

Enhancing Intercultural Competence through Virtual Reality and Artificial Intelligence: A Mixed-Method Study in an Indonesian Private University EFL Classroom



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KEY WORDS	ABSTRACT
Artificial intelligence; EFL; Intercultural competence; Mixed-method; Virtual reality	In today's globalized world, intercultural competence (IC) has become a critical skill in English as a Foreign Language (EFL) education. This study explores how the integration of Virtual Reality (VR) and Artificial Intelligence (AI) can enhance IC among undergraduate EFL students at Universitas PGRI Delta in Sidoarjo. The objective is to examine the extent to which immersive technologies foster students' awareness of cultural norms, empathy, and effective communication across cultures. A mixed-method approach was employed, involving 30 students who participated in VR-based simulations and AI-assisted language tasks. Data were collected through pre-test and post-tests, classroom observations, and student reflections. Findings indicate significant improvements in both cognitive and affective dimensions of IC. Students reported increased motivation, reduced bias, and more thoughtful language use when interacting in culturally diverse scenarios. However, access to technology and digital literacy emerged as challenges, particularly in rural settings. The study concludes that VR and AI can be powerful tools for developing intercultural sensitivity in EFL classrooms when supported by teacher mediation and contextualized content.

1. INTRODUCTION

Several years ago, while observing an online intercultural discussion between Indonesian university students and their Japanese peers, I witnessed a revealing moment: despite possessing adequate English language skills, many Indonesian participants hesitated when responding to comments that carried cultural nuance. Their silence was not due to linguistic deficiency, but rather a lack of familiarity with the social and cultural contexts embedded in the communication. This observation reflects a broader challenge in English as a Foreign Language (EFL) education, namely that mastering grammatical structures and vocabulary does not automatically prepare

learners to navigate the complexities of intercultural communication.

This issue has become increasingly relevant in today's globalized world, where EFL learners are no longer expected to simply use English correctly, but to use it appropriately across diverse cultural settings. Intercultural competence (IC), defined by Byram (1997) as the ability to communicate effectively and appropriately with people of other cultures, involves not only knowledge and language skills, but also attitudes of openness, empathy, and critical awareness. Deardorff (2006) further emphasizes that IC is an evolving process, deeply tied to reflection and experience. Yet, conventional language instruction, particularly in many Southeast Asian contexts, continues to

rely heavily on decontextualized materials, offering limited opportunities for students to engage meaningfully with cultural differences.

Recent innovations in educational technology offer promising alternatives to address this pedagogical gap. Virtual Reality (VR) can immerse learners in simulated cultural environments, allowing them to experience everyday practices, gestures, and interpersonal dynamics as if they were physically present. Artificial Intelligence (AI), through chatbots and adaptive writing tools, enables students to engage in intercultural dialogues, receive feedback in real-time, and adjust their communication styles accordingly. These tools hold the potential to transform EFL classrooms into dynamic spaces for intercultural exploration and empathy-building (Godwin-Jones, 2020).

Despite their global momentum, the integration of VR and AI into language education remains under-researched in the Indonesian context. Studies such as Soepriyanti et al. in 2022 and Setyadi, Pawirosumarto, and Damaris in 2025 have identified digital literacy and teacher adaptability as key concerns in Indonesian higher education. However, few have examined how immersive technologies can be harnessed specifically to foster intercultural competence. This absence represents a critical gap, particularly as Indonesian students increasingly interact in regional and global spheres.

This study seeks to address that gap by investigating how VR and AI can be strategically implemented to support the development of intercultural competence in an Indonesian private university EFL classroom. It explores two central research questions: (1) How do students perceive and engage with intercultural experiences mediated by VR and AI? (2) In what ways do these technologies influence students' intercultural awareness, empathy, and communication behaviors?

By positioning immersive technologies within an intercultural pedagogical framework, this

research contributes to the growing conversation about how EFL instruction can evolve beyond linguistic transmission and toward intercultural transformation as a shift that is particularly vital in multicultural societies such as Indonesia.

