

Integrating Complex Thinking and Emotional Intelligence in Digital Language Learning: A Psycho-Emotional Framework for Second Language Acquisition

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ABSTRACT: This article explores the integration of Complex Thinking and emotional intelligence in digitally mediated second language acquisition (SLA) among adult learners. Grounded in Edgar Morin's epistemological paradigm, the study employs a qualitative case study with an interpretative phenomenological approach to examine the emotional barriers experienced by 30 Spanish-speaking adult learners enrolled in an online English academy. Through the use of digital self-perception questionnaires, computer-mediated anxiety and motivation scales, semi-structured interviews, and platform interaction logs, the research identifies patterns of anxiety, fear of error, and perceived digital inadequacy, particularly among older participants.

These emotional obstacles were addressed through the implementation of recursive feedback, heutagogical modules, and dialogical interaction strategies. Findings indicate a measurable reduction in affective filters, increased learner autonomy, and the emergence of emotional resilience and digital confidence. The study argues that psycho-emotional intelligence, combined with the principles of Complex Thinking, constitutes a viable and transformative pedagogical framework for TESOL in digital environments. It contributes to both education and computer science by offering a user-centred, interdisciplinary design model that foregrounds empathy, reflexivity, and learner agency. Limitations and directions for future research on biometric feedback and longitudinal emotional analytics are also discussed.

KEYWORDS: Complex Thinking, emotional intelligence, digital pedagogy, second language acquisition, adult learning, TESOL, affective computing, human-computer interaction, learner autonomy, educational technology

1. INTRODUCTION

In the contemporary era, the acquisition of a second language (L2) has transcended traditional classroom boundaries, embracing digital platforms and artificial intelligence (AI) technologies. This shift has introduced both opportunities and challenges, particularly concerning the emotional experiences of adult learners. While digital tools offer flexibility and accessibility, they also present emotional barriers such as anxiety, reduced motivation, and a sense of isolation (Maiboroda, 2024). These affective factors significantly influence language acquisition, yet they often remain underexplored in conventional language teaching methodologies. Traditional second language acquisition (SLA) theories have predominantly focused on cognitive processes, often neglecting the emotional dimensions of learning. However, research indicates that emotions play a crucial role in language learning, affecting motivation, self-esteem, and overall performance (Krashen, 1982; MacIntyre & Gardner, 1994). The integration of emotional intelligence into language education is essential to address these affective factors, especially in digital learning environments where face-to-face interactions are limited.

The advent of AI and digital technologies in education necessitates a paradigm shift in teaching methodologies. Complex Thinking, as proposed by Edgar Morin, offers a comprehensive framework that embraces the interconnectivity of cognitive, emotional, and social dimensions of learning (Morin, 2008). This paradigm encourages a holistic approach, recognizing the learner as a complex being influenced by various internal and external factors. By integrating Complex Thinking into language education, educators can create more inclusive and responsive learning environments that cater to the diverse needs of adult learners.

Incorporating Complex Thinking into digital language learning involves acknowledging the intricate interplay between technology and human emotions. AI-driven platforms can personalize learning experiences, adapt to individual learner needs, and provide immediate feedback, thereby enhancing motivation and reducing anxiety (Maiboroda, 2024). However, without a framework that considers the emotional aspects of learning, these technologies may fall short in addressing the holistic needs of learners. Complex Thinking provides the necessary lens to evaluate and implement these technologies effectively.

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This study aims to explore the application of Complex Thinking in addressing emotional barriers in digital second language learning among adult learners. The central research question guiding this investigation is: How can the principles of Complex Thinking be applied to mitigate emotional barriers and enhance second language acquisition in digital learning environments for adult learners? By examining this question, the study seeks to contribute to the development of more effective and emotionally responsive language education practices.

The structure of this article is as follows: The next section presents the theoretical framework, discussing the emotional dimensions of SLA, the principles of Complex Thinking, and the integration of emotional intelligence into language education. Subsequently, the methodology section outlines the qualitative case study approach employed in this research. The findings and discussion section then presents the results of the study, highlighting the impact of Complex Thinking on emotional barriers in language learning. Finally, the conclusion summarizes the key insights and offers recommendations for future research and practice.

