



AI's Role in Enhancing Cross Cultural Competence and Leadership through Online Education Programs

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Abstract

Cross-cultural competence (CCC) is essential for any future leader. The paper analyzes and discusses the potential of artificial intelligence (AI) to narrow the divide existing in online degree programs, a pivotal element in fostering leadership excellence and capabilities while ensuring universal access to technology. The study's methodology primarily involves an in-depth literature review of existing research and theories on AI, online education, and cross-cultural competence. It discusses the strengths and weaknesses of current online educational platforms and recommends introducing AI precision education to bridge the shortcomings of different platforms. The paper reveals some critical insights: CCC is essential for students and future leaders to function in a globalized, increasingly interconnected world; however, there has been a gap between students' assumed CCC and their actual CCC. The paper identifies shortcomings in their CCC curriculum and suggests improvement methods by analyzing the world's top ten STEM universities. The paper finds that AI's ability to accommodate cultural and cognitive differences promotes an inclusive educational environment and addresses broader digital access and equity issues. It concludes with a strong argument for integrating AI in online cross-cultural education to prepare future leaders with the skills necessary to thrive in a globalized, increasingly interconnected world.

Keywords: Digital equity, Internationalization at Home (IaH), leadership excellence, personalized learning, technology access

1. Introduction

In our increasingly interconnected society, it is essential for leaders in all sectors, including education, to know the skill sets needed to engage and link cultures. There are advantages and disadvantages of online cross-cultural education. Though positive attitudes towards online language learning experiences in a cross-cultural context highlight the merits of working in mixed groups with basic skills, several challenges have also been reported, such as remote-intercultural communication and time management (Brdulak et al., 2022; Ahmad & Ahmad,

2022). Progressive pedagogical approaches have focused on improving multicultural competencies among distance learners through decolonizing traditional curricula and internationalizing learning environments (Chen et al., 2020). Artificial Intelligence (AI) in online programs can be an excellent tool for enhancing Cross-Cultural Competence (CCC) among students, which would likely change the whole global education scene. Comparatively, the levels of intercultural competence among STEM learners are lower than those of their non-STEM counterparts, likely because of the traditional masculinity of this field (Lucietto & Russell, 2020). However, engagement in living-learning communities and global science programs can significantly enhance intercultural competence among STEM learners (Starr & Jin, 2022). These programs have been discovered to enhance the intercultural agility and competence of science, technology, engineering, and mathematics (STEM) students, including civil engineers who require a global mindset. These programs offer chances for learners to gain intercultural competencies and other essential professional skills (Berrueta et al., 2023). Students participating in these international mobility programs know the importance of working in multicultural teams, among many others, thereby developing coping mechanisms for addressing cross-cultural or professional misunderstandings (Sierra-Huedo & Foucart, 2022).

Researching the multifaceted roles of AI in enhancing CCC in STEM education offers an array of research opportunities. AI can help adapt to learners' cultural backgrounds when providing feedback, significantly improving learners' motivation (Sidi-Ali, 2019). AI-driven personalized learning experiences reflecting students' cultural backgrounds and skills hold immense potential for better understanding different cultures and becoming culturally sensitive. In this regard, immersive AI simulations, encompassing various forms of cultural contexts, are deemed quite helpful; however, there are also concerns about the extent of their actual impact on cultural awareness and sensitivity among students. Consequently, this has led to questions about whether those tools can promote cross-cultural dialogue effectively while fostering self-knowledge among students involved in STEM programs. AI simulations can allow learners to experience and navigate everyday intercultural encounters and enhance their ability to handle real-life situations (Coffey et al., 2017).

The above discussion leads to the following research question. What role can AI play in promoting cultural sensitivity over traditional educational methods, and can AI-facilitated content improve cultural knowledge? Through the literature review, the study identifies that AI-powered language tools are efficient in closing communication gaps. In addition, AI promotes self-awareness through AI-facilitated reflective practices (Mollo et al., 2017). The role of artificial intelligence (AI) in adapting learning experiences necessitates further inquiry into diverse cultural contexts, enhancing conflict resolution skills, and managing cultural diversity within collaborative projects. There is also the possibility for artificial intelligence (AI) to transform learning into a process where conflicts can be resolved more efficiently, and diversity is managed well during group projects (Donahoe, 2020). Understanding the sources and features of conflicts and the principal contradictions and aspects is crucial for effective conflict management (Shah et al., 2024).