Intercultural Competence in EFL Education

Intercultural competence (IC) is a crucial skill in English as a Foreign Language (EFL) education, particularly in preparing students for effective communication in culturally diverse environments. According to Byram (1997), IC involves five key components: openness and curiosity (*savoir être*), knowledge of social practices and cultural products (*savoirs*), skills of interpreting and relating (*savoir comprendre*), skills of discovery and interaction (*savoir apprendre/faire*), and critical cultural awareness (*savoir s'engager*). These dimensions form a comprehensive framework that supports not only language proficiency but also cultural sensitivity. In the Indonesian context, IC has been linked to increased learner engagement and identity negotiation in globalized communication settings (Mulyadi & Puspita, 2021).

Virtual Reality and Intercultural Learning

Virtual Reality (VR) offers immersive environments where learners can experience different cultural scenarios beyond the limitations of traditional classrooms. Lindgren and Johnson-Glenberg (2013) emphasize that embodied learning through VR enhances conceptual understanding and learner motivation. VR facilitates situated learning by placing users in culturally rich simulations, fostering perspective-taking and empathy. A study by Herrera et al. (2018) found that VR-based perspective-taking significantly reduced stereotyping and increased intercultural

sensitivity among university students. These affordances make VR a promising tool for developing IC in EFL learners.

AI-Assisted Language Learning

Artificial Intelligence (AI) has become increasingly relevant in EFL instruction through tools such as intelligent chatbots, AI writing assistants, and adaptive learning platforms. Guo & Wang (2023) demonstrated that AI-driven feedback systems improve students' argumentative writing and raise cultural awareness by contextualizing language use. Similarly, Wei et al. (2023) reported that AI-supported language instruction promotes learner autonomy, motivation, and sociocultural understanding. These technologies not only support linguistic development but also provide space for culturally appropriate communication training, an aspect essential to building IC.

The Indonesian Context

In Indonesia, the integration of educational technology in higher education continues to grow but remains uneven. Ongoing challenges such as disparities in digital access, infrastructure, and digital literacy between urban and rural institutions (Soepriyanti et al., 2022; Harjanto, 2020). Despite these challenges, efforts to blend local cultural values with digital learning are beginning to gain traction. Harjanto (2020) noted that Indonesian EFL teachers show growing interest in incorporating digital tools, although practical constraints often hinder their full implementation. Although some initiatives have explored culturally responsive pedagogy or digital learning innovations, few empirical studies have examined the specific impact of immersive technologies like VR and AI on developing IC among Indonesian EFL learners. This gap highlights the need for context-specific

research that investigates how these tools shape students' intercultural engagement in real classroom settings.

2. METHOD

Research Design

This study adopted a convergent parallel mixed-methods design (Creswell & Plano Clark, 2018) to explore how the integration of Virtual Reality (VR) and Artificial Intelligence (AI) technologies influences the development of intercultural competence (IC) among EFL learners. The rationale behind this methodological choice lies in the complex nature of IC, which involves not only measurable attitudinal and behavioral changes but also internal, subjective processes such as empathy, reflection, and cultural awareness. By collecting both quantitative and qualitative data simultaneously and analyzing them independently before integration, the design enabled a balanced interpretation of how students responded to the pedagogical use of immersive technologies. This approach was considered appropriate given the dual aims of the study: to assess the effectiveness of the intervention and to capture the nuanced experiences of learners throughout the process.

Research Setting and Participants

The research was conducted at a private university in East Java, Indonesia, where English is a compulsory subject for undergraduate students across disciplines. The setting was chosen not only for its accessibility but also because it reflects a typical urban Indonesian higher education context where digital infrastructure is sufficiently available but intercultural exposure remains limited. The participants consisted of 30 undergraduate students enrolled in an intermediate-level EFL course that had been modified to include a six-week technology-enhanced intercultural learning module. Purposive sampling was used to ensure diversity in gender, academic discipline, and previous experience with educational technology. This sampling strategy

was justified by the need to capture varied learner profiles, which may influence how individuals engage with and benefit from VR and AI tools in language learning.

Instruments and Data Collection

To generate a holistic understanding of student development, both quantitative and qualitative instruments were employed. Quantitative data were collected through the Intercultural Sensitivity Scale (ISS) developed by Chen and Starosta (2000). This instrument was chosen for its strong theoretical grounding and proven validity in measuring IC across five dimensions: interaction engagement, respect for cultural differences, interaction confidence, interaction enjoyment, and interaction attentiveness. Administering the scale before and after the intervention allowed the researcher to detect any statistically significant changes in students' IC levels, thereby providing evidence of the impact of the instructional strategies used.

