Immersive Inclusivity: AI-Enhanced Virtual Reality for Language and Cultures Learning

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DOI: https://doi.org/10.71957/ma7h9872

Abstract

Virtual Reality (VR) has emerged as a transformative tool, offering significant potential to enhance inclusivity. This paper examines the integration of VR and Artificial Intelligence (AI) in language and cultures learning, focusing on its application in fostering an inclusive and immersive educational experience. It presents AI-driven VR scenarios that transform language learning into an inclusive, immersive experience. The Unity-based experience enabled real-time spoken interaction by combining OpenAI's Audio Transcriptions API (Whisper-1), the GPT-4o dialogue model, and AWS Polly for text-to-speech. A case study has been conducted with Spanish B2-level students who engaged in a VR job interview simulation within the Data Immersion Suite. This platform provided an interactive environment for students to practice real-world communication while receiving peer feedback. Given that higher-level language acquisition demands not only grammatical accuracy but also real-world communicative competence, VR offers a dynamic solution by simulating authentic interactions in a low-pressure setting. The combination of VR and AI created a customisable and accessible learning platform, accommodating varied learning paces and reducing social anxiety. The effectiveness of VR and AI as tools for inclusive, immersive learning is further supported by existing research indicating that multisensory engagement enhances retention (Shadiev et al., 2021). These pedagogical innovative sessions provide valuable insights for developing innovative and inclusive approaches aligning with contemporary pedagogical demands while increasing the appeal of our academic offerings in the context of CTP.

Introduction

This paper presents an innovative pedagogical approach that integrates Artificial Intelligence (AI) and Virtual Reality (VR) into the language learning classroom, with a specific emphasis on inclusivity, experiential engagement, and confidence-building. The initiative aims to revolutionise language acquisition by moving beyond static computer-assisted instruction toward dynamic, multimodal immersion. Language learners, particularly those with Individual Learning Support Plans (ILSPs)—personalised accommodations for students with specific learning needs—often face heightened pressure in conventional classroom settings where anxiety, self-consciousness, and performance-based assessment can hinder communication. The integration of VR into language education addresses these challenges by offering a low-stakes, gamified, and adaptive learning environment. The VR Spanish Session aligns with ongoing efforts to embed inclusive technologies into higher education, fostering neurodivergent accessibility and cross-cultural empathy. This immersive experience was developed for SPAN200, a second-year undergraduate module at Lancaster University focused on advancing listening and speaking skills in Spanish. Conducted at the end of the academic year, this lesson supported 29 students preparing for study abroad or seeking Spanish-language work placements with a scenario that simulated a job interview. This short paper outlines the pedagogical design of the VR Spanish Session, presents findings from this immersive learning experience, and reflects on its broader implications for inclusive, AI-enhanced language education.

Designing Immersive Pedagogies

This initiative draws on interdisciplinary research and pedagogical practice to rethink language learning through immersive technologies. Grounded in scholarship from educational technology and inclusive learning, the project explores how AI-enhanced VR can redefine student engagement and accessibility.

Notable precedents include Kaufhold and Steinert's (2023) work on haptic VR labs for visually impaired STEM learners, and Altın et al.'s (2025) review of VR interventions supporting social skills in children with autism. Freina and Ott (2015) stress the role of low-cost VR in democratising access in underserved areas, while Shadiev et al. (2021) demonstrate VR's potential in fostering cross-cultural empathy and emotional

intelligence. Together, these works signal a pedagogical shift: immersive technologies offer a means to reconfigure traditional learning boundaries and nurture diverse learner profiles. While these studies highlight the inclusive and affective potential of VR, many [1] limited by narrow disciplinary scope, short-term interventions, or lack of integration with adaptive AI feedback systems. In contrast, our initiative combines immersive VR with real-time AI-driven linguistic analysis and flipped learning design, aiming not only to reduce anxiety and enhance accessibility but also to embed sustained, reflective learning practices. By situating language acquisition within culturally embedded simulations and providing CEFR[2]-aligned feedback, our approach extends the inclusivity goals of earlier models while addressing their scalability and pedagogical depth. At Lancaster University, this scholarship informed the development of the VR Spanish Session, a collaborative project between language staff in the School of Global Affairs and the Innovation Team. The collaboration began over a year ago following a VR webinar, where initial contact was made with the Innovation team. Most of the design work took place online, with Raeesa leading the technical development and Alícia coordinating the language content. Additional input came from both Innovation and Language and Cultures colleagues throughout the scenario-building process. The initiative was deployed in three strategic phases: Scenario creation, material curation and immersive deployment.