Integrating AI into online programs offers a potential way to improve CCC among future leaders. This study examines how AI can provide personalized digital experiences through the theoretical background of Cultural Convergence Theory and Contextual Learning Theory. The study analyzes different facets of CCC and attempts to redefine multicultural STEM pedagogy in an ever more connected world to prepare students with the cultural competence necessary for thriving in a globally connected world, thus reinventing STEM education within the context of globalization. The study is structured in the following way: after the introductory part, the study outlines a literature review, encompassing the theoretical background, CCC, and CCC in

STEM. Subsequently, the study proceeds with online education and the application of AI. The study culminates with the discussion and concluding remarks.

2. Literature Review

This study focuses on how artificial intelligence can bridge the gaps within online degree programs to enhance cross-cultural competence and leadership skills. Using cultural convergence theory demonstrates the role played by AI in facilitating cross-cultural communication and knowledge acquisition necessary for fostering critical cultural awareness. On top of this, contextual learning theory emphasizes that AI can produce immersive, authentic learning experiences that mirror actual cultural contexts students face because it helps address problems linked to accessibility associated with AI. Therefore, according to these theories, the study implies that AI can adapt its feedback to match students' actual CCC levels, thus leading to an inclusive educational environment where future leaders are groomed to tackle worldwide disparities of culture and digital technologies.

2.1. The Cultural Convergence Theory and Contextual Learning Theory

In a modern, globalized world, conducting business with foreign nationals and traveling to distant, foreign lands have become normalized, even if many industries require them. It requires individuals to be proficient in their field of expertise and know other cultures. Knowing other cultures signifies understanding cultural differences and possessing cross-cultural awareness (Shadiev et al., 2023). According to cultural convergence theory, cross-cultural learning is a process that happens through communication and interaction with people from other countries. Through this process, individuals exchange culturally-embedded information, and they get to understand the cultural traits of the world another person lives in. Furthermore, as people acquire knowledge of different cultures, they become more aware of cultural differences and develop critical attitudes toward others and their culture.

The cross-cultural learning process evolves in two stages. First, there is cross-cultural communication, a stage characterized by an interaction of two or more people from diverse cultures. The interaction facilitates the second stage- cross-cultural knowledge acquisition. It includes not simply the acquisition of information about other cultures but also the development of critical opinions as well. People going through this process also get to understand their own culture better. This process reveals that learning about culture does not happen in a vacuum, irrespective of one's surroundings, but in a particular context. A cultural convergence theory further elaborates it.

The cultural convergence theory explains that “learning is a contextualized process that takes place in real activities, situations, and cultures.” (Shadiev et al., 2023). Any skill or subject a person studies depends on the context in which the person is exposed. Culture may be studied from books or related literature. However, this process can not be as successful as when a person emerges from an authentic culture and has a chance to interact with its people. In this way, a person has a better chance of developing a deeper and more nuanced understanding of the respective culture. It is also indicated by Shadiev et al. (2023) as the most promising way of developing positive cultural attitudes. At the same time, it is acknowledged that it is challenging to study a culture authentically. Traveling to that destination is costly and time-consuming, and not everybody has a chance to interact with a native person from that specific culture. It is an area where many educators see the application of AI as promising and

effective. AI tools provide a chance for cross-cultural interaction through virtual reality or other tools.

Furthermore, as mentioned above, cultural learning and learning about almost anything happens in a related context. It is especially true for learning history, international relations, or collective memory from past wars. Learners from different cultures have had exposure to different media outlets and potentially different 'truths/ facts' about history. When meeting together, these people can have a conflict resulting from a lack of understanding of another person's perspective. It can be resolved by studying the history and culture taught in that respective country/ culture. However, this process is quite lengthy, and most people do not have the resources or even the willingness to undergo that kind of process. In this respect, AI tools can assist a person by providing necessary information more efficiently. It can be convenient for students or people working in international relations, politics, or international business.