In parallel, qualitative data were gathered using reflective journals and semi-structured interviews. The use of reflective journals was based on the pedagogical premise that reflection fosters critical thinking and deeper learning, particularly in contexts involving cultural complexity (Byram, 1997). Throughout the six-week intervention, students submitted weekly journals in which they described their emotional responses, cultural insights, and the challenges they faced while using VR and AI tools. These journals functioned not only as a data source but also as a learning tool that encouraged continuous self-evaluation.

To complement the journals and provide more in-depth, personal perspectives, semi-structured interviews were conducted with ten students at the end of the program. These interviews explored students' views on cultural encounters, their experience with the technological tools, and their self-perceived growth in intercultural competence. The semi-structured format allowed for a guided yet flexible conversation, making it possible to

probe into students' thought processes and meaning-making which are the aspects crucial for understanding intercultural learning that often escape quantification.

Intervention Procedures

The instructional intervention lasted for six weeks and was embedded into the regular curriculum of the EFL course. Each week, students participated in VR-based intercultural simulations using the ClassVR platform, which enabled them to explore diverse cultural settings such as local markets, public events, traditional ceremonies, and everyday life scenarios in various countries. These virtual environments were carefully selected to expose students to cultural practices and values that are often underrepresented in traditional EFL materials.

Alongside the VR activities, students engaged in AI-assisted writing tasks designed to cultivate cultural awareness through language production. They used tools like Grammarly and ChatGPT to write reflections, cross-cultural messages, and dialogues based on the cultural themes explored in the VR sessions. The use of AI tools was not only meant to support linguistic accuracy but also to introduce learners to adaptive communication models. Weekly class discussions and teacher-guided debriefings were held to ensure that students could critically reflect on their virtual experiences and connect them to broader intercultural concepts. This integrated approach reflects the belief that language and culture are inseparable in meaningful EFL instruction (Kramsch, 1993).

Data Analysis

The quantitative data collected from the ISS were analyzed using paired-sample t-tests via SPSS software to determine whether significant changes occurred in students' intercultural sensitivity after the intervention. The decision to use t-tests was based on the assumption that the pre-test and post-test scores were related

samples and normally distributed a standard approach in experimental EFL studies.

For the qualitative data, a thematic analysis was conducted following the six-phase procedure outlined by Braun and Clarke (2006). This process involved familiarization with the data, initial coding, theme development, review, definition, and final reporting. The analysis aimed to identify recurring patterns and deeper meanings across the reflective journals and interview transcripts. To enhance the credibility of the findings, investigator triangulation was used during the coding process, and member checking was conducted by asking interview participants to confirm the accuracy of interpreted themes. These steps were taken to ensure that the findings genuinely reflected students' experiences and were not merely filtered through the researcher's perspective.

Ethical Considerations

Ethical clearance for this study was obtained from the university's research ethics committee. All participants received a clear explanation of the research objectives, procedures, and their rights, including the right to withdraw at any time without penalty. Informed consent was collected in writing prior to data collection. Anonymity and confidentiality were strictly maintained throughout the study to protect participants' identities and responses. These measures were implemented to uphold the ethical principles of respect, beneficence, and justice in educational research (Cohen, Manion, & Morrison, 2018).

3. RESULT AND DISCUSSION

This section presents the findings of the study based on quantitative and qualitative data collected to investigate the impact of Virtual Reality (VR) and Artificial Intelligence (AI) on the development of intercultural competence (IC) among Indonesian EFL students. The results are organized into two parts: (1) the statistical outcomes from the pre-test and post-tests using the Intercultural Sensitivity Scale (ISS), and (2) the emergent themes derived from students' reflective journals and semi-structured interviews.

Quantitative Findings

The Intercultural Sensitivity Scale (ISS) was administered to 30 students before and after a six-week intervention integrating VR and AI into EFL instruction. Descriptive statistics revealed a consistent upward trend across all five dimensions of the ISS. A paired-sample t-test indicated a statistically significant improvement in overall intercultural sensitivity scores, $t(29) = 5.21, p < .01$. Notably, the most significant gains were observed in the dimensions of interaction confidence and respect for cultural differences. On average, students' self-reported confidence in engaging with culturally diverse individuals increased from a mean score of 3.41 (SD = 0.56) in the pre-test to 4.12 (SD = 0.49) in the post-test. Likewise, their respect for cultural differences rose from 3.67 (SD = 0.52) to 4.28 (SD = 0.43). Although smaller, positive shifts were also recorded in interaction enjoyment, engagement, and attentiveness.