The first phase of scenario creation involved the translation of learning objectives into culturally relevant simulations such as job interviews, restaurant interactions, and tourist office exchanges. These scenarios were co-designed by developers at the ISS Innovation team and Spanish-language specialists from the School of Global Affairs to ensure accessibility and progression across CEFR levels A1–C2. Each scenario included differentiated prompts and role conditions, allowing beginner learners to engage with foundational vocabulary while advanced students tackled nuanced, context-rich dialogue The immersive application was built in Unity, with learners conversing in-world with role-conditioned AI characters aligned to each scenario (e.g., recruiter, waiter, clerk). Prompts were crafted to reflect realistic dialogue and align with specific

[2] The Common European Framework of Reference for Languages is an international standard for describing language proficiency across six levels (A1–C2), used to assess and compare learners' skills in reading, writing, listening, and speaking.

linguistic goals, enabling students to engage with authentic communicative tasks (figure 1). Using OpenAI's Audio Transcriptions API (Whisper-1), the GPT-4o model, and AWS Polly, the system enabled real-time speech-to-text and text-to-speech, allowing for fluid conversation and adaptive feedback. Following each session, students received a **c**omprehensive AI-generated report that included: A full transcript of their interaction, CEFR-aligned analysis of grammar and vocabulary, sentiment analysis via AWS Comprehend, Scenario-specific feedback to support reflection and growth.