2.2. Cross-Cultural Competence

The importance of cross-cultural competence (CCC) in leadership is a well-established fact divided into three domains: Knowledge, attitudes, and behaviors (Bazaz et al., 2014). However, Yashnyk and Turitsyna (2023) delve deeper into these components and see the interrelation between cognitive knowledge, abilities, personal traits, and critical skills required for cross-cultural communication. Furthermore, Liao and Thomas (2020) think that intercultural experience is crucial in increasing cultural intelligence - an intrinsic aspect of CCC, by developing a model that posits differential relationships between the four dimensions of cultural intelligence, including meta-cognitive, cognitive, motivational, and behavioral as well as three intercultural effectiveness outcomes such as cultural judgment and decision making, cultural adaptation, and task performance in culturally diverse settings (Ang et al., 2007).

Cross-cultural competence is a big umbrella with all the skills and knowledge people need to work effectively in diverse cultural settings. At its core is being culturally sensitive and knowledgeable. A similar understanding from Liamputtong (2010) suggests that cultural sensitivity means respecting different cultures so people can learn from each other. Przytuła et al. (2023), on the other hand, point toward international student mobility programs as a powerful way of giving students a range of new skills, knowledge, and attitudes - which they can then use back home in their own culture, knowing what makes people different, respecting it, and trying to apply that lens to wherever people are or with whomever people are working.

On the other hand, crossing cultures needs self-awareness and cross-cultural communication to transverse the intricacies of international dealings. For instance, intercultural competence is deemed by Dobrovolska et al. (2019) as a modern testament that young people in any profession must be able to communicate well across diverse cultures and know themselves enough so as not to be biased by their own cultural background. Nonetheless, the findings of Monthienvichienchai et al. (2002) show that cultural awareness and communicative competence are directly linked; besides, the researchers establish that encouraging open dialogue and self-reflection facilitates successful cross-cultural interactions. Therefore, global scholars emphasize building communicative abilities alongside self-understanding, which are indispensable for life in mixed multiracial surroundings.

Cultural adaptability and conflict resolution are important aspects of cross-cultural competencies for dealing with complex, diverse cultural environments. Emotional intelligence and cultural adaptability are instrumental in cross-cultural competency, enabling superior intercultural adjustment and performance in multicultural settings (Liao et al., 2021). It

demonstrates why adaptability and conflict resolution skills must be part of a comprehensive cross-cultural competence program. In another study, Przytuła et al. (2023) affirm the value of short-term foreign mobility programs in enhancing students' cross-cultural competencies, such as mediation and negotiation techniques, when they further illustrate how adaptability and conflict resolution help promote better intercultural interactions.

Cross-cultural competence is a crucial requirement of managing cultural diversity and showing flexibility, which, in turn, helps to compete with others globally at the level of both organizations and individuals. Cox and Blake (1991) assert that this ensures not only better cost structures, diverse human resource bases, creativity, innovation but also problem solving quality that can affect organizational flexibility hence they further argue that effectively managing cultural diversity enhances an organizational competitive advantage. It is this perspective on the importance of managing cultural diversity for developing cross-cultural competence that underscores the importance of this study. Moreover, according to Knap-Stefaniuk and Burkiewicz (2021), cross-cultural competence is necessary for higher education as it equips learners with the requisite skills to adapt to different cultures when entering the global labor market. They posit that future leaders must possess effective navigation across diverse cultures or demonstrate multicultural adaptability to remain sustainable, thus making cross-cultural competence no longer a professional advantage but an outright necessity for survival in the current world characterized by intensifying interconnections.

Multifaceted in nature, cross-cultural competence (CCC) is essential for leaders with knowledge, attitudes, and behaviors to navigate cultural differences effectively. The basis of CCC is understanding various cultures and the role that intercultural experiences play in building cultural intelligence, as Liao and Thomas (2020) pointed out. These views are further supported by Liamputtong (2010) and Dobrovolska et al. (2019), which emphasize cultural sensitivity and self-awareness and foster mutual understanding and respect for different cultures, among other attitudes contributing to this end. Also, effective cross-cultural communication, conflict resolution, and managing cultural diversity are essential for successful global interactions and organizational competitiveness (Przytuła et al., 2023; Liao et al., 2021; Cox & Blake, 1991). This comprehensive approach integrating knowledge, attitudes, and behaviors is crucial for preparing future leaders to thrive in an increasingly interconnected world, thus emphasizing the significance of CCC in developing global leadership excellence.

