings to enhance ICC. These studies, conducted in the United States, South Korea, China, Malaysia, Jordan, India, Sweden, Japan, and Taiwan, represent a global community of educators and researchers. This global representation highlights the widespread interest and shared commitment to utilizing AI and ICT to enhance students' cultural awareness and communication skills, reflecting the collective efforts of a larger academic community with a common goal.

The primary objectives of these studies focus on assessing the effectiveness of AI tools in enhancing ICC, exploring innovative teaching methodologies, and investigating the role of technology in bridging cultural and linguistic gaps. For instance, Chang (2023) aimed to evaluate the impact of AI chatbot-based instruction on students' ICC within a Tourism English course, while Cheng (2024) focused on integrating information literacy and global communication skills into university curricula.

Other studies, including those by Ismailov (2021) and Khasawneh (2023), aimed to examine the impact of virtual exchanges and advanced translation technologies on students' ICC and intercultural awareness. These studies emphasize the varied and significant applications of AI and ICT in education, including language learning, cross-cultural communication, and more specialized domains such as inquiry-based learning and addressing digital inequality.

The diverse objectives outlined in Table 2 reflect the multifaceted nature of AI and ICT research in education, particularly in enhancing ICC. These objectives emphasize the importance of exploring diverse educational approaches and technological tools to identify the most effective strategies for fostering student cultural competence. Furthermore, the global scope of these studies reflects a collective commitment to overcoming cultural and linguistic barriers in education. These studies contribute to a deeper understanding of how technology can be applied to create more inclusive and culturally aware learning environments by investigating various aspects of AI and ICT integration.

Table 2

Study Information and Objectives

Author/s	Year of Publication	Country of Origin	Objective of the Study
Chang	2023	South Korea	To assess the impact of AI chatbot-based instruction on students' ICC in a Tourism English course
Cheng	2024	China	To integrate information literacy and global communication skills into university curricula
Ismailov	2021	Japan	To explore the effects of virtual exchanges in an inquiry-based learning environment on students' ICC and intra-cultural awareness
Khasawneh	2023	Jordan	To explore the role of AI in enhancing cross-cultural communication through advanced translation technologies
Long & Lin	2022	China	To cultivate college students' cross-cultural communicative competence using AI within English teaching
Ou & Malmström	2023	Sweden	To examine the role of communicative competence and digital inequality in English-medium higher education within the context of increasing digitalization
Rahiman & Kodikal	2023	India	To investigate the impact of AI on revolutionizing learning and teaching practices in higher education
Sarwari et al.	2024	Malaysia	To assess the impact of AI on intercultural communication among postgraduate students in a multicultural university setting
Senyshyn	2019	United States	To support international students' transition to higher education and enhance their intercultural communication competence (ICC)
Wang, Yang, et al.	2023	Taiwan	To evaluate the effectiveness of ICT-enhanced learning on improving intercultural competencies and student engagement in a hospitality course
Xia et al.	2024	South Korea	To leverage AI to enhance language learning strategies in cross-cultural communication contexts

Methodology and AI Tools Used

The studies in Table 3 present a range of innovative methodologies and AI tools designed to enhance students' ICC. These methodologies, ranging from experimental and quasi-experimental designs to quantitative and mixed methods approaches, reflect the cutting-edge strategies employed to assess the effectiveness of AI in educational settings.

Methodological Approaches

Several studies employed experimental and quasi-experimental designs to provide structured environments for comparing AI-supported interventions with traditional methods. For instance, Chang's (2023) study used an experimental design to compare outcomes between students who engaged with AI chatbots and those who followed traditional learning methods. This approach allowed for a precise examination of the specific impact of AI on student learning, isolating variables to determine the effectiveness of AI chatbots in enhancing ICC.

Similarly, Ismailov (2021) utilized a quasi-experimental design to investigate the impact of AI-supported telecollaboration tools compared to traditional telecollaboration methods. The quasi-experimental setup enabled the study to maintain some level of control while exploring how AI integration can influence student outcomes in cross-cultural communication contexts. Comparing the results from different pedagogical approaches within a controlled environment provided valuable insights into the benefits and limitations of AI in these settings.

Quantitative studies also play a significant role in the research. For example, Long and Lin (2022) conducted a large-scale quantitative study with 1,050 students, utilizing comprehensive and traditional evaluation techniques. The study's substantial sample size and methodological precision provided a strong basis for evaluating the effectiveness of smart software and AI tools in enhancing ICC. Using a quantitative approach, the researchers collected measurable data that offered clear and enlightening insights into how AI tools can be integrated into language learning to improve cross-cultural communication.