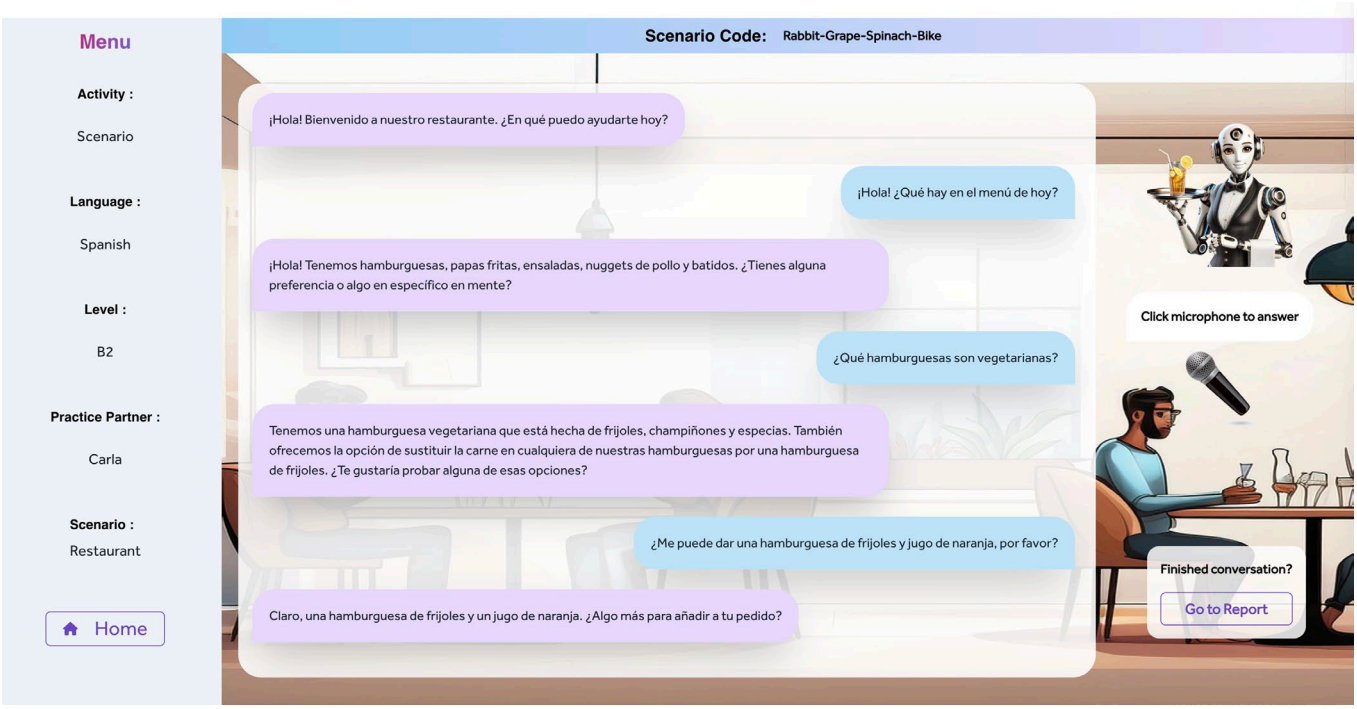

Figure 1. Online version of the restaurant scenario in Spanish

Once the scenarios were functional, supporting materials, including vocabulary and visual prompts, instructional videos, and peer-assessment checklists, were curated and distributed to students prior to the immersive session. Learners were also given access to a web-based version of the scenario, allowing them to rehearse interactions asynchronously and at their own pace. This approach reflects a flipped learning model, where foundational content is introduced before class, enabling students to engage more deeply during the live session through active, experiential learning. Flipped learning enhances student outcomes by shifting passive reception of information to active knowledge construction. It supports differentiated pacing, fosters autonomy, and allows classroom time to be used for higher-order tasks such as problem-solving and reflection. As Baig and Yadegaridehkordi (2023) note, flipped classrooms in higher education promote engagement, critical thinking, and self-directed learning by

leveraging pre-class digital resources and in-class collaborative activities. AI generated feedback was organised into the following components: (i) a scenario-performance report (task achievement and pragmatic appropriateness), (ii) a language-use report mapped to CEFR descriptors (figure 3), (iii) a full transcript of the interaction (figure 2), and (iv) sentiment analysis to support self-assessment (figure 3). In this context, the pre-session materials helped students build confidence and linguistic readiness, while post session peer assessment and AI-generated reports converted performance into CEFR-aligned, actionable next steps.