2.3. CCC in STEM Education

Cross-cultural competence is becoming widely recognized as an essential part of the higher education learning environment, especially in STEM fields. Suprun and Suprun's research points out the universally inclusive features of the educational environment and underscores the need for cross-cultural competence with the integration into the European scientific and educational space. The researchers present modern social, political, and economic realities that call for a shift in specialists' professional level and personal qualities (Suprun & Suprun, 2023).

The study conducted by Alexis et al. on a Singapore Study Abroad Program with STEM undergraduate students shows that studying abroad can be hugely beneficial in developing cross-cultural and global inter-dependency (Alexis et al., 2017). They found that programs like these can significantly enhance foreign language skills, different cultural knowledge, cross-cultural skill development, and transformation of worldviews for more successful cross-cultural awareness and communication competence. Wernick and Branch explore international service learning as a technique to teach students cross-cultural competence within the "Smart Machine Age" (Wernick & Branch, 2022). Their research focuses on one social

entrepreneurship project that partners with student organizations, NGOs, and women's self-help groups in India. They suggest experiential learning as an effective method to teach this necessary life skill. Wernick and Branch argue that traditional pedagogy should be used to teach something other than cross-cultural competence.

Wood's (2021) exploration was to study the development of pedagogical content knowledge (PCK) in STEM education, emphasizing the significance of lesson and learning action research. This method improves teachers' comprehension of students' experiences, thus enabling the integration of CCC into teaching methods in STEM. The outcomes reveal that engaging educators in reflective practice and research significantly enhances their capacity to deliver culturally competent STEM education. Liu (2023) presented an entirely new manner for enhancing foreign language teachers' intercultural teaching competency using deep learning algorithms. Improving the learning ability of support vector machines with wavelet kernel functions achieved a high accuracy rate in teaching intercultural competence. This innovation has a high potential for higher vocational institutions of technology innovation, such as college training or testing institutions.

These studies demonstrate how important it is to integrate lessons on cross-cultural competence into STEM education curricula, such as studying abroad or implementing unique projects into classes to teach students real-world competency in other cultures. The emphasis on this crucial component reflects how interconnected our world has become within scientific communities – future leaders must be effective problem solvers while respecting diverse cultures/systems (Alexis et al., 2017). Therefore, when taken as a whole, these studies show that CCC development is complex within STEM education while emphasizing such aspects as studying abroad, creative strategies for teaching, and AI tools to ensure learners and teachers can succeed in different academic and professional settings as globalized citizens.

Including cross-cultural competence training in online STEM educational programs shows an immense shift towards embracing global diversity and enhancing international collaboration. Nozhovnik et al. (2022) highlight the growing trend of technology-driven approaches to undergraduate cross-cultural skills, which has shown positive results through language training. Innovative instructional methods could boost STEM education by preparing students with technical skills and navigating the vast pool of cultural differences. The need for technology use in bridging cultural gaps is critical as online education thrives on digital platforms that offer opportunities for students and instructors to interact.

Recognizing the potential of online digital platforms, many companies have been offering courses to foster CCC on massive and small online platforms. However, both platforms have limitations; for example, many drop-outs (massive online platforms) and high enrollment fees (small online platforms). Furthermore, their educational programs cannot be compared with complete university programs that expect far higher dedication and longer studying engagement from students. However, even in the top ten universities, where STEM education is considered the best globally, CCC is not emphasized as obligatory (see Table 1). Therefore, students might underestimate the necessity of fostering CCC and future career limitations if their CCC skills are deemed inadequate. The situation may become even more problematic if universities expect their students to navigate their CCC education by independently selecting courses from other departments. In this situation, students may select courses that do not match their needs and might be disappointed.

Therefore, we recommend universities help students enhance their CCC through proper cultural education or training. Sjøen (2023) stresses the importance of including comprehensive approaches in teacher education programs and believes this should be extended to STEM fields with cross-cultural competence training considered a fundamental component. This approach

emphasizes how educators should be equipped with the skills needed to create a culturally inclusive learning environment, thereby improving student's educational experiences. We need STEM professionals with good cross-cultural communication and collaboration knowledge as the world becomes interconnected.