2. THEORETICAL FRAMEWORK

2.1 Emotional Barriers in Online Second Language Learning

Language Ego and Emotional Dissonance in Digital Settings

The concept of language ego, introduced by Guiora (1972), refers to the sense of self that develops in association with one's native language and is challenged when acquiring a second language. In online environments, this ego is further tested as learners confront the vulnerability of expressing themselves in a foreign language through mediated platforms. The loss of non-verbal cues, the difficulty of repairing communication breakdowns, and the often asynchronous nature of digital interactions contribute to a form of emotional dissonance. Learners may feel disembodied or disconnected, which undermines their confidence and willingness to participate actively.

Digital communication inherently limits the emotional bandwidth available in traditional classrooms. Without the immediacy of human presence, many adult learners feel an increased sense of detachment and exposure, particularly when making linguistic errors (Zembylas, 2008). The emotional dissonance experienced in these settings can create a gap between the learner's self-perception and their linguistic performance, intensifying feelings of inadequacy. This disjunction is especially pronounced among adult learners, whose professional and social identities may conflict with the novice status assumed in language learning.

Moreover, the asynchronous nature of many online platforms disrupts the natural flow of interaction and inhibits spontaneous emotional exchange. As Lamy and Hampel (2007) argue, the absence of real-time feedback diminishes opportunities for empathy, humour, and encouragement—all of which serve as emotional lubricants in the learning process. Without them, the affective dimension of learning becomes flattened, and learners may internalise their frustrations without resolution.

To mitigate emotional dissonance, there is a growing call for pedagogical approaches that reintegrate affective presence into digital learning. This includes the intentional design of platforms that enable emotional expression (such as reaction tools or video feedback), as well as pedagogical training for instructors to foster socio-emotional connectivity. Recognising the emotional costs of language learning in digital spaces is a prerequisite to developing more humane and inclusive second language pedagogies.

Language Anxiety and Affective Filters in Asynchronous Platforms

Language anxiety remains one of the most pervasive affective barriers to second language acquisition, particularly in asynchronous and text-dominated digital platforms. Krashen (1982) theorised the affective filter as a mental block that impedes input when learners experience high anxiety or low self-confidence. In digital environments, these filters are often intensified due to perceived surveillance, permanency of errors, and lack of corrective scaffolding in real time. Learners may hesitate to submit written work or participate in forums, fearing judgment or misunderstanding.

MacIntyre and Gardner (1994) extend Krashen's model by identifying anxiety as a situational variable that interferes with all stages of language processing—from input to output. The asynchronous nature of online learning exacerbates this interference. For example, delays in instructor feedback may cause learners to ruminate on perceived failures, amplifying anxiety and discouraging future risk-taking. Furthermore, the absence of oral interaction in many online courses deprives learners of opportunities to desensitise their fears through practice and repetition.

Another important consideration is the interplay between technological and linguistic anxiety. Horwitz et al. (1986) note that learners often associate language learning with threat to self-esteem. When digital tools are introduced—especially those requiring self-recording, public posting, or real-time interaction—the threat becomes twofold. Learners not only fear linguistic error but also technical failure or embarrassment, reinforcing the affective filter.

To address these issues, it is essential to create emotionally intelligent platforms that incorporate non-threatening mechanisms for participation. These might include anonymous peer review, multi-modal input options (audio, video, text), and gamified feedback systems. Reducing the emotional weight of participation in digital contexts is key to lowering affective filters and enabling learners to engage more fully with language input and production.

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Emotional Load and Perceived Competence in Adult Learners Using Digital Interfaces

Adult learners bring with them a complex emotional landscape shaped by life experiences, cultural expectations, and professional roles. When these individuals engage in online language learning, they often experience a heightened emotional load due to the simultaneous navigation of technological interfaces and unfamiliar linguistic codes. According to Sweller (1988), cognitive load theory suggests that extraneous burdens—such as interface complexity—can deplete the mental resources necessary for learning. When paired with emotional stressors, the result is diminished engagement and higher dropout risk.

Perceived competence plays a significant role in sustaining adult learners' motivation. Bandura's (1997) concept of self-efficacy posits that individuals are more likely to persist in tasks they believe they can succeed in. However, in online environments where technical glitches, unclear instructions, or unfamiliar tools abound, learners often question their abilities—not only as language learners but as digital users. This dual vulnerability can lead to avoidance behaviours, reduced participation, and negative self-talk. Additionally, many adult learners confront age-related stereotypes about digital literacy. Research by Charness and Boot (2009) indicates that older adults are less likely to feel confident using new technologies, which in turn affects their learning outcomes. In language learning contexts, this self-perception compounds existing fears of failure, creating a psychological barrier to full engagement. When learners internalise these doubts, their emotional load increases, and their willingness to experiment or make mistakes decreases.