In addition, researchers employed mixed methods approaches to capture both quantitative and qualitative data, providing a more holistic understanding of AI's impact. For instance, Wang, Yang, et al. (2023) combined video projects, pre-and post-tests, and focus group interviews in their mixed-methods study to explore the effectiveness of ICT-enhanced learning in a hospitality course. This approach enabled them to quantify improvements in students' ICC while gaining deeper insights into their experiences and perceptions of AI tools in their learning process.

AI Tools and Procedures

The AI tools used in these studies varied significantly and were tailored to the specific objectives and educational contexts. For example, Chang (2023) implemented AI chatbots to create an interactive learning environment where students could practice and refine their communication skills. These chatbots simulated real-time interactions that mimicked real-world scenarios, offering students a practical and engaging way to develop their ICC and demonstrating the immense potential of AI in education.

In contrast, Khasawneh (2023) focused on AI-based translation tools in a descriptive study involving language experts and professional translators. These tools were evaluated for their ability to bridge linguistic and cultural gaps, with procedures that included analyzing participant feedback to assess their effectiveness in capturing cultural nuances.

Rahiman and Kodikal's study (2023) explored the use of adaptive learning systems and chatbots among 250 faculty members. This study highlights how AI tools can be adapted to fit the instructional needs of diverse educational settings, demonstrating their versatility and applicability.

Xia et al. (2024) conducted an empirical study across 20 universities, employing NLP and machine learning-based AI tools to enhance language learning strategies. The broad scope of this study, covering multiple institutions, allowed for a comprehensive analysis of how AI tools can be used to tailor language instruction to meet the specific needs of students in cross-cultural communication contexts.

The procedures used in these studies varied depending on the AI tools and the educational objectives. While some studies, like those by Cheng (2024), linked postgraduate and undergraduate courses through blended learning projects that utilized various ICT tools, others focused more on specific AI technologies. For example, using telecollaboration tools with AI support in Ismailov's (2021) study was designed to facilitate inquiry-based learning, encouraging students to engage in cross-cultural exchanges with peers from different backgrounds.

Table 3

Methodology and AI Tools Used

Author/s	Methodology and Procedure	AI Tool Used	Participants
Chang	An experimental study comparing the outcomes of students engaging with AI chatbots versus traditional learning methods	AI chatbots	Not specified
Cheng	A blended learning project that linked postgraduate and undergraduate courses across disciplines	Various ICT tools, not specifically AI-focused	28 students
Ismailov	A quasi-experimental design comparing the outcomes of students engaged in inquiry-based telecollaboration versus traditional telecollaboration	Telecollaboration tools with AI support	Not specified
Khasawneh	A descriptive study involving language experts and professional translators, focusing on AI-based translation tools	AI translation tools	110 participants
Long & Lin	A quantitative study involving 1,050 students, utilizing fuzzy comprehensive evaluation and traditional assessment methods	Smart software and AI tools	1,050 students
Ou & Malmström	A linguistic ethnographic study conducted at a Swedish university, focusing on digital and communicative practices among students	AI language tools (e.g., Grammarly, Google Translate)	Not specified
Rahiman & Kodikal	A quantitative study involving 250 faculty members from QS-ranked universities across Asia	Adaptive learning systems, chatbots	250 faculty members
Sarwari et al.	A quantitative study involving 110 participants, analyzing their use of AI tools in communication	ChatGPT	Postgraduate students
Senyshyn	A longitudinal study involving 58 international students, utilizing reflective exercises and intercultural conversation partnerships	Not AI-focused	58 international students
Wang et al. (a)	A mixed-methods study involving video projects, pre- and post-tests, and focus group interviews	Various ICT tools, not specifically AI-focused	42 students
Xia et al.	An empirical study conducted across 20 universities, focusing on the use of AI-enhanced language learning tools	NLP and machine learning-based AI	Students from 20 universities

Challenges, Limitations, and Pedagogical Implications

The studies in Table 4 present a comprehensive analysis of the potential benefits of AI and ICT tools on students' ICC across various educational settings. The outcome measures, findings, and pedagogical implications reveal the promising impact of integrating AI into the curriculum.