Developing cross-cultural competence does not stop at just being a pedagogical adjustment but is also a strategic necessity. Aggarwal and Wu (2021) argue that developing this skill is critical to enhancing business outcomes across various organizational functions. The online STEM programs need to integrate cross-cultural competence training to produce technically skilled, culturally competent graduates capable of contributing effectively to the global STEM community.

3. Methodology

The methodology of the study, as, in general, an extensive literature review, involves numerous existing researches, theories, and ideas related to Artificial Intelligence, online learning, and Cross-Cultural Competence. The Cultural Convergence Theory and Contextual Learning Theory provide the theoretical background for this literature review, which examines the relevance of AI's role in education. These theories were selected because they explain the process of acquiring cultural knowledge and highlight the context's significance. Cultural learning context is essential in offline and online courses, as they should credibly replicate reality.

The study first analyses online educational programs offered by massive and small online learning platforms and identifies their advantages and disadvantages. The study analyzes the world's top STEM universities and their programs (Table 1). These universities are selected because they offer premium STEM education to students and raise future leaders. However, the study identified that CCC must be incorporated into their STEM education. Students need systematic guidance to navigate their course selection. This process often happens without knowing which courses would benefit them and in which ways. For those reasons, the study develops a roadmap of AI-supported online programs that enhance students' CCC and promote their self-awareness and overall leadership skills (see Table 2).

4. Online Education and the Application of AI

The literature on online education programs in China, particularly during the COVID-19 pandemic, covers various experiences, challenges, and opportunities. These research studies provide important insights into the implementation, effectiveness, and perception of e-learning in different educational sectors and demographics across China.

Even though Ghanaian international students living in China face difficulties like high internet data costs and slow network connections within their university homes, they still mostly agree with the introduction of online study courses. This positive reception among international students reveals its potential utility; however, it also demonstrates the necessity of improvements concerning infrastructure that could lead to smoother distance education (Demuyakor, 2020). One such program was taken by 108 mainland Chinese and Hong Kong university-level participants during the lockdown periods imposed by the pandemic outbreak. The level of engagement demonstrated through this program shows prospects for tailor-made e-courses that can maintain student involvement even during frequent disruptions due to external factors similar to pandemics (Ng., 2022). This participatory case study examined a COIL program at Shanghai University (SHU) during the Covid-19 pandemic, which found

three main things: organizing COIL Programs with a global perspective, enhancing teaching methods through intercultural communication, and identifying barriers that affect COIL programs in Chinese universities. These findings highlight the significance of maximizing cross-border educational experiences while tailored approaches should address specific challenges (Zhu et al., 2023).

A negative attitude often stems from a lack of emotional attachment, which calls for an emotionalistic learning environment that focuses on students' feelings. Such an approach can increase significantly learners' satisfaction (Tian & Lu, 2022). Pharmacists in hospitals located in Northwest China perceive antimicrobial stewardship programs positively despite facing workload issues, such as poor communication between them and doctors or limited knowledge about AMS. Therefore, there is an urgent need for better training and communication strategies to improve participation rates in these programs (Ji et al., 2021). Taken together, these papers highlight the complex nature of online education during emergencies while also reiterating the importance of addressing technological as well as pedagogical and affective engagement difficulties. They show how online platforms can bring novelty to education and help shape China's virtual education sector for a better future- possibly with global implications.

According to Zhou et al., AI is the next revolution in front of humanity. Most people get in contact with AI-based technologies or services; however, they need help understanding the technology behind them (Zhou et al., 2021). Therefore, it is essential to teach people how to use AI and understand the strengths/weaknesses and the ethics of the technology behind it. The authors explain that there are debates within academia on the content that should be taught, pedagogical methods, and how it should be taught. Massive Open Online Courses (MOOC) are considered practical and widely available platforms for teaching AI. These courses offer free-of-charge resources available to everyone with internet access.

Furthermore, they show how world-class universities teach AI. Common topics include core algorithms, typical applications, fundamental concepts, system development, ethics, and regulation. Around 50% of courses teach online procedural teaching, while approximately 30% use task-driven learning. The authors identified that scenario-based and project-based learning could not be fully used, and teamwork in MOOC courses could not be applied thoroughly. This type of teamwork requires frequent interactions between an instructor and students, among students, and among members of the same team.

