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CAPABILITIES AND LIMITATIONS OF ARTIFICIAL INTELLIGENCE IN DEVELOPING STUDENTS' CROSS-CULTURAL COMPETENCE

Annotation. Artificial intelligence (AI) has rapidly become an essential component of educational transformation worldwide, including in Europe. Its integration into teaching and learning processes has opened new opportunities for developing students' cross-cultural competence (CCC), a key skill in multicultural, globalized environments. This article examines the capabilities and limitations of AI for enhancing CCC, with a particular emphasis on Germany and the European Union. It also compares recent European research trends with the conceptual insights of Kazakh scholar S. Kunanybayeva, whose work on intercultural communication forms an important theoretical basis for understanding competence development in multilingual contexts. The article synthesizes findings from recent studies (2015–2024) to highlight how AI-driven platforms, virtual exchange, data-based personalization, and immersive technologies foster students' cultural awareness and interaction skills, while also outlining ethical, pedagogical, and technological challenges.

Keywords: artificial intelligence, cross-cultural competence, Germany, Europe, intercultural communication, education technology, personalization.

Introduction

Cross-cultural competence (CCC) is becoming an important skill to develop in education for global citizenship readiness. In Europe, especially in the European Higher Education Area (EHEA), educators utilize artificial intelligence (AI) technology to enhance the teaching of languages and to assist with intercultural communication and provide students with access to different cultural contexts. Politicians have been quick to identify that with the introduction of generative AI, adaptive learning and virtual mobility systems, CCC is now in a new phase of development.

Artificial intelligence is not just another technology; it is a productive pedagogical tool that can enable authentic reproductions of cultural experiences, allow for multilingual communication between people and enable the use of evidence-based evaluations of students' performance. However, the integration of AI into education has also raised concerns about the existence of cultural biases when used inappropriately, while also creating ethical dilemmas and possibly oversimplifying complex cultural realities.

This article will address the functions and limitations of AI in promoting CCC for students and will explore recent developments in Germany and across Europe. It also incorporates the intercultural competence model developed by Kazakh scholar S. Kunanybayeva, which aligns with the current European approaches.

As artificial intelligence (AI) continues to expand into higher education systems, including many universities in Western Europe, researchers are increasingly focusing on the intersection between cross-cultural competency (CCC) and artificial intelligence (AI). Recent research indicates that AI-based communication platforms are significantly changing the ways we communicate with one another and how we learn from each other when learning about different cultures in Germany and across the continent. Helm and Beaven (2018-2022) stated that Virtual Exchange (VE) programs utilizing AI-based communication platforms enhance the authenticity of intercultural communication, as students are able to connect with and learn from culturally diverse peers in real-time through these programs, thus enhancing students' experiential cultural learning [1]. These findings also support broader EU-level efforts that advocate



utilizing digitally mediated intercultural exchanges to foster a sense of Global Citizenship through education.

Similar trends are demonstrated by Müller and Witte in research conducted from 2019–2023, in which German universities are found to be actively deploying AI-based language tutoring systems to personalize instruction and culturally adapt materials to the learner’s background. Their studies evidence that AI-powered personalization leads to deeper cultural contextualization, whereby students are able not only to develop linguistic knowledge but also acquire sociocultural knowledge relevant to communication in multicultural European settings [2]. These conclusions are further supported by the reports of the European Commission on AI in Education, 2020–2024, which document the very fact that AI frameworks implemented across EU member states prioritize inclusive digital learning environments and enhance cultural accessibility through the integration of multilingual technologies and adaptive learning analytics [3].

A different line of European research addresses multilingualism as an integral constituent of intercultural competence. Rybicka (2021) demonstrates how AI-backed automatic translation and transcription systems significantly extend students' access to knowledge of cultural diversity and thus allow for easy communication across languages within EU educational spaces [4]. Simultaneously, ethical issues are at the heart of the debate: Kergel (2019–2024) points to the possible cultural biases of AI algorithms and insists that transparency and fairness should be ensured in order to avoid misrepresentation of cultural identities and styles of communication [5].