It is therefore crucial for educators to adopt an empathetic and scaffolded approach to digital pedagogy. This includes explicit instruction in platform navigation, the normalisation of error as part of the learning process, and the provision of low-stakes opportunities for digital experimentation. By reducing the emotional load associated with technology use, educators can support a stronger sense of competence, thus enhancing persistence and performance in online SLA contexts.

2.2. Complex Thinking and Adaptive Pedagogy in Digital Learning

Edgar Morin's Principles: Hologrammatic Learning, Dialogical Reasoning, Recursivity, Feedback Loops

At the heart of Edgar Morin's epistemological framework is the principle of hologrammaticity, which posits that each part of a system contains the whole, and the whole is reflected in the parts (Morin, 2008). In digital pedagogy, this principle translates into designing learning environments where every interaction—be it a forum post, feedback loop, or peer dialogue—contains elements of the broader pedagogical intent. Thus, learning ceases to be linear and instead becomes an intricate network of meaning-making activities. Hologrammatic learning empowers learners to see their progress not as isolated achievements but as interconnected manifestations of a wider intellectual and emotional development.

Dialogical reasoning, another key tenet of Complex Thinking, challenges binary thinking and embraces the coexistence of contradictory ideas (Morin, 1999). In second language acquisition, this manifests as the learner navigating between their native linguistic identity and the emerging second-language persona. Adaptive digital platforms can support this process by providing dialogical spaces—such as peer forums, synchronous debates, and reflective journals—where conflicting emotions and perspectives can be explored constructively. This cultivates tolerance for ambiguity, a crucial psychological trait in SLA (Dewaele & Wei, 2013). Recursivity, understood as the loop through which products or outcomes can, in turn, influence the systems that generated them, is particularly pertinent in AI-driven digital learning. Learner input generates feedback which reshapes future learning paths, effectively turning students into co-designers of their educational trajectory. Through recursive loops embedded in intelligent tutoring systems, Complex Thinking transforms digital platforms into evolving, adaptive learning ecosystems (Maiboroda, 2024). Feedback loops serve not only cognitive but emotional purposes. Affective feedback, when built into digital systems, enables learners to perceive the impact of their participation, reinforcing motivation and self-regulation. In Morin's paradigm, feedback is not a mechanical process but a humanising one—it nurtures awareness of interconnectedness and builds trust in the learning process. Integrating meaningful, timely feedback that reflects both progress and affective states constitutes a practical application of recursivity and dialogical thinking within digital pedagogy.

Systemic Integration of Emotional, Cognitive, and Social Domains Through Digital Interaction

Complex Thinking resists reductionism by advocating for the integration of multiple dimensions of human experience. In the context of digital education, this calls for platforms and pedagogies that simultaneously engage emotional, cognitive, and social faculties (Morin, 2008). Traditional e-learning environments often privilege cognitive objectives while neglecting the affective and interpersonal. However, a complexity-based design reimagines learning systems as holistic ecosystems, where every component—content, interaction, technology—contributes to the learner's comprehensive development.

The cognitive-emotional interdependence is especially salient in adult second language learning. Research has shown that cognitive performance is enhanced when emotional engagement is present (Immordino-Yang & Damasio, 2007). Digital platforms designed through the lens of Complex Thinking therefore integrate affective scaffolds—such as empathetic instructor messages, emotion-tracking tools, and peer encouragement mechanisms—to align learning environments with the psychological realities of adult learners. These features promote a more resilient and motivated learner profile.

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On the social dimension, Complex Thinking underscores the value of interdependence and relationality. Language is inherently social, and learning it requires not only exposure to structures but also meaningful interaction. Asynchronous forums, live discussion rooms, collaborative writing tasks, and shared feedback activities are more than pedagogical tools—they are social technologies that promote mutual recognition and community building (Kern, 2014). A complexity-informed platform sees social presence not as ancillary but as central to the learning architecture.