Other than ineffective scenario-based learning and project-based learning, MOOCs have other disadvantages. According to Lin and Lai, MOOCs have a high registration rate but low completion rate, low interaction between an instructor and students, ethics and effectiveness issues related to certification/evaluation, and relatively high platform maintenance costs (Lin & Lai, 2021). They recalled a previously suggested solution, introducing a miniature private online course (SPOC). SPOCs have a high interaction between teacher and student, a high-class completion rate, and offline class examinations. SPOCs have, also, some shortcomings. It includes class restrictions in terms of number of students and enrollment fee. Furthermore, since teachers usually teach using the flipped teaching technique, they must invest more time and energy in preparing the classes.

The authors suggest AI precision education to bridge the disadvantages of MOOCs and SPOCs. Based on big data, AI can examine individual characteristics of each student and suggest a curriculum and teaching methods tailored for each student. In this way, an instructor, assisted by the AI, recognizes each student's traits and offers targeted learning. It differs from a traditional educational concept, where all students use the same materials and are supposed to process information at the same speed. In the traditional concept, students' characteristics are often seen as disadvantages rather than advantages.

Contrary to this, the authors suggest that AI may assist teachers in "adaptable teaching." Adaptable teaching, contrary to traditional educational concepts, respects students' differences and assists students in discovering and displaying their strengths. Ultimately, adaptable teaching aims to improve students' chances of success by utilizing their strengths and improving their overall ability. Following this concept and by recognizing the strengths/weaknesses of MOOCs/SPOCs, the authors advocate the introduction of "AI Precision Education." It collects student data through big data, creates a database of each student, and forms a learning strategy. It includes suggesting a course and providing feedback through a learning assistant. AI Precision Education can be effectively used on MOOC and SPOC platforms.

5. Findings and Discussion

In a globalized, interconnected world, where people are required to work and communicate with different kinds of people, it is essential to understand each other's cultural backgrounds. To understand each other, people need not only to understand the language another person is using but also cultural differences and how they affect a person's behavior. In other words, it is essential to have cross-cultural understanding and sensitivity. According to the Cultural Convergence theory and Contextual Learning theory, cultural learning happens through a two-step process: cross-cultural communication and cultural knowledge acquisition.

The study finds that AI can assist cross-cultural communication through translation (Shadiev et al., 2019). Shadiev et al. (2019) experimented with two groups of people communicating with speech-enabled language translation (SELT). They communicated in their native language, and then the speech was converted to text and translated into English. The experiment demonstrated that cross-cultural learning occurred during the process, and participants' intercultural sensitivity improved (Shadiev et al., 2019).

Another application of AI is AI-assisted communication. Khasawneh (2023) argued that AI may serve as a means to overcome challenges of cultural diversity and facilitate intercultural dialogue. It is done through AI-assisted communication. Khasawneh (2023) states, "Achieving successful cross-cultural communication necessitates exhibiting awareness and a profound comprehension of the societal setting. Linguistic obstacles can impede intercultural communication, posing challenges in transmitting concepts and establishing interpersonal connections." Khasawneh's study, similar to previous studies, elaborated that AI-assisted translation can help individuals communicate cross-culturally and foster cross-cultural learning and sensitivity. However, it also showed the limitations of AI. It is a machine-based tool that has difficulties translating idiomatic expressions and cultural nuances. For those reasons, translation experts who participated in the study evaluated that AI cannot completely replace human translation or replace people's need to learn foreign languages. Furthermore, they expressed the need to examine AI tools to decrease the probability of exhibiting cultural prejudices.

The study finds that the use of AI in cross-cultural learning extends beyond translation and assisted communication. The application of AI can foster cross-cultural understanding in effective and time-saving manner. Shadiev et al. (2023) conducted an experiment involving two groups of students from China and Russia. The researchers designed a VR-based learning activity where participants were engaged by joining a virtual reality experience supported by 360-degree video technology and AI-assisted translation. Before and after the activity, the students' intercultural understanding was measured across dimensions like interest, curiosity, openness, and respect. Participants exhibited enhanced cross-cultural comprehension in all

categories after the learning activity, which involved creating, sharing, and discussing cross-cultural content.