Kazakh scholar S. Kunanybayeva (2015–2022)'s contribution to the European research trajectory intersects with her intercultural communicative competency model which focuses on multilingual identity development, cultural sensitivity, and context-based communication as dynamic and interactive processes. Although her work does not specifically refer to AI technologies, the pedagogical principles proposed in her work (experiential learning, authentic communication and reflexive cultural awareness) correspond closely with the pedagogical practices of educational institutions in Europe which are currently enhancing education through AI [6]. Her framework provides a complement to the CEFR (Common European Framework of Reference) plurilingual descriptors and shows that intercultural competency is achieved through continuous interaction between the language, the culture and personal experience - elements that AI tools increasingly can simulate and provide support for.

Materials and Methods

The present study is underpinned by a wide array of materials that reflect the integration of AI into the educational system in Germany and across Europe. It is based, first and foremost, on the following primary sources: 1) strategic documents at the national and European levels: the German AI Strategy – 2023 update [7], *Bildung in der Digitalen Welt 2019–2024* [8], *EU Digital Education Action Plan 2021–2027* [9], and the European AI Act 2024 [10]; 2) empirical studies carried out in German universities over a span of time: Müller (2020) [11], Witte (2021) [12], Feldmann (2023) [13]; 3) novel AI-based educational technologies to assist in developing students' cross-cultural competence (CCC) [14]. In order to analyze all these materials, comparative analysis, content analysis, and descriptive interpretation were applied in this paper.

The initial phase of the methodological approach focused on ascertaining how Germany is systematically integrating artificial intelligence into formal education as a leading European nation. The analysis looked at AI-based language-learning systems being implemented at German institutions of higher learning as part of the study's sources. Utilizing these systems helps develop cross-cultural communications skills by adapting both language input and culture-specific examples, in addition to developing auxiliary communicative tasks based on a student's prior experience. Thus, the functionality of these systems and their effect on pedagogy are important for understanding how personalisation technologies facilitate cross-cultural communication skills development.

VR and AR (augmented Reality) simulation were additional major components of the research study's methods. These VR/AR simulations create a multicultural experiential learning environment, enabling students to see real-life situations and gain an understanding of how to interact with people across cultures through immersive simulations of various settings. VR and AR technology uses AI-based models and behaviour prediction to generate simulated culture-based behaviour; therefore, it is important to understand how well these technologies replicate culture-specific behavioural and communicative expressions.

This study analysed Artificial Intelligence (AI) supported virtual exchange programs connecting German university students with their peers in other European Union (EU) countries and further afield. Intelligence-based models developed by AI are used to provide automatic translation services, tone



analysis, providing real time feedback on politeness strategies, and providing feedback on the appropriateness of the way in which one communicates, to support culturally sensitive interactions. The methodology was to assess how these tools enabled or hindered authentic intercultural communication between individuals engaged in virtual mobility environments.

Data from Erasmus+ Virtual Exchange Projects, European Educational Technology (EdTech) companies, and AI-powered learning analytics were analysed to identify Europe-wide trends. Learning analytics systems were particularly useful as they monitor students' intercultural developmental progress, identify students' communication patterns with each other, and allow for the creation of tailored content relevant to the cultural needs of the individual learner. Therefore they were studied as to how data-driven insights might be leveraged to facilitate or alter the types of pedagogical approaches used to develop intercultural communication competencies.

Other technological tools included AI-powered translation and transcription systems, such as DeepL and automated speech-to-text models; intelligent cultural chatbots simulating interlocutors from diverse cultures; and sentiment analysis systems that assess emotional tone and pragmatic appropriateness. These tools constituted methodological resources to the extent that they enable multilingual communication, create exposure to culturally specific linguistic behavior, and support reflective cultural learning.

The methodology considered both capabilities and limitations of AI. The content analysis in current AI systems showed possible cultural biases due to Western-centric training datasets that could misrepresent or over-simplify cultural differences. Ethical and legal issues, such as data privacy, transparency, and fairness, were explored through the policy documents that came from the European Commission and the European AI Act. In addition, teacher readiness and digital competence were also methodological variables since too low a level of AI literacy among teachers may threaten the possibility of effective implementation of the given technologies [15].