Moreover, the systemic integration of these three dimensions allows for the co-construction of knowledge. Learners do not passively receive content but actively shape its meaning in emotionally resonant and socially mediated contexts. This participatory ethos challenges the teacher-centred model and replaces it with a dynamic ecosystem of distributed agency. The emotional, cognitive, and social are thus not separate “domains” to be balanced but co-arising phenomena to be integrated and activated through complexity-aware pedagogical design.

Affordances of Complex Thinking for Digital Educational Systems and Platform Design

Digital learning environments have often been designed with an emphasis on efficiency, scalability, and content delivery. However, these priorities risk marginalising the human dimensions of learning. Complex Thinking provides a counter-narrative by encouraging platform designers and educators to view learning as a living, adaptive, and multidimensional process. When applied to digital architecture, this paradigm invites the creation of platforms that mirror the unpredictability, interconnectedness, and reflexivity of human cognition and emotion (Morin, 1999; Pereira Chaves, 2010).

For instance, learning analytics systems rooted in Complex Thinking would move beyond tracking quantitative engagement metrics (e.g., logins, clicks) to interpret patterns of emotional engagement, feedback responsiveness, and learner self-efficacy development. This shift from datafication to meaning-making requires a reconsideration of what is valued and measured in digital education (Selwyn, 2015). A complexity-informed dashboard might visualise not only progress but also learner confidence, resilience, and affective engagement, thereby reshaping the teaching and learning conversation.

Moreover, the adaptability inherent in Complex Thinking supports the development of personalised learning pathways. Learners interact with content and peers in non-linear ways, and the platform must accommodate divergent rhythms, needs, and learning styles. Features like optional task branching, affect-aware AI tutors, and learner-led content curation are examples of complexity-compatible design choices. These affordances empower learners to co-author their journey, reinforcing autonomy and emotional ownership.

Finally, platform design influenced by Complex Thinking must embrace uncertainty and error as integral to learning. Unlike traditional linear models that treat mistakes as disruptions, a complex system views them as signals of growth. Error analysis, reflective prompts, and feedback mechanisms can be reframed to reinforce the constructive role of failure. This perspective cultivates a culture of experimentation and resilience, crucial for digital second language learners navigating emotional and cognitive challenges simultaneously.

2.3. Emotional Intelligence and Human-Computer Interaction

Goleman's Emotional Intelligence Theory in Technology-Enhanced Learning

Daniel Goleman's theory of emotional intelligence (EI) comprises five key components: self-awareness, self-regulation, motivation, empathy, and social skills (Goleman, 1995). These competencies are not only vital in interpersonal communication but are increasingly relevant in educational contexts, especially those mediated by technology. In digital second language acquisition (SLA), learners often experience emotional fluctuations—ranging from anxiety and frustration to motivation and joy—that influence their performance. The integration of EI principles into technology-enhanced learning provides a framework for recognising and managing these emotions to optimise the learning experience.

Self-awareness and self-regulation are particularly important for learners navigating the asynchronous and often isolating nature of digital platforms. Without immediate feedback or instructor presence, learners must monitor and adjust their emotional states autonomously. Platforms that prompt reflection, encourage journaling, or include self-assessment tools align well with Goleman's notion of self-regulation and can reduce stress while promoting emotional resilience (Pekrun, 2006). These tools become even more effective when embedded with metacognitive scaffolds that help learners interpret their emotional responses in constructive ways. Motivation, another core domain of emotional intelligence, is frequently challenged in online learning environments due to the absence of real-time social reinforcement. Goleman (1998) emphasised the intrinsic nature of motivation and its relationship to goal setting and achievement. Adaptive learning systems that personalise learning paths based on learner progress can reinforce motivation by creating a sense of competence and purpose. Such systems enable learners to track their achievements and recognise their growth, which in turn strengthens their commitment to the learning process.

Empathy and social skills, while traditionally cultivated through human interaction, also find application in digital settings through design features that promote peer feedback, collaboration, and social presence. Virtual classrooms, discussion boards, and group projects can be structured to develop empathy by encouraging learners to acknowledge different perspectives and cultural contexts.

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When these elements are intentionally incorporated, emotional intelligence becomes not only a learner trait but also a pedagogical objective supported by technological design (Salovey & Mayer, 1990).