AI can also bridge the digital divide, make it available to many people, and enhance social equality. Rönnblom et al. (2023) noted that awareness, accessibility, affordability, availability, and adaptability regarding AI have promoted bridging algorithmic divides, making AI's benefits accessible to all persons. Yu (2020) also suggested that combining anti-discrimination principles with data protection law can help ensure fairness within algorithmic decision-making in the digital age while utilizing AI for online cultural education. Equality can be fostered by using law communications, policy, ethical principles, institutional mechanisms, and practices across various disciplines, such as STEM and sociology, while creating an equitable digital society.

6. Conclusion

This study has explored how Artificial Intelligence (AI) can improve Cross-Cultural Competence (CCC) and leadership skills in online education. Using Cultural Convergence Theory and Contextual Learning Theory, AI can offer individualized, experiential learning that spans cultures and improves students' intercultural competence. The findings support AI technology's ability to align feedback with learners' actual CCC levels, promote digital equity, and train future leaders to understand the intricacies of global culture. Various innovative applications can make CCC in online education better by AI. For example, course materials of an AI-powered LMS may be adaptable according to students' cultural backgrounds. Moderated by AI discussion forums, which have equal participation levels and culturally sensitive exchanges among students, AIs generate evaluations that offer customized assessments and scenarios promoting cultural sensitivity. By way of illustration, inclusive learning platforms that adapt and VR immersion take an aggregate approach towards enhancing cultural competency within schools that value diversity.

However, despite these hopeful insights, this research is confined to a literature review, which has yet to be empirically validated specifically for the proposed AI applications in online education. The diversity of educational environments where such intelligent technologies have been used and their differential effectiveness should have been covered more extensively. Therefore, the study suggests overcoming the limitations of this study by conducting research based on empirical analyses that evaluate the practical implementation of AI in enhancing CCC within online education contexts. Longitudinal studies that follow CCC development and leadership skills over time would provide more reliable data about the efficiency of AI intervention. By integrating artificial intelligence with emerging technologies like augmented reality (AR) and virtual reality (VR), cross-cultural training could provide novel bases for enhancing cultural immersion.

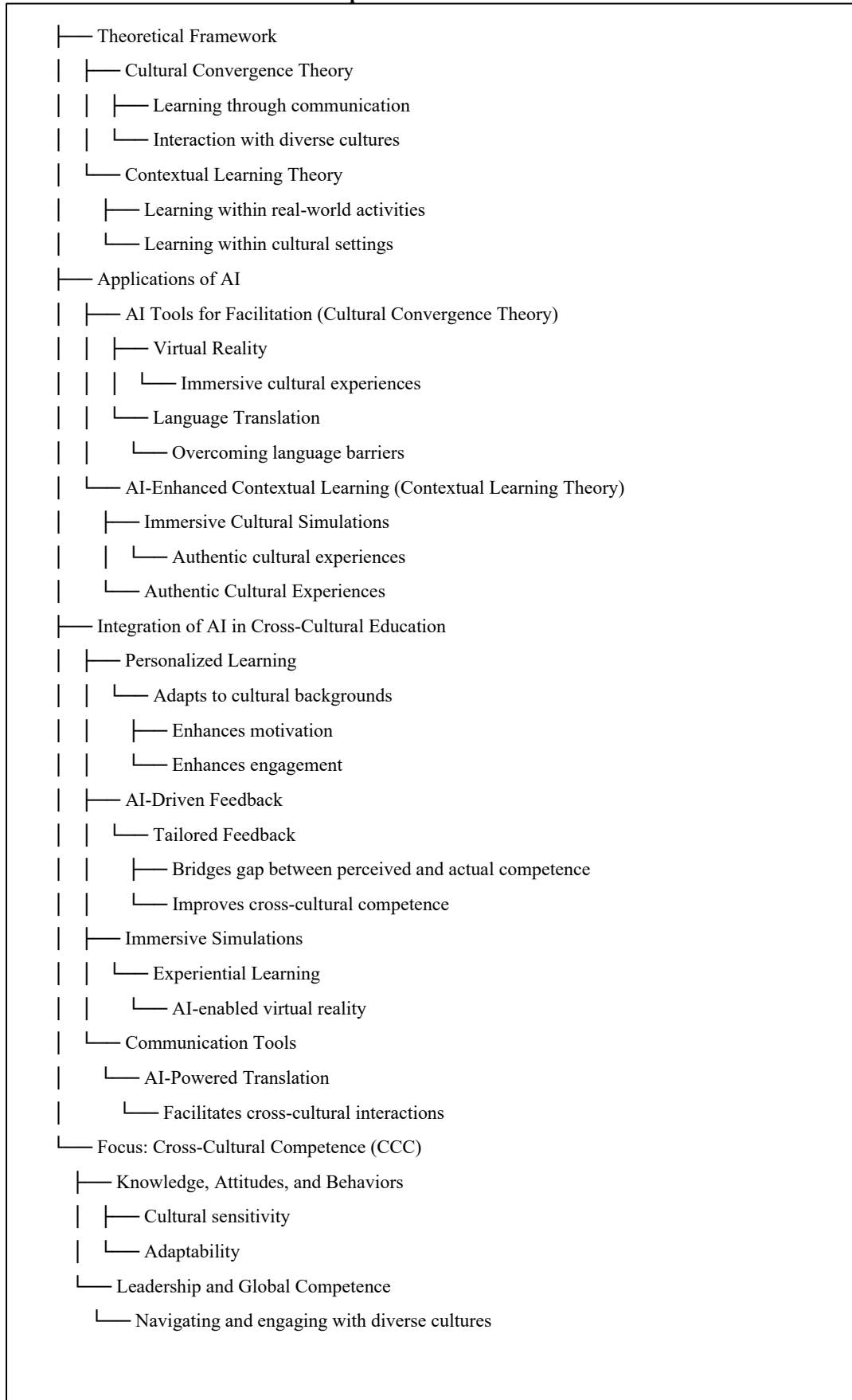
Table 1. Top 10 STEM universities (strengths and weaknesses of their online education programs)