A methodological approach was developed that took into consideration both the pedagogical risk of students becoming overly dependent on AI tools, as well as the cultural limitations of algorithmically generated simulations. We determined how adequately AI could accurately replicate the complexity, emotional richness, and contextual richness of socio-political and historical aspects that influence differences in cross-cultural interaction.

As a whole, this materials and methods section incorporates a multi-dimensional analysis using information from several different sources, including governmental policy level data, educational research studies, published literature, and other informational sources. By merging all of this information together it is anticipated that we can have a comprehensive method to investigate how AI can assist in the development of cross-cultural competence in Germany and Europe while also helping to identify some of the issues and difficulties that may arise as a result of these new types of educational technologies.

Germany has played a leading role in conceptualizing, measuring, and pedagogically supporting intercultural competence, and such expertise will underpin a sound theoretical basis from which to understand how AI can be integrated into intercultural education. German national strategies for artificial intelligence underline not only technological innovation but also ethical principles, transparency, inclusiveness, and teacher readiness [16]. The Kultusministerkonferenz points out in its framework “Bildung in der digitalen Welt” that the successful integration of AI in education is based on structured methodical design and further training of educators, which in particular is relevant when AI is used for intercultural learning contexts[17].

One of the leading German contributions is the creation of Cult-Euro-1, a standardized and empirically verified test designed at the Osnabrück University of Applied Sciences under the guidance of P. Genkova. Cult-Euro-1 makes a distinction between general intercultural competence and Germany-specific intercultural competence, thus enabling researchers to observe changes in students' attitudes, motivations, and behavioral strategies during international or digitally supported learning programs. This instrument provides a methodological basis for assessing whether AI-supported tasks effectively enhance core dimensions of intercultural competence[18].

The German academic tradition offers many valuable concepts related to intercultural communication through the research of A. Thomas and his colleagues, as outlined in the Handbook of Intercultural Communication and Cooperation [19]. The authors of these publications provide the reader with comprehensive theoretical models and practice-based approaches to developing skills in empathy, tolerance for ambiguity, and reflective communication, which have become increasingly common as guidelines when developing hybrid or AI-based learning environments. In addition to developing these materials, these authors also encourage that rather than replacing the human interaction present in



traditional classrooms, the AI-based learning environments should serve as supportive tools to promote structured reflection and guided learning.

Another example of practice-focused innovation is the development of an intercultural chatbot called TOPOI GPT by the Diversity and Innovation Academy in partnership with scholars Sh. Ruppert and A. Verdooren. The TOPOI model as developed by Hoffmann and Verdooren (Diversity Competence: Cultures Do Not Meet, But People Do) served as the foundational platform for developing TOPOI GPT. The main focus of the chatbot is to facilitate the learner's analysis of the intercultural misunderstanding within the five areas of language, organization, pattern, interest and assumptions. Unlike many existing "cultural expert" chatbots, TOPOI GPT is designed to encourage the learners to question their own assumptions, reflect on their own interpretations and consider other options for action. This way, TOPOI GPT transforms AI technology into an educational instrument to support learners in developing their intercultural self-reflection.

Results

The examination of educational systems in relation to the use of AI technology in the creation and development of CCCs has produced numerous conclusions. Overall, the investigation of educational institutions in Germany and Europe demonstrates that AI-enabled learning tools facilitate the delivery of intercultural learning experiences with a high level of personalization, immersion, and multilingual resources; however, the disadvantages posed by these technologies include limited depth of culture, the potential for bias, and inadequate preparation for pedagogical practice.

The use of AI-enabled language acquisition platforms by educational institutions in both Germany and Europe has presented clear advantages regarding the capability of these systems to provide students with highly personalised and contextualised cultural content. The AI-driven design for language acquisition platforms allows students to receive tailored explanations of culturally-specific idioms, conversations, and communication strategies, as determined by their individual experiences and academic pursuits. By providing culturally-specific explanations that take into account both language and learning backgrounds, these platforms have greatly improved students' understanding of the cultural nuances and complexities associated with the communication of meaning.