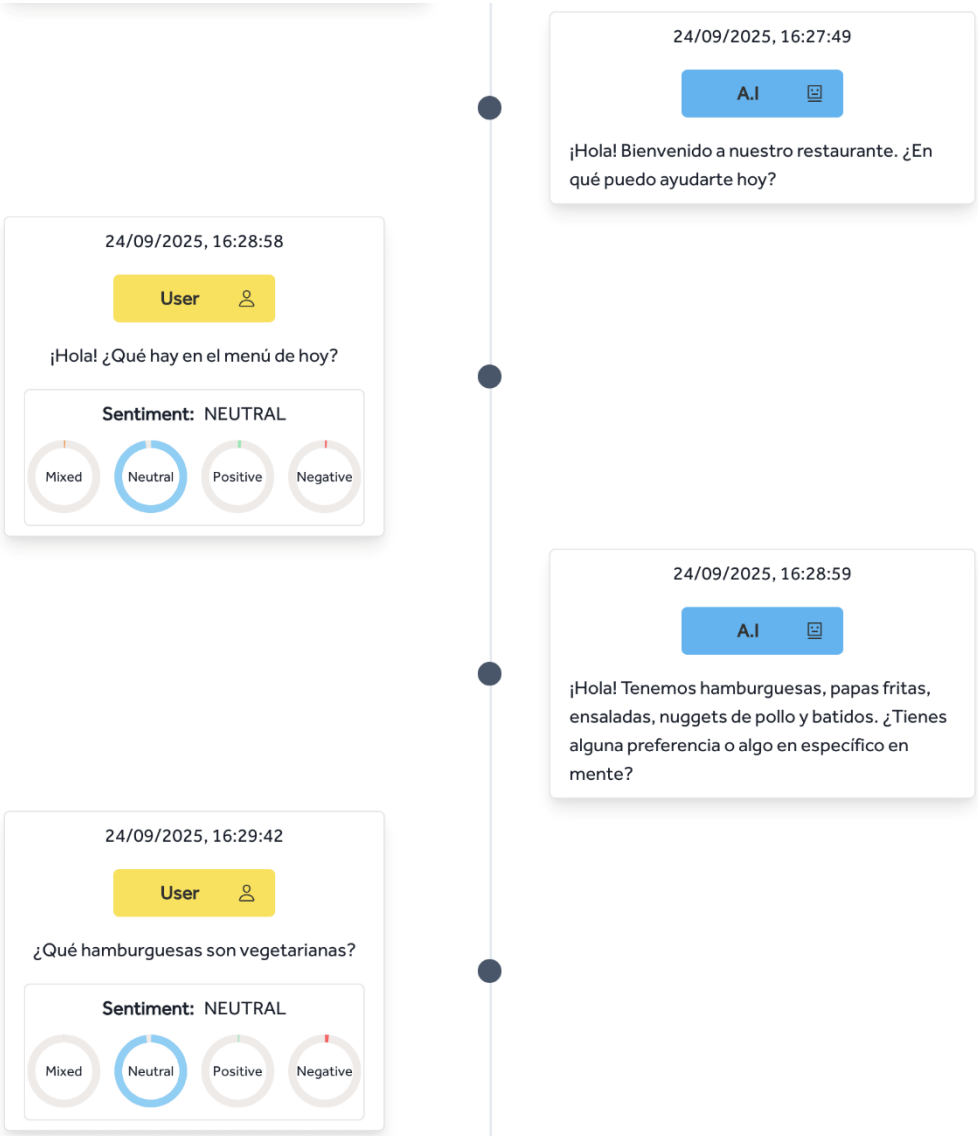

Figure 2. Transcript of the conversation with translation into English and sentiment analysis

