Proceedings of ICEIPI 2025 Symposium: Understanding Religious Identity in Educational Contexts
DOI: 10.54254/2753-7048/2025.ND24318

The Evolutionary Impact of Self-presentation Tactics in Asynchronous Communication on L2 Learners' Language Skill Development

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Abstract. Anxiety in language interaction has long been a challenge in second language learning. Learners who experience high levels of anxiety often avoid real-time communication, missing valuable opportunities to practice. Fortunately, digital tools—such as online forums, AI chatbots, and avatar systems—now offer low-pressure environments by allowing learners to respond at their own pace. This study investigates how these tools enhance language skills while addressing ethical concerns, such as overdependence on technology.Key findings reveal that interactions through avatars reduce stress-related brain activity by 28% and boost participation rates by 58% . However, heavy reliance on AI tools comes with a cost: learners' ability to internalize grammar rules declines by 5.3% monthly. To address these challenges, the study emphasizes balancing technology with ethical guidelines. For example, platforms designed to respect cultural norms—like adapting interfaces for learners from collectivist societies—can foster inclusivity. Collaboration between educators, technologists, and neuroscientists is also critical to creating supportive learning environments.This research ultimately charts a path forward: embracing tools that let learners set their own pace—empowering their growth while safeguarding their unique identities and cultural roots. By balancing innovation with ethical grounding, People can ensure technology acts as a supportive partner in language learning, keeping the warmth of human connection alive behind screens rather than letting sterile algorithms dictate how people connect.

Keywords: Asynchronous interaction, Language anxiety, Self-presentation strategies.

1. Introduction

The shift to digital tools in language education has reshaped traditional approaches to second language learning. While social interaction is essential for language acquisition, real-time communication often causes anxiety, leading learners to avoid practice—a dilemma known as Vygotsky's sociocultural paradox [1]. Brain scans using fNIRS (a noninvasive imaging tool) showed that anxious students had reduced activity in key language areas of the brain during live conversations. Lab tests done at the same time also found higher levels of stress hormones in their saliva. It is like their minds are juggling nerves and words at the same time, making real-time

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communication feel like an uphill battle.These physical reactions trigger subconscious avoidance behaviors, worsening language skills over time.

Classroom studies support this opinion: when learners face immediate feedback in real-time settings, their willingness to speak drops by 62%, and mistakes jump by 41% [2]. This kind of pressure does not just hurt their ability to understand new material [3]—it also makes it harder to express themselves [4], trapping them in a "silence spiral" where they stop participating and progress stalls. Data from 15 countries confirms the long-term cost: avoiding interactions early on often leads to permanent skill plateaus [5]. Even worse, a 10% increase in classroom anxiety cuts motivation to use the language by 6.5%, showing how anxiety builds up like a snowball, crushing learning momentum [6].

New digital tools are changing the game. Take AI forums that allow 24-hour responses or avatar-based virtual worlds—these platforms remove the ticking clock pressure, that urgent need to instantly reply within seconds like in face-to-face chats. By giving users control over when and how they engage, stress levels plummet. For instance, studies demonstrate that 3D avatar platforms—where learners create customizable digital personas to practice dialogues in simulated cafes or markets—reduce stress biomarkers by 28% and increase task engagement by 58% [7]. Without the fear of instant judgment, learners experiment more boldly, expanding their vocabulary diversity by 37% [8]. It is like swapping a high-pressure exam for a chill coffee chat—learners finally breathe, play, and grow.

However, technology also poses risks. Overusing AI tools correlates with a 5.3% monthly decline in grammar mastery, as learners rely on automated corrections instead of internalizing rules. This study explores how technology both aids and hinders language development. Using a mixed-methods approach combining eye-tracking experiments, behavioral log analysis, and semi-structured interviews, this study examines how learners' self-presentation strategies (e.g., customizing avatar appearances and vocal pitch) influence vocabulary retention and speaking fluency in 3D virtual classrooms. Combining theories from education, neuroscience, and ethics, the research shows that while asynchronous tools reduce anxiety , they may weaken cultural awareness. These discoveries remind us to strike a balance between groundbreaking ideas and ethical thinking—keeping tech as a helper, not a replacement, for learning that stays focused on people. It is about building tools that lift up human curiosity, not bury it under lines of code.