Outcome measures and findings

The outcome measures varied significantly across studies, reflecting the diverse objectives and contexts in which AI tools were employed. For example, Chang (2023) focused on students' improvements in respecting cultural differences and attentiveness in interactions through AI chatbot-based instruction. Chang's findings highlighted the effectiveness of AI chatbots in enhancing specific aspects of ICC, though they also identified challenges in more complex tasks where AI struggled to provide adequate support.

Similarly, Long and Lin (2022) measured cross-cultural competence through CET-4 scores, a standardized English proficiency test widely recognized in Chinese universities, and other assessments. They found that while AI tools significantly improved communication skills, the correlation between language proficiency and cultural competence remained modest. Their findings suggest that although AI can enhance specific skills, more is needed to fully address the broader aspects of cultural understanding.

In contrast, Ismailov (2021) and Khasawneh (2023) explored AI's role in fostering intercultural awareness and communication through virtual exchanges and AI-based translation tools, respectively. Both researchers found that while AI tools facilitated communication across cultural barriers, they often needed help capturing cultural nuances, leading to potential misunderstandings. This limitation highlights the importance of using AI with traditional educational methods to ensure a more comprehensive understanding of cultural contexts.

Pedagogical implications

The pedagogical implications of these studies emphasize the need for a balanced approach to integrating AI into education. For instance, Cheng (2024) demonstrated that blended learning approaches, incorporating ICT, effectively prepared students for globalized professional environments by significantly improving their cultural awareness and IT skills. Cheng's holistic approach to education, which combines AI tools with traditional teaching methods, enhanced students' overall competence in intercultural communication.

Wang, Yang, et al. (2023) also emphasized the importance of integrating ICT with practical support mechanisms to better prepare students for real-world intercultural challenges. Their study showed that while ICT-enhanced learning led to significant gains in cultural knowledge, practical challenges such as language barriers in real-world contexts persisted. This finding suggests that students may need additional support to realize the benefits of AI and ICT tools fully.

Pros and cons of the studies

The pros and cons of these studies provide further insights into AI's effectiveness and limitations in enhancing ICC. For example, Long and Lin (2022) used a large sample size in their study, which increased the reliability of their findings. However, the modest correlation

between language proficiency and cultural competence suggests that researchers must explore this relationship more deeply.

On the other hand, Ismailov (2021) used a quasi-experimental design to compare AI-supported and traditional methods. This design effectively demonstrated the benefits of combining AI with inquiry-based learning, a student-centered approach that focuses on questioning, critical thinking, and problem-solving. However, it also limited Ismailov's ability to establish causality, indicating a need for more rigorous research designs in future studies.

Khasawneh (2023) detailedly examined AI translation tools, offering valuable insights into their strengths and weaknesses in intercultural contexts. Khasawneh found that while these tools facilitated communication, their limitations in capturing cultural nuances emphasized the importance of complementing AI with cultural education to reduce risks of miscommunication.

In conclusion, the studies reviewed in this table collectively illustrate AI and ICT tools' significant potential in enhancing students' ICC. However, they also illustrate the importance of a balanced approach that combines AI with traditional educational methods, reassuring us that the careful implementation of AI is key. The findings suggest that while AI can provide valuable support in developing specific aspects of ICC, more is needed to fully replace the depth and richness of human interaction and cultural education. Future research should address the limitations identified in these studies, particularly concerning the cultural sensitivity of AI tools and their integration into broader educational frameworks.

Table 4

Outcomes, Findings, and Implications

Author/s	Outcome Measures	Findings (Potential Benefits and Drawbacks)	Pedagogical Implications	Pros of the Study	Cons of the Study
Chang	Improvements in students' respect for cultural differences and attentiveness in interactions	AI chatbots were effective in enhancing ICC, particularly in fostering cultural respect; however, more complex tasks presented challenges for students.	AI chatbots should be integrated into learning environments to simulate real-world interaction contexts, improving ICC.	Clear demonstration of AI's effectiveness in enhancing specific aspects of ICC.	Potential challenges in scaling and applying findings to other contexts.
Cheng	Improvements in information literacy and global communicative competence	The integration led to significant improvements in students' cultural awareness and IT skills, fostering a global perspective among participants.	Blended learning approaches, incorporating ICT, are effective in preparing students for globalized professional environments.	Effective integration of interdisciplinary courses provides a model for holistic education.	Results may be specific to the disciplines studied and might not apply broadly across other fields.
Ismailov	Measures of ICC and intra-cultural awareness, based on pre- and post-tests	Inquiry-based learning approaches significantly enhanced students' ICC and	Integrating inquiry-based learning with AI tools can deepen cultural understanding and	The study effectively demonstrates the benefits of combining inquiry-based	The quasi-experimental design limits the ability to establish causality.