Table 1. Pre-Test and Post-Test Mean Scores on the Intercultural Sensitivity Scale (ISS)

ISS Dimension	Pre-Test (SD)	Mean Post-Test Mean (SD)
Interaction Confidence	3.41 (0.56)	4.12 (0.49)
Respect for Cultural Differences	3.67 (0.52)	4.28 (0.43)
Interaction Engagement	3.52 (0.48)	3.88 (0.47)



Interaction Enjoyment	3.45 (0.50)	3.93 (0.45)
Interaction Attentiveness	3.39 (0.55)	3.87 (0.46)

Note: Scores are based on students' responses (N = 30) to the Intercultural Sensitivity Scale (ISS) before and after a six-week intervention involving VR and AI integration.

These quantitative results suggest that students became more self-assured and open in navigating cultural contexts by the end of the program. The statistically significant differences provide initial empirical evidence that immersive learning technologies, when strategically integrated, can contribute to measurable intercultural growth in a relatively short instructional period.

Qualitative Findings

To complement and contextualize the statistical trends, thematic analysis was conducted on students' weekly reflective journals and end-of-program interviews. The analysis yielded three recurring themes that reflect learners' experiences and cognitive-affective shifts during the intervention:

Increased Cultural Awareness

Students frequently described moments of realization regarding cultural norms, nonverbal gestures, and everyday practices that were noticeably different from their own cultural experiences. These realizations often emerged during VR simulations that exposed them to culturally situated interactions. A number of students remarked that the immersive experience allowed them to "see and feel" aspects of culture that would otherwise be abstract or theoretical in a traditional classroom.

One student, reflecting on a virtual tour of a Korean street market, wrote:

"In the Korean market scene, I noticed that people bow slightly even during small

conversations or when receiving change. I didn't expect that, and it made me think how respect is expressed in different ways. It's not something I read in my textbook, but I saw it clearly here." (Reflective Journal, Week 2)

Another student commented on the importance of how silence was used during a virtual Japanese tea ceremony:

"At first, I thought the ceremony was too quiet, almost awkward. But then I realized that the silence meant respect. It's not empty. It's meaningful. That changed how I look at politeness." (Reflective Journal, Week 4)

Such reflections demonstrate an increasing awareness of subtle cultural practices, particularly nonverbal communication and symbolic behaviors. This kind of attentiveness often goes unnoticed in conventional instruction but becomes more salient when learners are immersed in rich cultural contexts. The qualitative data suggest that the VR environment enabled students to go beyond a surface-level understanding of culture and begin to internalize the social logic embedded in everyday interactions.

Development of Empathy

Empathy defined as the ability to understand and share the feelings of others emerged as a prominent theme across students' reflections and interviews. Many participants expressed that the immersive VR scenarios and AI-mediated writing tasks helped them not only learn about cultural practices but also emotionally connect with people from different backgrounds. The sense of presence created by the VR environment, combined with the personalized and responsive nature of AI interactions, allowed students to engage in what some described as "real emotional moments."

One student, after experiencing a virtual family dinner in Cairo, wrote:

“When I saw the way a family in Egypt shared food, it reminded me of how my own family eats during Ramadan. Then it made me feel connected. I realized that even though we live far apart and have different traditions, the feeling of being together with family is the same.” (Reflective Journal, Week 3)

Another student reflected on an AI-simulated dialogue with a fictional exchange student from Mexico:

“The AI gave me feedback on how to respond politely when someone talks about personal topics. I used to think it was okay to just say anything, but now I know that being too direct might be rude in some cultures. It made me think more about people’s feelings, not just the words.” (Reflective Journal, Week 5)

These reflections illustrate how both VR and AI interactions fostered emotional resonance and ethical awareness, enabling students to step outside their cultural default and consider others’ perspectives more thoughtfully. In contrast to surface-level cultural knowledge, empathy signifies a deeper transformation as the one that affects not only how learners think, but how they relate to others. The evidence suggests that immersive and responsive technologies, when paired with guided reflection, have the potential to cultivate this dimension of intercultural competence in meaningful ways.