Enhanced Immersive Exposure using VR/AR Technologies

VR/AR simulations employed in German universities provided students with realistic exposure to multicultural settings, such as professional negotiations, academic teamwork, and informal social exchanges. Students reported higher engagement and confidence when interacting in culturally diverse scenarios, and instructors noted improved application of CCC elements such as empathy, turn-taking, politeness, and conflict resolution strategies.

AI-powered translation and transcription tools, such as DeepL and real-time speech recognition, significantly enhance multilingual communication in Erasmus+ Virtual Exchange programs. Students from different linguistic backgrounds were able to participate more actively, reducing communication barriers and increasing the equity of interaction.

The instructors, meanwhile, received detailed insights on students' intercultural advances through learning analytics systems that monitored interaction patterns, emotional tone, politeness norms, and effective communication. The automated feedback tools brought a noticeable improvement in the application of the students' communicative strategies according to cultural expectations.

The analysis of the German contributions shows that AI integrated into intercultural training is most effective if linked to validated assessment tools and theoretically founded models. The review of the applications of Cult-Euro-1 in German higher education reveals that students who take part in internationalized and AI-supported learning environments tend to show measurable gains with regard to increases in empathy, ambiguity tolerance, and culturally adaptive communication strategies. Similarly, TOPOI-based chatbot experiments also show that AI has the potential to support reflective thinking by stimulating learners to analyze the linguistic, organizational, and perceptual dimensions of intercultural misunderstandings. Overall, it would appear that AI-mediated tasks, when methodologically framed, have the potential to support key elements of intercultural competence rather than merely reproducing scripted patterns of communicative behavior.

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Most importantly, however, the comparative research of AI-supported learning formats at European and German institutions also yields the following conclusion: pedagogical task design is the key to substantial learning outcomes. Programs using AI-generated scenarios within a teacher-led reflective framework, case-based discussion, and standardized diagnostics (such as Cult-Euro-1) evidenced better students' degree of engagement and deeper cultural insight compared with programs offered strictly through automated interaction. Data thus support the idea that AI helps best not as a replacement for, but as an augmenting agent to reinforce meta-cognitive awareness in support of culturally sensitive communicational skill development. The results thus underline the potential of combining German methodological traditions with AI-driven formats in the development of robust, ethically aligned models for intercultural competence development.

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Despite these significant advantages, however, the results also yield a number of important limitations in AI integration into intercultural education. One of the most consistent issues is cultural bias in AI data, which often leads to oversimplification or stereotyping of certain cultural behaviors. This limitation connects with another constraint from the review: the lack of emotional nuance within AI-generated interactions. AI tools can mimic much of the patterns and structures of communication; what they have not yet succeeded in doing too well is capturing deeper levels of cultural life, like subtle emotional connotations, historical sensitivities, and contextual meanings embodied in authentic intercultural understanding. Besides this, the research points out the challenge of teacher readiness in Germany and the wider European Union. Many teachers are still not sufficiently equipped with AI literacy or training to adequately implement the tools within their pedagogical practice, further diminishing the overall impact of the AI-mediated intercultural learning. Finally, the results point to the fact that students may develop overdependence on automated feedback, becoming overly reliant on algorithmic suggestions rather than engaging in reflective human-mediated intercultural dialogue. This risk in overdependence reduces the depth of learning and limits the acquisition of critical thinking and self-awareness-skills so crucial for genuine cross-cultural competencies.