		engagement, outperforming traditional methods.	foster higher levels of student engagement in intercultural communication.	learning with AI tools.	
Khasawneh	Effectiveness of AI in translation and cross-cultural understanding	While AI translation tools can facilitate communication, they struggle with capturing cultural nuances, which can lead to misunderstandings.	AI translation tools should be used in conjunction with cultural education to mitigate risks of miscommunication and reinforce cultural sensitivity.	Provides a detailed examination of the strengths and weaknesses of AI translation tools in intercultural contexts.	Limited to translation tools, so findings may not be applicable to broader AI applications in education.
Long & Lin	Measures included CET-4 scores and assessments of cross-cultural competence	AI tools significantly improved students' communication skills, though the correlation between language proficiency and cultural competence was modest.	AI should be combined with traditional teaching methods to comprehensively enhance both language and cultural competencies.	Large sample size increases the reliability of findings.	The modest correlation suggests that further study is needed to understand the relationship between language proficiency and cultural competence.
Ou & Malmström	Measures of communicative competence and student engagement	Digital inequality exacerbated disparities in students' communicative competence, with those less familiar with digital tools at a disadvantage.	Educational institutions should address digital divides by ensuring equitable access to digital tools and providing support for students from diverse backgrounds.	The study highlights important issues related to digital inequality, providing a strong case for more inclusive educational practices.	Findings are context-specific, making it challenging to generalize across different educational settings.
Rahiman & Kodikal	Faculty engagement and student learning outcomes	AI significantly enhanced personalized learning and faculty engagement, though concerns about the potential for AI to replace human roles in education were noted.	AI should complement traditional teaching practices, ensuring that human elements in education are preserved and enhanced.	The study offers valuable insights into faculty perspectives on AI integration in higher education.	Concerns about AI replacing human roles in education highlight the need for further ethical considerations.
Sarwari et al.	Communication efficacy across cultural barriers, measured through student surveys	AI tools, such as ChatGPT, were effective in reducing language barriers and enhancing communication; however, concerns about cultural biases	AI should supplement but not replace face-to-face interactions, with educators addressing potential cultural biases in AI tools.	Provides insight into the practical use of AI tools in diverse educational settings.	Concerns about cultural biases in AI tools remain unresolved, requiring further investigation.

		within AI tools were highlighted.			
Senyshyn	Student adaptation to the academic and social environment in the U.S.	The course effectively supported students' adaptation and enhanced their ICC, though some initial resistance to assignments was noted.	Reflective exercises combined with practical engagements are crucial for developing ICC in international students.	Longitudinal design allows for a deeper understanding of students' progression over time.	Limited sample size and geographic focus might reduce generalizability.
Wang et al. (a)	Improvements in intercultural competence and student engagement	ICT-enhanced learning led to significant gains in students' cultural knowledge and engagement, though practical challenges such as language barriers in real-world contexts persisted.	ICT should be integrated with practical support mechanisms to better prepare students for the challenges they may face in real-world intercultural settings.	Provides strong evidence of the benefits of ICT in enhancing intercultural competencies.	The study's focus on a specific course limits the generalizability of its findings.
Xia et al.	Measures of language proficiency and cultural understanding	AI tools effectively enhanced students' language proficiency and cultural sensitivity, with recommendations for integrating AI with other disciplinary approaches.	AI tools should be used to complement traditional language instruction, with an emphasis on applying these tools within culturally relevant contexts.	Large-scale study provides robust evidence of the benefits of AI in language learning.	The study primarily focuses on language learning, limiting its applicability to other areas of intercultural education.

Discussion

This systematic review examines the transformative potential of AI and ICT in enhancing ICC at the university level. As AI increasingly integrates into educational environments, its potential to reshape how students learn and interact with different cultures becomes more evident. To fully understand the significance of these findings, it is crucial to explore the underlying factors contributing to the observed outcomes and consider their broader implications for educational practice and policy.

Factors Affecting AI's Role in ICC

The positive impact of AI on ICC is primarily due to its role in crafting immersive and interactive learning environments. These environments enable students to engage in realistic cross-cultural interactions and refine their communication skills in a controlled setting. For instance, AI tools such as ChatGPT and AI-driven simulations are particularly effective. These tools facilitate meaningful dialogues that mirror real-world intercultural encounters, thereby enabling students to manage cultural differences more effectively.