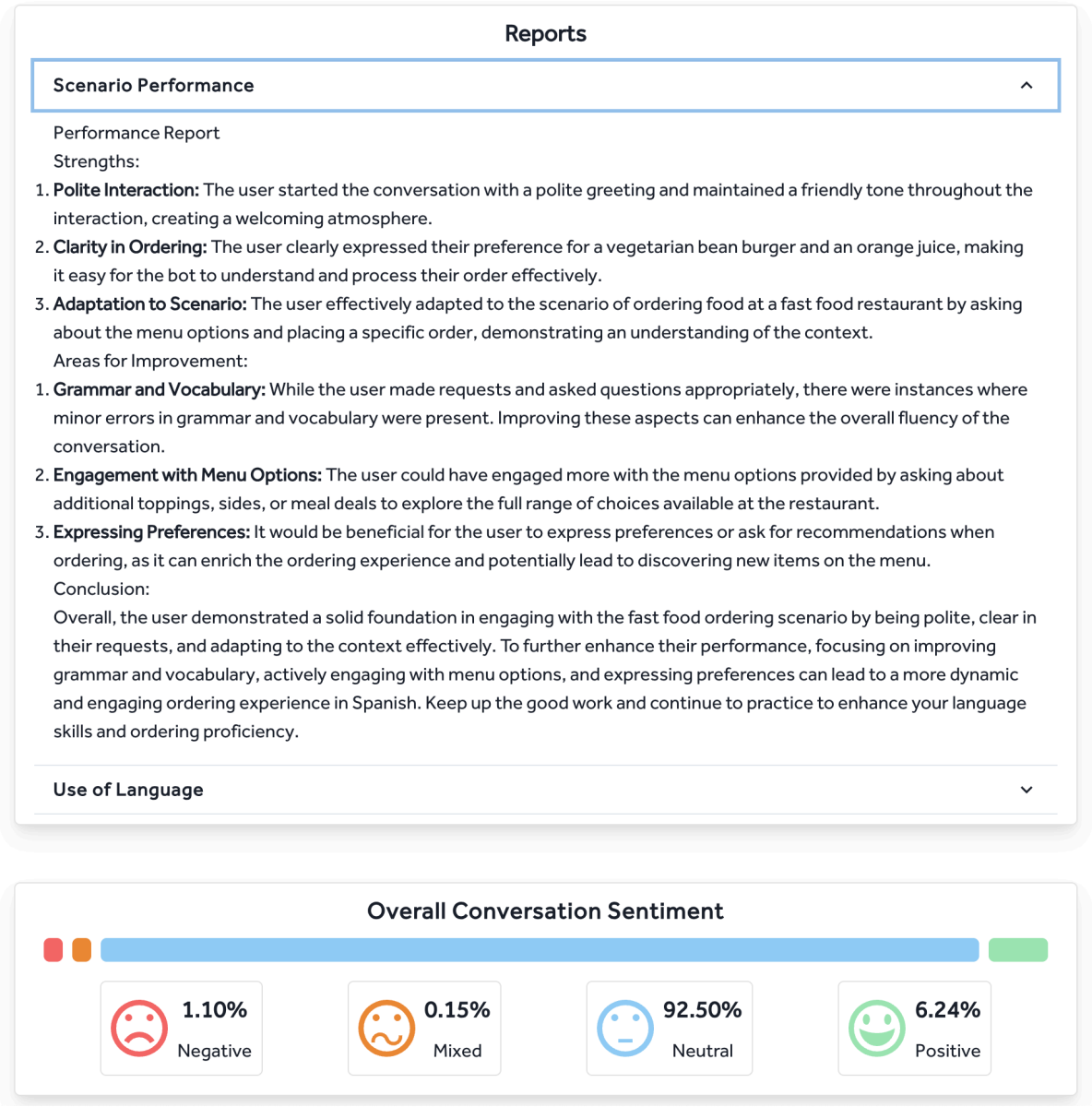

Figure 3. Sentiment analysis and reports

The third phase was the deployment of the immersive experience at the Lancaster's Data Immersion Suite, a state-of-the-art facility featuring a wraparound video wall, surround sound, and real-time data visualisation capabilities (Figure 4). Designed to simulate complex, life-like scenarios, the suite enabled students to engage in spoken interactions with AI-driven chatbot and enhanced the immersive experience.

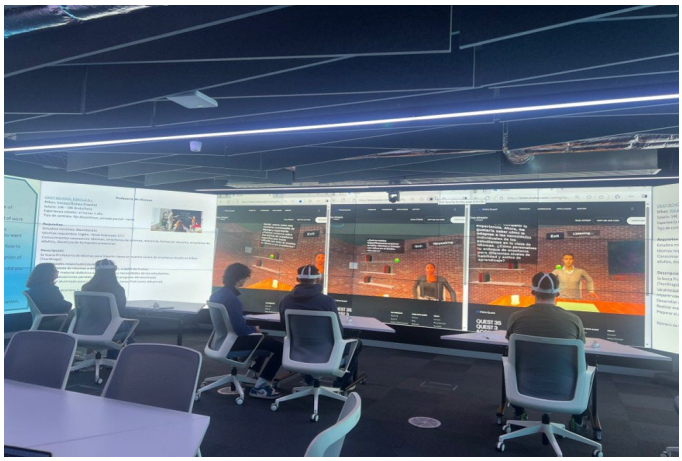

Figure 4. Immersive session in the data immersion suite

Student experience and Inclusive impact

Most of the cohort had prior experience using digital language tools like Duolingo. Some had previously used VR headsets, mainly for recreational gaming, though for many this was their first exposure to educational VR. Scenario design aligned with SPAN200's learning outcomes so that they could explore Spanish-speaking work culture, including formal linguistic registers such as *usted*, and domain-specific vocabulary. They were expected to respond to typical interview questions, refined nonverbal communication strategies, and structured personal introductions focused on skills and achievements. The AI interviewer would also introduce more challenging prompts, allowing students to develop resilience and improvisation. Learners also prepared culturally appropriate questions to ask at the end of the interview, strengthening conversational depth and engagement.

Students praised the sessions for reducing pressure, supporting autonomy, and enhancing motivation. Most reported feeling comfortable with the headset, and nobody experienced motion sickness, thus suggesting the format's accessibility across learner profiles and its adaptability to unfamiliar technological environments. Following these sessions, informal discussions with students and pedagogical evaluation of the module[3] revealed four main areas of strength:

- **Anxiety Reduction**: The VR setting provided a psychologically safe space to practice language, mitigating stress through simulated yet low-pressure interaction. Crucially,

[3] This initiative and discussions were conducted as part of routine pedagogical enhancement within a credit-bearing module. Student participation in feedback activities was voluntary and anonymous, and no identifiable or sensitive data were collected.

anxiety is known to exacerbate existing learning needs and physical disability conditions, often reducing learners' ability to perform at optimum levels. By lowering affective barriers, the immersive format enabled more equitable participation and improved performance across the cohort.