Table 1. Summary of AI Tools and Their Impact on Cross-Cultural Competence

AI Tool / Technology	Observed Benefits	Identified Limitations
Adaptive language-learning systems	Personalized cultural content; improved intercultural pragmatics	Risk of over-reliance; limited cultural depth
VR/AR intercultural simulations	High immersion; realistic cultural scenarios; increased empathy	Difficulty replicating emotional nuance; resource-intensive
AI-supported Virtual Exchange	Enhanced multilingual interaction; real-time support; increased participation	Algorithmic bias in tone/politeness interpretation
AI-powered translation tools	Reduced language barriers; increased inclusivity	Inaccuracies in culturally specific expressions
Learning analytics & automated feedback	Detailed tracking of CCC progress; personalized improvement suggestions	Potential privacy concerns; limited contextual understanding
Intelligent cultural chatbots	Safe environment for practicing intercultural communication	Stereotyped responses due to training data limitations



Discussion

The findings of the present study confirm that AI is transforming cross-cultural competence development across Germany and the wider European space in meaningful ways. This, in turn, offers innovative pedagogical pathways toward students' intercultural awareness, sensitivity, and communicative adaptation within AI-driven personalization, immersive VR/AR simulations, multilingual communication tools, and data-driven feedback systems. These results are echoed in current European educational policy priorities, especially the EU's focus on digital inclusion and multilingualism, confirming that AI-powered settings can offer even more inclusive and culturally sensitive learning opportunities.

But the research also reveals that the potential of AI to develop cross-cultural competence depends significantly on pedagogical conditions under which these technologies are used. It is in the context of a more general human-centered instructional approach, one that involves reflection, dialogue, and direct experience, that AI technologies prove genuinely helpful. This is consistent with the theoretical premises presented in Kunanybayeva, who has stressed the dynamic and interactive nature of intercultural communicative competence. These principles can be supported and enhanced by AI tools through adaptive cultural scenarios and interactive models of communication, but they cannot replace the depth of cultural contact provided by a human agent.

Furthermore, such limitations as cultural bias, inadequate teacher preparation for the complexities of AI, and the limited emotional nuance of AI interactions themselves point toward the need for critical digital literacy on both the side of educators and learners. These limitations indicate that AI is best thought of as an ancillary pedagogical tool, rather than a pedagogy in and of itself. While AI might provide access to multilingual and multicultural experiences, the authenticity and ethical sensitivity necessary for profound cross-cultural understanding still require human judgment, contextual interpretation, and reflective practice. As European universities continue to scale up their AI infrastructures, policy, training, and ethical frameworks designed to address these limitations will be crucial to ensuring maximum pedagogical value from AI-mediated intercultural learning.

Conclusion

This research study identifies an outstanding opportunity for the use of AI technology to improve the cross-cultural competence of students who are involved in the German and European education systems. Almost all AI-based tools are capable of providing students with personalized learning experiences based on their individual needs and preferences, such as the ability to work collaboratively with others online in real-time, and the use of multiple languages through machine translation applications. AI will allow students to better manage the many challenges they face while attending school in multicultural environments by providing them with an increased level of self-assurance, empathic understanding, and communication skills.

However, the study also highlights that the contributions of AI to cross-cultural education have not been the same for all students, nor have they occurred across all aspects of instruction. Cultural stereotypes, a lack of emotional intelligence in AI systems, and a lack of readiness for teachers are all factors that inhibit the full use of the potential advantages of AI in instructional settings. As such, the integration of AI in instructional practices should occur as part of a well-balanced instructional model that respects technological innovation as an important and beneficial component of the learning process, while still recognizing the importance of teacher-student interaction, cultural relevance, and reflective practice in the learning experience.

Furthermore, the findings of this study highlight the importance of aligning AI-driven educational initiatives with broader socio-cultural goals within European higher education. As universities increasingly internationalize their academic environments, AI can serve as a catalyst for fostering intercultural dialogue, mobility, and collaboration. However, the successful adoption of AI hinges on institutional readiness, including clear ethical guidelines, sustainable digital infrastructure, and ongoing professional development for educators. Without these foundational supports, even the most advanced AI tools may underperform or inadvertently reinforce existing cultural inequalities. Thus, the future of AI-enhanced intercultural education depends not only on technological progress but also on institutional commitment to inclusivity and culturally responsive teaching.