The study by Chang (2023) is a prime example of how AI tools can simulate conversational scenarios that students might encounter in a global context. By allowing students to experiment with different communication strategies and receive immediate feedback, these simulations help students refine their intercultural communication skills. Similarly, Sarwari et al. (2024) found that AI-driven simulations, particularly those incorporating VR and AR, offer students immersive cultural experiences that make abstract concepts more tangible and relatable. By placing students in virtual environments that replicate the cultural contexts they are studying, these tools enable students to develop a deeper understanding of cultural norms and values.

Another significant factor contributing to AI's positive impact on ICC is its ability to customize educational content to the cultural backgrounds of individual students. This level of personalization is a significant advantage over traditional one-size-fits-all approaches to education. AI tools make learning more relevant and engaging by aligning learning experiences with students' cultural contexts. Kamalov et al. (2023) demonstrate how AI can address the limitations of traditional education by offering personalized learning experiences that resonate with students' unique cultural perspectives.

In addition to enhancing the relevance of educational content, AI also supports the development of intercultural competence by providing real-time feedback and suggestions for improvement. This capability is precious in helping students develop the nuanced skills needed for effective intercultural communication, such as understanding non-verbal cues and context-specific language use. The potential of AI to provide continuous, adaptive learning experiences tailored to individual student needs is evident in several studies findings (Dong, 2023). These tailored interventions allow for more targeted support, helping students overcome specific challenges in their intercultural communication development.

Challenges and Limitations of AI in Enhancing ICC

Despite the clear benefits of AI in enhancing ICC, the review also highlights several challenges and limitations that must be considered. One of the most significant challenges is AI's difficulty in understanding and conveying cultural nuances. Communication is not merely about exchanging words; it involves tone, context, non-verbal cues, and deeply embedded cultural meanings. Khasawneh (2023) points out that AI's limitations can lead to misunderstandings and misinterpretations, particularly in more complex communication scenarios. For example, while AI can accurately translate words, it may fail to capture the intended meaning or the cultural significance of specific phrases or gestures. This limitation emphasizes the need for human involvement to ensure that AI tools are used in a culturally sensitive and accurate manner.

Moreover, the effectiveness of AI in enhancing ICC is also influenced by the quality of the data on which AI algorithms are trained. If the data used to train AI models are biased or lack diversity, the AI's ability to accurately reflect and respect cultural differences may be compromised. This is particularly concerning given the potential for AI to reinforce existing stereotypes and biases if not correctly managed. The findings of this review suggest that as AI becomes more prevalent in educational settings, it is crucial to ensure that the data used to train these models represent students' diverse cultural backgrounds. Failure to do so could result in AI tools perpetuating rather than mitigating cultural misunderstandings.

The digital gap presents another significant challenge to implementing AI in education. As Ou and Malmström (2023) discuss, differences in access to digital tools and technologies can intensify existing inequalities in educational outcomes. Students from disadvantaged backgrounds may have limited access to the technologies needed to benefit from AI-driven learning experiences, putting them at a disadvantage compared to their more privileged peers. This digital gap affects students' ability to engage with AI tools and limits the potential for these tools to be completely integrated into the educational experience. To address this issue, policymakers and educators must work together to ensure that all students have equitable access to the necessary tools and resources.

Pedagogical Implications of AI for ICC

The findings of this systematic review have several important implications for educational practice and policy, particularly in the context of curriculum design, teacher training, and the ethical use of AI in education. One of the most significant implications is the potential for AI to transform the way cultural competence is taught and assessed in higher education. The positive outcomes associated with AI tools suggest that integrating AI into educational practices significantly enhances cultural competence among students, better preparing them for the challenges of a globalized workforce. For curriculum designers, this means moving towards more AI-integrated learning experiences that offer personalized, adaptive, and culturally relevant content. By applying AI's ability to customize educational experiences to individual students' needs, educators can create more inclusive learning environments that address the diverse cultural backgrounds of their students. This approach improves the learning experience and equips students with the skills they need to manage cultural differences in their future careers.

However, the findings also highlight the need to consider the ethical and practical challenges associated with AI in education. As mentioned earlier, the digital gap presents a significant barrier to equitable access to AI tools, potentially exacerbating existing inequalities. As such, it is essential to ensure that investments in AI in education are accompanied by efforts to provide the necessary infrastructure and support for all students, particularly those from disadvantaged backgrounds. This includes providing access to technology and ensuring that students have the digital literacy skills needed to use AI tools effectively.