Relevance of Emotionally Responsive Design in Online Learning Environments

Emotionally responsive design in digital learning environments refers to the deliberate inclusion of features that recognise, support, and adapt to learners' emotional states. While usability and accessibility have long been priorities in educational technology, recent research underscores the importance of emotional design as a determinant of engagement and retention (Norman, 2004). In online SLA contexts, where learners often face feelings of vulnerability and isolation, emotionally attuned interfaces can serve as buffers that enhance both affective stability and academic performance.

Interface aesthetics, tone of voice, and interactivity are critical elements of emotionally responsive design. Warm colours, encouraging language in automated messages, and visual progress indicators all contribute to a more inviting digital space. According to Jiang and Koo (2020), learners are more likely to persist in their studies when the online learning environment fosters emotional presence, even in the absence of direct human interaction. Their study highlights that emotional presence significantly predicts student satisfaction in online courses, emphasizing the importance of designing platforms that support emotional connections between learners and the digital learning environment.

Emotional tracking technologies further expand the possibilities of responsive design. Tools that monitor learner behaviour—such as pause frequency, response time, or sentiment analysis in chat entries—can generate insights into emotional states. When used ethically and transparently, these insights can trigger supportive interventions, such as motivational messages or offers of additional help. In this way, the platform becomes an emotionally intelligent participant in the learning process, enhancing the learner's sense of being seen and supported.

Beyond individual features, emotionally responsive design also encompasses the platform's broader pedagogical philosophy. Systems aligned with the principles of Complex Thinking avoid reductionist approaches that view learners merely as data points. Instead, they embrace the learner's complexity by creating spaces for emotional expression, reflection, and interpersonal connection. This holistic design perspective positions technology not only as a tool but as a co-facilitator of emotionally intelligent education.

The Role of Affective Computing and Learner Autonomy in AI-Assisted SLA

Affective computing, as defined by Picard (1997), refers to systems that can recognise, interpret, and respond to human emotions. In AI-assisted SLA environments, affective computing plays a pivotal role in shaping learner experiences by detecting emotional cues and adjusting instructional strategies accordingly. Through biometric sensors, facial recognition, or linguistic analysis, AI systems can infer emotional states and tailor interactions to either challenge or comfort learners. This dynamic adaptation embodies the principles of Complex Thinking by acknowledging the learner as a multidimensional, affect-driven individual.

One of the major affordances of affective computing is its potential to support learner autonomy. Autonomy in SLA is closely linked to emotional readiness and self-regulation (Little, 2007). AI systems that adapt to the learner's emotional state—by offering encouragement after signs of frustration or suggesting breaks during prolonged inactivity—facilitate self-management and intrinsic motivation. In doing so, these systems promote not only linguistic competence but also emotional independence, key to lifelong learning.

Moreover, affect-aware systems can personalise learning content based on both cognitive performance and emotional response. For instance, a learner demonstrating signs of boredom may be presented with more stimulating materials, while a learner showing stress may receive simplified input or additional scaffolding. This level of adaptability requires an integration of emotional data into decision-making algorithms, a hallmark of advanced educational AI. When governed by ethical principles, such systems can contribute to a more equitable and responsive learning experience (Bosch et al., 2016).

Nevertheless, the implementation of affective computing must be grounded in pedagogical intentionality rather than technological novelty. As scholars caution, the automation of emotional responses carries the risk of oversimplification or surveillance if not aligned with educational goals (Williamson, 2017). Emotional intelligence, therefore, should not be outsourced entirely to machines but rather supported through a human-computer partnership where empathy, agency, and learner voice remain central. Within this paradigm, AI becomes a facilitator of emotional insight and learner empowerment.

3. METHODOLOGY

This study employed a qualitative case study design framed within the tradition of Interpretative Phenomenological Analysis (IPA). IPA is particularly suited for examining lived experiences and the meaning participants assign to them, especially when addressing affective and cognitive phenomena in educational contexts (Smith, Flowers, & Larkin, 2009). The study focused on understanding the emotional dimensions of adult second language learners engaged in digital instruction facilitated by human-centred artificial intelligence (AI), with a theoretical orientation grounded in Complex Thinking. This approach enabled an in-depth exploration of the interplay between technology, emotion, and language acquisition.