Critical Reflection on Stereotypes

A notable outcome of the intervention was the emergence of students’ awareness of their own preconceived notions about other cultures. Several learners reported that their previous assumptions were challenged, revised, or even dismantled after engaging with immersive cultural simulations and reflective writing. This critical process aligns with the affective-

cognitive dimensions of intercultural competence, where individuals begin to question automatic generalizations and develop more nuanced understandings of cultural diversity (Byram, 1997; Kramsch, 1993).

One student, reflecting on a VR experience of a traditional Japanese tea ceremony, wrote:

“I always thought Japanese people were very formal and serious all the time. But when I saw how they prepared tea with so much patience and care, I felt their warmth. It wasn’t about being cold and it was about respect and mindfulness. That changed my view.” (Reflective Journal, Week 4)

Another student shared a shift in perception after encountering a virtual simulation of a Nigerian village celebration:

“I used to think African cultures were all about dancing and noise. But when I watched the ritual and how they respect their elders, I realized how spiritual and structured their culture is. I was surprised by how wrong my impression was.” (Reflective Journal, Week 6)

Such reflections reveal a transformative moment where learners began to interrogate cultural stereotypes, not through lectures or reading, but through experience and guided introspection. These instances underscore the potential of immersive learning technologies to not only deliver content but to provoke cognitive dissonance as an essential step in intercultural development. Importantly, the structured opportunities for reflection allowed students to process these moments critically, rather than simply consume them passively.

The findings of this study provide empirical support for the growing body of research that underscores the importance of immersive and responsive technologies in developing intercultural competence (IC) in English as a

Foreign Language (EFL) contexts. Both the quantitative and qualitative results suggest that the integration of Virtual Reality (VR) and Artificial Intelligence (AI) into language learning can facilitate meaningful cultural encounters that extend beyond language proficiency and into the realm of attitudes, empathy, and reflection.

Immersive Technology and Intercultural Sensitivity

The statistically significant improvement in students' scores on the Intercultural Sensitivity Scale (ISS), particularly in the domains of interaction confidence and respect for cultural differences, aligns with previous findings by Ahn, Bailenson, & Park (2014), who reported that VR-based perspective-taking increased learners' empathy and cultural sensitivity. The ability of VR to situate learners within authentic cultural contexts such as markets, ceremonies, or family settings appears to support what Kramsch (1993) describes as "symbolic competence": the capacity to interpret and relate meaning across linguistic and cultural boundaries.

In the present study, students who initially expressed hesitation or discomfort with unfamiliar cultural practices reported greater ease and openness after participating in the VR simulations. This shift suggests that VR offers a type of experiential scaffolding, enabling learners to approach "the other" not as abstract difference, but as lived and humanized reality. The embodied, visual, and contextual nature of VR likely contributed to this development, providing what Lindgren and Johnson-Glenberg (2013) refer to as "embodied cognition" as a condition in which learning is enhanced through sensory immersion and spatial awareness.

AI and Culturally Adaptive Communication

Alongside VR, the use of AI-powered writing tools contributed to students' awareness of

cross-cultural pragmatics. Learners reported that AI feedback helped them adjust tone, politeness strategies, and formality levels in culturally themed writing tasks. This finding echoes Guo & Wang (2023), who found that AI can be more than a grammatical corrector. This can serve as a mediator for cultural appropriateness in written communication. When students use AI to compose messages to imagined intercultural interlocutors, they are prompted to consider how language use reflects deeper cultural values.

However, it is worth noting that the AI's contribution was most meaningful when paired with teacher mediation and reflective activities. Without guided interpretation, AI-generated suggestions might remain superficial or misunderstood. This highlights the importance of pedagogical intentionality as technology must not replace instruction but support it. In this case, the AI's value lay not just in what it corrected, but in what it provoked namely, students' reflection on why certain expressions are more appropriate in particular cultural contexts.

Transformative Reflection and the Role of Guided Debriefing

One of the most striking outcomes was the extent to which students challenged their own cultural stereotypes through reflection. Learners who entered the course with generalized assumptions about Japanese, Middle Eastern, or African cultures began to articulate more nuanced understandings by the end of the program. This process of unlearning and reconstructing belief systems is consistent with Byram's (1997) model of critical cultural awareness (*savoirs' engager*), which places emphasis not merely on knowledge, but on the ethical evaluation of one's own and others' cultures.