In addition to addressing the digital gap, the ethical implications of AI in education must also be considered. The potential for AI to reinforce cultural biases is a critical concern that must be addressed through clear guidelines and standards. For example, if AI algorithms are trained on biased data, they may inadvertently perpetuate stereotypes or reinforce existing inequalities. To prevent this, it is essential to ensure that AI models are trained on diverse and representative data sets that reflect the cultural diversity of the student population. Educators and policymakers must work together to develop standards and guidelines that promote the ethical use of AI in education, ensuring that these tools are used in ways that enhance rather than hinder cultural competence.

The role of educators in the AI-enhanced learning environment is another critical consideration. While AI offers many benefits, it is not a substitute for the depth and richness of human interaction in education. Educators play a crucial role in guiding the use of AI, ensuring that it enhances rather than diminishes cultural diversity. The need for human

intervention to correct and refine AI outputs is a significant limitation that must be acknowledged when integrating AI into educational settings. Educators must have the skills and knowledge to effectively integrate AI into their teaching practices. This includes understanding AI's strengths and limitations and being able to interpret and act on the feedback provided by AI tools. Faculty training and professional development are essential components of this process, ensuring that educators are prepared to use AI to enhance the learning experience for all students.

Future Directions and Research Implications

The findings of this systematic review also suggest several areas for future research. One important direction for future research is the exploration of the long-term impact of AI on ICC. While the studies reviewed provide valuable insights into the short-term effects of AI on ICC, there is a need for longitudinal studies that examine how AI impacts students' cultural competence over time. This research could provide a deeper understanding of how AI tools influence students' ability to manage cultural differences in their professional and personal lives and how these tools can be improved to better support long-term cultural learning.

Another area for future research is exploring how AI can be integrated into broader educational frameworks to support holistic cultural education. While AI tools have shown effectiveness in specific areas, such as language learning and cross-cultural communication, they often need to address the broader aspects of cultural understanding. Future research should explore how AI can be combined with other educational approaches, such as experiential learning, to create a more comprehensive and culturally sensitive educational experience. This research could also examine how AI can support cultural competence development in disciplines beyond language learning, such as history, sociology, and anthropology.

The ethical implications of AI in education also require further exploration. As AI becomes more prevalent in educational settings, it is essential to continue examining how these tools impact students' cultural competence and what measures can be taken to ensure that AI is used responsibly and ethically. This research should focus on developing best practices for AI in education, mainly promoting cultural sensitivity and inclusivity. Additionally, researchers should explore how AI can address educational inequalities, particularly those related to the digital divide and access to technology.

Conclusion

To conclude, this systematic review has demonstrated that AI and ICT tools possess significant potential to enhance ICC in university-level education. The findings highlight how AI can provide immersive, personalized, and context-specific learning experiences that help students develop crucial intercultural skills. However, while the potential of AI is clear, several challenges and limitations must be addressed to maximize its effectiveness in educational settings. One of the critical strengths of AI in education is its ability to create dynamic, interactive environments that mirror real-world cultural scenarios. By allowing students to engage with AI tools like ChatGPT, VR, and AR simulations, educators can offer practical opportunities for students to refine their communication strategies and deepen their understanding of cultural norms and values. Furthermore, AI's ability to personalize ensures

that learning experiences can be tailored to individual students' cultural backgrounds, making education more relevant and inclusive (Wang, Lund, et al., 2023).

Despite these benefits, the review also highlights significant challenges, particularly in ensuring that AI tools are culturally sensitive and ethically used (Jenks, 2024). AI's limitations in capturing the nuances of human communication, combined with concerns about biases in AI training data, emphasize the need for careful implementation and ongoing human supervision. Additionally, the digital gap presents a considerable barrier to equitable access to AI-enhanced education, requiring targeted efforts to ensure that all students can benefit from these technologies (Williamson & Prybutok, 2024). For future research, it is essential to investigate the long-term effects of AI on ICC and explore how AI can be integrated into broader educational frameworks to support holistic cultural education. Researchers must also continue to examine the ethical implications of AI in education, developing best practices to promote cultural sensitivity, inclusivity, and equitable access. In the end, the successful integration of AI into education will require a collaborative effort among educators, policymakers, researchers, and technology developers. By addressing the challenges and utilizing AI's potential, we can create more inclusive and culturally aware learning environments that better prepare students for the demands of a globalized society (Chan, 2023; Sarwar et al., 2024).

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Competing Interests

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