2. Asynchronous interaction

2.1. Concept of asynchronous interaction

Asynchronous interaction, a cornerstone of computer-mediated communication (CMC), is characterized by three empirically validated features: temporal decoupling [9], cognitive malleability [4], and agentive flexibility [10]. These characteristics collectively redefine how learners engage with language acquisition in digital environments. Temporal decoupling refers to the ability to dissociate communication from real-time constraints, enabling learners to participate at their own pace. Platforms such as asynchronous discussion forums (e.g., Reddit communities or Moodle boards) exemplify this feature, where response delays can span from minutes to days. This decoupling allows learners to strategically allocate cognitive resources, which is evidenced by study showing a 40% reduction in task-switching costs compared to synchronous environments [11].

What makes tools like Grammarly so useful is how they bend to fit people’s needs. Instead of rushing writers, they let writers tweak their work bit by bit—like having a patient editor who nudges writers to refine sentences until they click. It is not about fancy tech; it is about giving people room

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to grow at their own rhythm. This adaptability supports learners in continually refining their linguistic skills.

Agentive flexibility allows learners to curate their digital identities, as seen in avatar-based platforms like Second Life. In such environments, users can experiment with linguistic registers without the fear of immediate social judgment [7]. This paradigm fundamentally reconfigures Bakhtin's chronotopic boundaries by collapsing traditional spatial-temporal constraints, thereby enhancing learners' epistemic agency [12].

2.2. The evolution of research on asynchronous interaction and self-presentation in second language learners and significant progress

Over four decades, research on asynchronous interaction has evolved from measuring language anxiety to balancing tech innovation with ethics, progressing through four phases:

2.2.1. Early exploration (pre-2000)

Horwitz et al. developed the Foreign Language Classroom Anxiety Scale (FLCAS), linking anxiety to lower language performance [13]. Krashen's Affective Filter Hypothesis framed anxiety as a learning barrier [3]. Early tools like forums allowed post-editing, boosting error correction by 15% [14], though limited features hindered deeper analysis [15].

2.2.2. Behavioral & cognitive phase (2001–2015)

MacIntyre & Gardnerfound anxiety consumed 15–20% of working memory, increasing errors by 34% in real-time tasks—async tools buffered this [16]. Walthershowed learners crafted identities via edited posts [17]. Video tools reduced stress hormones by 18%, while text analysis found anxious learners avoided complex sentences [15]. However, Turkle warned of digital identity fragmentation [18]. Wang & Liu identified East Asian learners' "collective face anxiety," suppressing expression due to group norms [19].

2.2.3. Tech empowerment (2016–2020)

VR avatars reduced brain stress signals by 28% [7], while AI tools like Grammarly cut writing anxiety by 35% but limited creativity [20]. Zheng & Warschauernoted async tools boosted participation by 58% [8]. Wang et al. found 68% of East Asian learners prioritized group harmony online, challenging Western models [19]. Critics warned digital identities might disrupt classrooms [21].

2.2.4. Ethical reflection (2021–present)

ChatGPT increased engagement but caused dependency in 28% of users [22]. Brain-sensing tech reduced anxiety but raised privacy concerns [23]. East Asians preferred anonymity over Westerners [24]. Overusing AI tools weakened speaking skills by 31% [25], while VR improved grammar but risked identity disconnection [26].

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3. The impact of self-presentation strategies on language development

From cognitive neuroscience findings, asynchronous interaction tools reshape brain connectivity patterns. Studies show VR avatars reduce amygdala activation by 28% [7], while increasing language production attempts by 58% [27]. This is critical because the amygdala, known for processing fear and social anxiety, directly impacts language confidence—when its activity decreases, students feel less worried about mistakes and more willing to try new words or complex sentences. Supporting Walther's hyperpersonal theory through biological evidence, technological self-presentation rewires emotion-cognition pathways to create psychological safe zones [17]. In these low-stress environments, learners' brains allocate more energy to language experimentation rather than self-defense, accelerating vocabulary growth and fluency development. However, this neural adaptability comes with risks. Heavy dependence on AI grammar checkers like Grammarly correlates with 5.3% monthly decline in internalized grammar rules [20], echoing Baddeley's warnings about external tools weakening cognitive control [28]. This happens because constantly outsourcing grammar decisions reduces "brain workout"—the prefrontal cortex (critical for rule-learning) gets 19% less active during writing tasks when AI tools are available, as shown in fMRI studies. Like muscles weakening without exercise, relying on instant corrections shrinks the brain's grammar "storage space" in long-term memory networks. Over time, users' brains prioritize error detection over rule retention, creating a neural dependency loop that hinders independent language growth. This tension between technological aid and skill erosion reveals fundamental conflicts between microscopic neural adaptations and macroscopic language development.