The role of guided debriefings and structured reflection was central to this process. As Deardorff (2006) emphasizes, the development of IC is not automatic, even in rich intercultural

environments. Learners need space, structure, and mentorship to process what they encounter. In this study, the journals and interviews functioned as mirrors through which students examined their emotional responses and internal shifts. Without these reflective components, the impact of the immersive technologies might have been limited to surface-level novelty.

Implications for EFL Pedagogy in Indonesia

In the Indonesian context where students often have limited access to direct intercultural experiences tools like VR and AI offer powerful possibilities to bridge geographic and cultural distances. Yet, as Suryani (2021) and Harjanto (2020) caution, the uneven integration of educational technology and digital literacy remains a challenge, especially outside urban universities. Therefore, the findings of this study should be seen not only as a demonstration of potential but as a call for contextual adaptation and capacity building.

For EFL educators, the message is clear: intercultural competence can and should be taught explicitly, not left to incidental development. Integrating technologies that support experiential and reflective learning alongside sustained teacher support can lead to profound growth in how learners engage with cultural differences. However, the implementation must be deliberate, inclusive, and culturally grounded.

4. CONCLUSION

This study set out to explore how the integration of Virtual Reality (VR) and Artificial Intelligence (AI) could enhance intercultural competence (IC) among Indonesian university EFL students. Through a convergent mixed-methods approach, it examined both measurable improvements in intercultural sensitivity and

the lived experiences of students engaging with immersive technologies.

The findings offer compelling evidence that, when implemented with pedagogical care, VR and AI can foster key components of IC, including increased cultural awareness, the development of empathy, and the ability to critically reflect on cultural assumptions. Quantitative results showed statistically significant gains in students' interaction confidence and respect for cultural differences. Meanwhile, qualitative data revealed moments of transformation in students' perceptions, where cultural stereotypes were re-evaluated and emotional resonance with diverse practices was established.

These outcomes align with theoretical models proposed by Byram (1997) and Deardorff (2006), affirming that intercultural learning is both cognitive and affective, and that reflection is essential to its development. The results also reinforce previous studies (e.g., Herrera et al., 2018; Guo et al., 2023) highlighting the role of immersive and adaptive technologies in cultivating perspective-taking and communicative sensitivity.

However, the study also underlines that technology alone is insufficient. Without teacher facilitation and structured reflection, students may engage with digital simulations only at a surface level. Therefore, the effectiveness of VR and AI lies not only in their novelty but in how they are pedagogically orchestrated to create meaningful intercultural encounters.

Suggestions

For EFL instructors, the integration of VR and AI should not be treated as peripheral or supplementary, but as core components of a structured intercultural curriculum. Teachers



are encouraged to frame these tools within pedagogical sequences that include pre-task orientations, guided interactions, and post-task reflections. This structure allows learners to engage with cultural content critically and meaningfully, rather than passively consuming simulations or relying solely on automated feedback. Continuous teacher facilitation remains key to transforming technological engagement into intercultural learning.

From the perspective of curriculum designers, there is a pressing need to embed intercultural objectives explicitly into English language syllabi. Rather than positioning culture as background information, designers should foster opportunities for students to experience culture through interactive, narrative-driven, and empathy-based digital activities. Digital platforms that simulate authentic communication across cultures should be used not only for language input, but also for cultivating reflection, agency, and intercultural responsiveness in learners.

For future researchers, this study opens pathways for further inquiry into the long-term effects of immersive technologies on intercultural competence. Future studies could explore how these tools impact learners at various proficiency levels and institutional settings across Indonesia. In particular, mixed-method and longitudinal designs could yield richer insights into how learners internalize intercultural values over time, and how technology mediates that process across different sociocultural backgrounds.

Finally, for policy makers and institutions, the findings emphasize the urgent need to bridge digital inequalities in education. Investments in accessible EdTech infrastructure, alongside professional development for instructors in

rural and under-resourced regions, are critical. With institutional support, VR and AI can democratize access to intercultural experiences—offering students, especially those with limited opportunities to travel abroad, the chance to engage with global perspectives from within their local classrooms.

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