- **Personalised Feedback**: AI-generated reports offered CEFR-aligned linguistic analysis and tonal insights, supporting differentiated learning pathways and enabling students to reflect on their communicative style and progress.
- **Multisensory Engagement**: The integration of visual, auditory, and kinaesthetic modalities enhanced retention and cognitive processing, particularly benefiting students with diverse learning preferences or sensory profiles
- **Cultural Empathy**: Role-playing situated scenarios encouraged exploration of linguistic nuance and cross-cultural understanding, fostering deeper engagement with Spanish-speaking professional contexts.

The pedagogical design is particularly impactful for neurodivergent learners and those with sensory or motor impairments. By leveraging adaptive technologies and inclusive design principles, the initiative enabled equitable access to experiential learning. Students consistently reported that the immersive format accelerated their learning and increased their confidence in real-world communicative scenarios

In broader practice, this initiative aligns with Lancaster University's strategic commitment to embedding accessibility, employability, and innovation across the curriculum. It demonstrates how immersive digital technologies can democratise language learning through experiential accessibility and reduce attitudinal and physical barriers across diverse learner groups.

What is more, it provides structured, reflective peer feedback using embedded assessment tools. Its successful deployment signals strong potential for cross-disciplinary scaling and national adoption, especially for language educators seeking inclusive, technology-enhanced pedagogies.

Conclusion

This project has illustrated how immersive technologies anchored in pedagogical theory and interdisciplinary collaboration can transform language education for diverse learners. By integrating AI-driven interaction with VR-enhanced simulation, the initiative addresses both structural and attitudinal barriers to language acquisition, particularly for students navigating neurodivergence, cultural distance, or communicative anxiety.

This innovative pedagogical approach also empowers learners to rehearse, reflect, and improve in ways that are personalised, inclusive, and emotionally resonant. The intentional use of flipped learning, the embedded design of realistic scenarios, and the deployment of Lancaster's Data Immersion Suite together signal a dynamic convergence of theory and practice.

Looking ahead, the project aspires to broaden its reach, linguistically, culturally, and institutionally. By refining affective design elements, future iterations aim to deepen learner engagement and extend the pedagogical blueprint. Ultimately, this work champions a vision of language learning that is immersive, empathetic, and transformational. Recognised by its innovation and inclusive impact on language pedagogy, the project has recently been shortlisted for the Immersive Experiential Learning Award at the QS Reimagine Education Awards,

Despite its pedagogical strengths, the project presented several logistical challenges. Setting up the VR headsets required technical support from Lancaster's Innovation Team, and the immersive format necessitated splitting classes into smaller groups, which increased staff workload and coordination demands. Additionally, while most scenarios functioned as intended, occasional glitches in AI responsiveness disrupted flow and required on-the-spot adaptation. The ethical use of sentiment analysis in student feedback requires caution, as interpretations of algorithmic tone vary and may lead to undue trust in its objectivity. Further improvements to scenarios require sustained investment in development and training, and given the current funding climate, financial constraints remain a significant limitation to scaling and sustaining these innovations.

These limitations underscore the importance of continued collaboration between academic and technical teams to ensure smooth delivery and scalability. Staff training modules tailored to digital pedagogy could support educators in interpreting and contextualising AI-generated insights. As underscored by the UK Parliamentary POSTnote (UK Parliamentary Office of Science and Technology, 2024), the need for clearer legal frameworks and staff training to mitigate risks such as algorithmic bias and over-reliance on automated feedback is required. To mitigate other limitations, asynchronous VR alternatives may also offer immersive, low-barrier engagement for students unable to participate in synchronous formats.

In response to this year's findings, the VR interview session will be embedded into the curriculum for the next academic cycle, ensuring structured integration and timetabled support. The challenges encountered have been instrumental in prompting efforts to humanise the chatbot interface and embed greater cultural sensitivity into its design, ultimately enhancing the relevance and responsiveness of its outputs. These adaptations reflect a commitment to more empathetic, context-aware engagement that will further be trialled in French in the academic year 2025-26, expanding its linguistic reach, and adapted for first-year students using simplified scenarios and lower CEFR levels. These developments reflect a commitment to inclusive progression and curricular innovation, reinforcing the project's potential as a scalable model for immersive language education.

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