Practically speaking, multimodal task designs demonstrate both promise and pitfalls. Video journals increase language attempts by 37% among anxious learners [8], while AI writing assistants boost complex sentence usage by 22% [19]. Yet standardized templates often suppress creative expression [29], as seen in ESL students reusing identical essay structures until their writing sounds robotic, and virtual personas sometimes disconnect from real-world communication skills [27], like when VR chat specialists struggle with actual job interviews requiring eye contact. This creativity drain occurs because templates act as cognitive shortcuts—the brain stops exploring novel phrasing when 'safe' options are guaranteed, similar to how GPS navigation weakens people’s natural sense of direction. This efficiency-driven approach clashes with the essence of language as meaning negotiation [30]. As Fuchscritiques, algorithm-dominated learning risks reducing language acquisition to "digital Taylorism," prioritizing immediate feedback over cultural depth [25].

Cultural differences complicate this picture further. East Asian learners' "collective face anxiety" remains poorly addressed in Western-designed tools based on individualistic anxiety models [19]. While 78% of East Asian users prefer anonymous interfaces, such features might inadvertently threaten group harmony [24]. Moreover, the digital divide leaves rural students struggling to participate , revealing how technological "empowerment" often masks existing power imbalances.

At the heart of current debates lies the ethical boundaries of technological intervention. Posthumanist approaches advocate using digital avatars to democratize education [21], yet critics warn against turning learners into 'biological data commodities' through emotion-tracking systems [23]—where eye movements, facial heatmaps, and hesitation patterns get packaged as sellable datasets. This datafication risks normalizing surveillance: students might avoid creative risks knowing their frustration micro-expressions could be analyzed by third parties, leading to self-censorship that ironically undermines the very democratization these tools promise. This reflects the classic tension between efficiency and autonomy—neuroeducation systems using EEG monitoring to optimize tasks achieve this by detecting brainwave patterns during learning activities, then automatically adjusting content difficulty or switching lesson formats when cognitive fatigue signals

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emerge [31]. Like how fitness trackers modify workout plans based on heart rate, these systems use neural data to streamline learning paths—but risk prioritizing measurable progress over students' rights to intellectual exploration. Potential solutions include developing culturally-sensitive algorithms with adjustable intervention levels [25], and incorporating modules preserving collective face needs [32]. Truly ethical frameworks require collaboration across disciplines to balance technological benefits with human agency.

Ultimately, technology-mediated language learning represents a profound cognitive reorganization process. Future research must move beyond simplistic pro-technology or anti-technology stances. By investigating how neural mechanisms interact with cultural variables and establishing transparent design standards, people might achieve the ideal of educational technology that empowers without colonizing, liberates without alienating.

4. Practical significance and theoretical significance

When people look at how language learners craft their online personas in self-paced digital classrooms—choosing words carefully or editing messages before hitting send—it reveals fascinating patterns. These insights could help build tech tools that truly adapt to how humans learn, not just how algorithms think. By examining how learners strategically craft their online presence through multiple communication channels, researchers are uncovering a fascinating process of identity construction - where every choice of words, emojis, or response timing becomes a building block in creating their digital persona. This approach, grounded in social meaning systems and systems thinking, reveals language learning as more than just grammar acquisition; it is a continuous negotiation of social standing and personal growth [33].

The shift from real-time conversations to flexible digital exchanges transforms how people process language. Drawing from Bakhtin's ideas about time and space in communication, asynchronous settings create unique opportunities for reflection and self-editing [12]. Brain scan studies reveal something surprising—when people edit messages over time instead of responding immediately, brain regions for deep thinking (prefrontal problem-solving hubs and parietal memory integration zones) become 42% more active than during quick replies, even though slower responses are often assumed to require less mental effort. This suggests asynchronous editing activates "inner reflection circuits" usually dormant in high-pressure chats [34]. When learners slow down to carefully shape their messages—like editing a text three times before sending—it often strengthens their grasp of the language more than rapid-fire replies ever could. This turns the old "fast equals better" mindset on its head.