Overall ranking ¹	University Name	Country	Program strengths	Program weaknesses
1	Massachusetts Institute of Technology (MIT)	US	-High reputation in STEM -Independent Online Learning platform MITx and sharing open courses through EdX -a lot of interdisciplinary courses	- CCC is not incorporated as a core component of STEM education - Students should take courses on CCC independently
2	Stanford University	US	- Offering paid courses on AI - offering some free-of-charge courses -overall high reputation	- CCC is not incorporated as a part of STEM - students should navigate CCC courses by themselves
3	University of Cambridge	UK	-Overall high reputation of the university - tuition waiver for most talented STEM students (STEM SMART)	- Lack of online available STEM programs - Lack of free of charge online courses
4	University of Oxford	UK	- Overall high reputation of the university - few online degree programs	-Most online programs are paid - Most programs are classified as either STEM or Humanities (lack of interdisciplinary online courses)
5	University of California, Berkeley (UCB)	US	-Independent online learning platform - availability of paid online courses as well as degree programs	- Free courses are not available on the university platform - courses are classified either as STEM or as Humanities (lack of interdisciplinary courses)
6	Imperial College London	UK	-Free online courses available through EdX and Coursera - programs for engaging youth in STEM	- CCC education is not highlighted as a part of STEM education -lack of interdisciplinary courses
7	ETH Zurich	Switzerland	-Free online courses available through EdX	-lack of interdisciplinary courses
8	Harvard University	US	-Free online courses available through EdX - Diversity of free STEM programs	- despite the commitment to cultural diversity, students are choosing CCC courses independently
9	Tsinghua University	China	-highlighted multidisciplinary education	-lack of free STEM courses - Students should navigate CCC education independently
10	California Institute of Technology (Caltech)	US	- A lot of free STEM courses available	- Students should navigate CCC education independently

Sources: Open Learning Massachusetts Institute of Technology (MIT), Stanford Online, University of Cambridge, University of Oxford, University of Berkeley, Imperial, ETH Zurich, Harvard Online, Tsinghua SEM, Online Learning at Caltech.

¹ Overall ranking is listed according to QS World University Rankings by Subject 2023: Engineering & Technology. See <https://www.topuniversities.com/university-subject-rankings/engineering-technology>.

Table 2: Roadmap of AI's Role in Online Cross-Cultural Education



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