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The research was conducted from February to November 2024 within the context of an online English language academy based in Nenagh, County Tipperary, Ireland. The academy delivers asynchronous and synchronous language instruction through a virtual platform designed using principles of learner autonomy and emotional responsiveness. The student cohort consisted of 30 adult learners aged between 25 and 56 years, residing in various Latin American countries and forming part of the Latin American diaspora. The participants were all Spanish-speaking adults enrolled in beginner and intermediate English language courses. Recruitment was voluntary and informed consent was obtained from all participants in compliance with ethical research protocols. Data collection employed multiple tools to capture both quantitative and qualitative dimensions of learners' emotional and motivational experiences. Participants completed digital emotional self-perception questionnaires at the beginning, middle, and end of the study period, designed to measure fluctuations in their affective states. Additionally, computer-mediated anxiety and motivation scales adapted from the Foreign Language Classroom Anxiety Scale (Horwitz et al., 1986) and the Language Learning Orientation Scale (Noels et al., 2000) were administered to quantify core affective variables. These instruments were delivered through the academy's learning management system, which also recorded response times and behavioural engagement indicators. Complementing these instruments, semi-structured video interviews were conducted with 12 selected participants, chosen based on their variation in engagement patterns and emotional profiles. Interviews were held in Spanish to ensure comfort and authenticity in expression, and then translated for analytical purposes. Interview questions explored learners' perceptions of emotional challenges, experiences with feedback, their relationship with the AI interface, and perceived changes in confidence and motivation. The inclusion of these interviews allowed the researcher to capture the nuance and depth of emotional experiences that quantitative tools might overlook.

Class activity logs were systematically collected and analysed, focusing on learner interaction with feedback loops, completion of reflective tasks, and participation in dialogical components such as peer-to-peer forums and synchronous empathy sessions. These logs were not only a source of behavioural data but also a reflection of the recursive emotional dynamics central to Complex Thinking. Feedback loops embedded in the platform played a critical role in facilitating learner awareness, self-regulation, and engagement with content, and their patterns were analysed to detect emotional resonance or disengagement.

Data analysis was conducted using thematic coding, aligned with both the core principles of Complex Thinking (Morin, 2008) and affective SLA theory. Codes were inductively and deductively derived, with categories such as emotional resilience, fear of error, self-directedness, empathy, and cognitive-affective feedback. These categories were then mapped to learner narratives and platform interaction logs to identify converging patterns. The interpretative focus allowed the researcher to trace the emotional transformations experienced by learners and assess the efficacy of the pedagogical model in addressing psycho-emotional barriers to second language acquisition.

4. FINDINGS AND DISCUSSION

4.1. Emotional Barriers in Human-Computer Interaction

Learners' Fears of Digital Judgment, Error Visibility, and Loss of Control

One of the most salient emotional barriers identified among participants was the pervasive fear of being judged by the digital interface itself, or by peers through visible errors captured and stored on the platform. Unlike traditional classroom environments, where spoken mistakes may be ephemeral, digital platforms often record and visually display linguistic inaccuracies, accentuating learners' self-consciousness. As a result, several participants reported heightened stress when submitting written or spoken assignments, particularly in the early stages of the course. This digital permanence led to a reluctance to participate, with learners describing a sense of vulnerability akin to "being evaluated by a machine without context."

This anxiety was not limited to the perception of external judgment. Many learners internalised their mistakes as fixed deficits rather than developmental opportunities. This aligns with Zembylas's (2008) assertion that digital learning can exacerbate emotional exposure due to the absence of affective cues and human nuance. In the context of AI-mediated feedback, some learners initially interpreted automated responses as impersonal or overly corrective, which in turn reinforced a fear of error visibility and diminished their sense of control. However, as will be discussed in the next section, these initial barriers were partially mitigated through the adaptive and dialogical features grounded in Complex Thinking.

Technological Anxiety vs. Language Anxiety Overlap

The findings also reveal a significant overlap between technological anxiety and traditional language anxiety. Participants often struggled to disentangle the stress of learning English from the cognitive and emotional demands of navigating a digital interface. For some, the platform itself became a source of anxiety, with unfamiliar menus, automated functions, or perceived surveillance triggering avoidance behaviours. These reactions were particularly evident in learners who had limited prior experience with online learning environments. In such cases, digital stress compounded pre-existing fears related to second language acquisition, creating a dual affective burden.