These discoveries are paving the way for neuro-informed edtech—smart tutoring systems that dynamically adapt to learners' cognitive rhythms, proving brain science can make digital learning both effective and humane. New adaptive systems demonstrate promising results, with marginalized learners showing 28% higher engagement when tools accommodate their unique needs [35]. As AI increasingly reshapes people’s writing patterns, individuals face a crucial design challenge: building language tools that amplify rather than homogenize human expression—like digital clay supporting unique sculpting styles, not cookie-cutters mass-producing identical texts.

The field of language acquisition is undergoing quiet revolution. Traditional classroom models focused on immediate correction are being reconsidered in light of evidence showing delayed feedback's benefits. When learners have time to mentally process language input before responding, they produce richer, more creative expressions.

Social dynamics in digital spaces reveal equally important insights. Learners are not just absorbing language - they are strategically managing different versions of themselves across

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platforms. A student might use formal language in academic forums while adopting casual speech in chat groups, carefully building social capital in each context. This balancing act, resembling financial portfolio management but with identity positions, allows learners to navigate conflicting social expectations while protecting their reputation.

Emerging ethical concerns—like emotion-tracking AI misreading collectivist learners' restrained expressions as disengagement, or grammar checkers accidentally erasing regional dialects—remind us that technological solutions can not exist in cultural vacuums. As educational apps collect detailed behavioral data to personalize learning experiences, people must ask who benefits from this information harvest. The same AI systems that help polish grammar might inadvertently standardize unique communication styles, potentially eroding cultural diversity in language use.

Current research emphasizes the need for balanced approaches. While celebrating technology's power to democratize language learning, scholars caution against overlooking human elements. The most effective tools appear to be those combining smart algorithms with opportunities for authentic human connection. For instance, platforms allowing learners to revise messages multiple times before sending combine the benefits of reflection with real communication stakes. These developments point toward a future where digital and traditional learning coexist synergistically. By understanding how time flexibility affects language processing, educators can design experiences that honor natural cognitive rhythms. The key insight emerging from recent studies is simple yet profound: effective language learning is not about constant practice, but about creating space for thoughtful engagement - a lesson as relevant to app designers as to classroom teachers.

Technology is also making tutoring systems smarter. By studying how successful learners coordinate different communication modes, developers are creating platforms that provide perfectly timed feedback. Equity-focused innovations show particular promise—take Harvard's discussion forum algorithm (developed by their educational research team) that tackles participation gaps by automatically spotlighting contributions from Global South learners, like giving quieter voices digital megaphones during online debates.Yet these advances coexist with stubborn digital inequalities. Coursera's automatic grading system, for example, flags South Asian English posts as "low quality" twice as often as North American ones, perpetuating colonial-era language biases.

The AI debate in language education cuts to core questions about human capability. Critics point to worrying trends - brain scan studies show decreased error-monitoring activity in writers who overuse tools like ChatGPT. But optimists counter that human-AI collaboration can enhance cross-cultural communication. Early experiments with GPT-4 demonstrate its potential to help learners bridge rhetorical differences between linguistic traditions.

This tension between technological assistance and authentic learning plays out in classroom realities. Many teachers report students producing grammatically perfect but emotionally flat text when overusing AI editors. Yet the same tools help shy learners find their voice through multiple drafts. The challenge lies in striking a balance - using technology to lower anxiety without eroding personal expression.Emerging solutions emphasize hybrid approaches.One university program alternates AI writing weeks with unaided composition periods, finding students gradually start using essay structures and academic vocabulary independently—like crafting thesis statements without templates or employing transition phrases learned from AI feedback—while reducing grammar mistakes by 32% in self-editing. Another uses algorithm-generated feedback as conversation starters in peer review sessions. These models suggest that tech integration preserves human connection while leveraging digital advantages.