The study also emphasizes the need for continued empirical research to better understand long-term outcomes of AI-assisted intercultural learning. While initial results are promising, there remains a need to investigate whether AI-driven interactions lead to lasting improvements in cultural sensitivity, critical thinking, and real-world communicative competence. Future research should explore longitudinal impacts, student perceptions, and comparative outcomes between AI-mediated and traditional intercultural learning methods. Such research would provide valuable insights for policymakers, educators, and



technology developers seeking to design AI systems that genuinely enrich intercultural understanding. By advancing this line of inquiry, educational institutions can ensure that AI not only complements existing pedagogical frameworks but also contributes meaningfully to shaping an equitable and culturally diverse learning ecosystem.

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Бусыгина А.Л.

ВОЗМОЖНОСТИ И ОГРАНИЧЕНИЯ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА В РАЗВИТИИ МЕЖКУЛЬТУРНОЙ КОМПЕТЕНТНОСТИ СТУДЕНТОВ

Аннотация. Искусственный интеллект (ИИ) стремительно становится ключевым компонентом образовательной трансформации по всему миру, включая Европу. Его интеграция в процессы обучения и преподавания открывает новые возможности для формирования



межкультурной компетенции (МКК) студентов, что является важнейшим навыком в многонациональной и глобализированной среде. В данной статье рассматриваются возможности и ограничения применения ИИ для развития МКК, с акцентом на Германию и Европейский Союз. Также проводится сопоставление современных европейских исследований с концептуальными идеями казахстанского ученого С. Кунанбаевой, чьи труды по межкультурной коммуникации служат теоретической основой для понимания процессов формирования компетенций в многоязычном контексте.

В статье обобщаются результаты исследований за 2015–2024 годы, показывающие, как ИИ-платформы, виртуальный обмен, персонализированное обучение и иммерсивные технологии способствуют развитию культурной осведомленности студентов и коммуникативных навыков, а также обозначаются этические, педагогические и технологические вызовы.

Ключевые слова: искусственный интеллект, межкультурная компетенция, Германия, Европа, межкультурная коммуникация, образовательные технологии, персонализация.

Бусыгина А.Л.

СТУДЕНТТЕРДІҢ КРОССМӘДЕНИ ҚҰЗЫРЕТТІЛІГІН ДАМЫТУДАҒЫ ЖАСАНДЫ ИНТЕЛЛЕКТТІҢ МҮМКІНДІКТЕРІ МЕН ШЕКТЕУЛЕРІ

Аннотация. Жасанды интеллект (ЖИ) бүгінгі таңда Еуропаны қоса алғанда, бүкіл әлемдегі білім беру трансформациясының негізгі компонентіне айналып отыр. Оның оқыту мен білім беру үдерісіне енгізілуі студенттердің кроссмәдени құзыреттілігін (КМК) дамытуға жаңа мүмкіндіктер ашады, бұл — көпұлтты және жаһанданған ортадағы аса маңызды дағды. Бұл мақалада ЖИ-дің КМК-ны қалыптастырудағы мүмкіндіктері мен шектеулері қарастырылады, сонымен қатар Германия мен Еуропалық Одақ тәжірибесіне ерекше назар аударылады.

Мақалада еуропалық соңғы зерттеулер мен қазақстандық ғалым С. Кунанбаеваның интеркультуралық коммуникация жөніндегі теориялық тұжырымдары салыстырылып, көптілді ортада құзыреттілікті дамыту үдерісін түсінуге негіз беретін ғылыми байланыстар ашылады.

2015–2024 жылдар аралығындағы зерттеулер негізінде ЖИ-платформалардың, виртуалды алмасудың, деректерге негізделген жекелендірілген оқытудың және иммерсивті технологиялардың студенттердің мәдени сауаттылығын және өзара әрекеттесу дағдыларын дамытудағы рөлі айқындалып, этикалық, педагогикалық және технологиялық мәселелер талданады.

Кілт сөздер: жасанды интеллект, кроссмәдени құзыреттілік, Германия, Еуропа, интеркультуралық коммуникация, білім беру технологиялары, жекелендіру.