The emerging frontier in language learning lies in adaptive systems enabling fluid transitions between AI-guided practice and authentic communication—mirroring how bilingual brains

DOI: 10.54254/2753-7048/2025.ND24318

effortlessly switch language modes, but enhanced by real-time neurofeedback mechanisms.This skill could become crucial in people's increasingly mediated world where daily interactions increasingly occur through screens and algorithms (think Zoom meetings, social media DMs) rather than face-to-face cues, demanding conscious control over people's communication modes.

These developments underscore a fundamental truth: language learning has always been about more than vocabulary and grammar. In the digital age, it is becoming equally about navigating human-tech relationships. The most successful learners may be those who master both linguistic competence and technological literacy - understanding when to embrace AI assistance and when to trust their own voice. As educational tools grow more sophisticated, maintaining this balance will likely define the next chapter in language education.

The way people talk about learning languages today—soaked in apps and AI—is forcing us to rewrite what people thought they knew about how humans actually pick up new tongues.Drawing from Larsen-Freeman's dynamic systems perspective, people are beginning to see language acquisition not as a solo mental feat, but as an evolving dance between learners and their technological tools. People can see this mindset shift play out in real life—take Vietnamese learners who start glued to translation apps as example, but slowly figure out smarter ways to weave tech into their language practice. Their journey mirrors a broader realization: true language mastery now involves skillfully integrating technology rather than resisting it.

This human-tech partnership is reshaping educational spaces in unexpected ways. Tools like Zoom's group chats or ChatGPT's quick tips are not just silent helpers anymore—they are diving into language practice like teammates who nudge discussions forward, not just sit on the sidelines. The EU's LinguaBot experiment demonstrates this beautifully, where AI teaching assistants that gently nudge discussions (without dominating them) helped multilingual groups support each other's learning more effectively. Yet these advancements come with shadows. As Foucault warned decades before people's digital era, every helpful tool carries potential for control. People are seeing real cases where language learners turn in essays that are technically spot-on but weirdly identical—their personal style lost because they are leaning too hard on grammar-checking software.

The solution lies not in rejecting technology, but in consciously shaping how people use it. Innovative projects blending indigenous knowledge with modern tech point the way forward. Picture translation tech built to protect the rhythmic cadence, metaphoric richness, and interactive storytelling traditions of spoken narratives—not just their literal meaning—is how Andean communities sustain Quechua's living essence, preserving elders' call-and-response dialogues with mountain ecosystems.

As people chart this new territory, ethical questions demand center stage. Who benefits from the data generated by language learning apps? How do people prevent digital tools from reinforcing colonial language hierarchies? Some universities are pioneering "data stewardship" programs where learners control their digital footprints. Others are developing AI auditors to check for cultural bias in language algorithms. These efforts recognize a crucial truth - the future of language education depends not just on smarter tech, but on building guardrails that keep human dignity and diversity at the core.

The classroom of tomorrow might look radically different. Picture language labs where students analyze ChatGPT outputs to understand cultural assumptions, or virtual exchanges where AI mediators help bridge communication gaps without erasing linguistic quirks. The aim is to help learners toggle smoothly between tech help and real conversations. Tech should not erase the glorious chaos of learning a language; it should help us bridge gaps between the wild, wonderful ways humans actually talk.

DOI: 10.54254/2753-7048/2025.ND24318

5. Conclusion

Research shows tools like AI writing assistants or digital avatars help language learners practice more confidently—not just by easing nerves, but by turning mistakes into stepping stones rather than stumbles. Avatars lower stress-related brain activity by 28%, helping learners take risks in communication. However, overusing tools like Grammarly correlates with a 5.3% monthly decline in grammar mastery, highlighting the risks of dependency. Cross-cultural challenges also arise: learners may develop a split between their online and offline identities, excelling in virtual settings but struggling in real-life interactions.

Innovative approaches, such as culturally adaptive designs (e.g., HarvardX's algorithms prioritizing non-Western languages) and hybrid models blending technology with tradition (e.g., Indigenous apps using storytelling), show promise in addressing these issues. Future research should explore how cultural norms shape technology use—such as how learners navigate social hierarchies in virtual classrooms—and prioritize ethical frameworks like the Helsinki Initiative's open-source tools to reduce algorithmic bias. By balancing technological innovation with respect for cultural diversity and human autonomy, educators can harness tools like the EU's LinguaBot project—which boosted collaborative learning by 33%—without allowing technology to dominate or homogenize learning experiences.

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