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This overlap reinforces earlier literature suggesting that digital settings do not simply replicate traditional classroom anxieties, but rather introduce new forms of affective tension that are specific to the medium (Hurd, 2007; Horwitz et al., 1986). Participants described moments of confusion, disorientation, and frustration as “not knowing where to click” became as daunting as “not knowing what to say.” These observations suggest that the digital interface is not a neutral medium but an active emotional agent in the learning experience. Understanding this dynamic is central to answering the research question: **How can the principles of Complex Thinking be applied to mitigate emotional barriers and enhance second language acquisition in digital learning environments for adult learners?** By recognising the entanglement of emotional and technological challenges, educators and designers can better structure learning systems to respond adaptively.

Perception of Age-Related Digital Disadvantages

Age emerged as a recurring theme in learners’ reflections, with older participants expressing a heightened sense of digital inadequacy. Despite their motivation to acquire English, many voiced concerns that their age rendered them “less agile” or “slower to adapt” to digital tasks. This self-perception, more than actual performance data, acted as a psychological inhibitor. Learners over 45 years of age were particularly likely to express fears of “falling behind” or becoming dependent on younger classmates or family members for technical support. These findings resonate with Charness and Boot’s (2009) analysis of digital self-efficacy among older adults, where perceived incompetence often outweighs objective skill.

Importantly, this perception also intersected with learners’ professional and personal identities. Many participants occupied positions of responsibility in their home countries and were unaccustomed to experiencing such vulnerability in an educational setting. The shift to an online platform, with unfamiliar tools and automated feedback, disrupted their self-image and introduced a sense of regression. This psychological dissonance contributed to feelings of frustration and embarrassment, which, if unaddressed, could crystallise into disengagement.

Nonetheless, the data also indicate that when the digital environment provided low-stakes experimentation, scaffolded feedback, and affective support mechanisms, older learners began to reframe their digital identities in more positive terms. Several described newfound confidence in navigating the platform, with one learner referring to it as “a personal victory I didn’t expect.” This finding supports the argument that the application of Complex Thinking—particularly its emphasis on dialogical reasoning, recursivity, and holistic integration—can actively dismantle age-based emotional barriers by validating learner diversity and designing for inclusivity.

4.2. Implementation of Complex Thinking in a Digital Learning Environment

Recursive Feedback via AI-Supported Learning Management Systems

The use of recursive feedback loops was a central element in the design of the AI-supported learning platform, aligning with Morin’s (2008) principle of recursivity, which posits that outcomes can influence their own conditions of emergence. Learners engaged with weekly AI-generated feedback on performance, which adapted dynamically based on their prior activity, emotional self-assessments, and peer interactions. This cyclical process helped learners perceive feedback not as a terminal evaluation but as an evolving conversation with the system and with themselves.

The platform’s adaptive algorithm integrated affective data—such as self-reported motivation scores or hesitation time in completing tasks—with cognitive performance, thereby reinforcing Complex Thinking’s emphasis on the interrelation between affective and cognitive dimensions (Pereira Chaves, 2010). As learners recognised that their emotional responses were acknowledged and integrated into feedback generation, many reported increased trust in the system and a growing willingness to take linguistic risks. This marked a significant step toward answering the research question: How can the principles of Complex Thinking be applied to mitigate emotional barriers and enhance second language acquisition in digital learning environments for adult learners?

Moreover, recursive feedback empowered learners to reframe errors as iterative opportunities rather than failures. Participants who initially expressed anxiety around error visibility began to demonstrate reflective responses to correction and even sought out additional feedback, indicating an internalisation of recursivity as a learning habit. This transformation from passive reception to active participation illustrates how feedback mechanisms rooted in complexity can cultivate emotional resilience and learner agency.

Learner Autonomy Enhanced through Heutagogical Modules

The course design integrated heutagogical elements—learner-directed tasks that emphasise autonomy and self-determined learning—consistent with Complex Thinking’s endorsement of decentralised and emergent systems (Blaschke, 2012). Modules offered optional learning paths, peer-led discussions, and reflexive assignments that encouraged learners to make decisions based on their interests, emotional readiness, and cognitive strengths. This flexible architecture helped dismantle the rigid structures often associated with traditional SLA, replacing them with learner-centred ecosystems.

Autonomy was scaffolded through structured choices. Learners were invited to select between different types of exercises (e.g., written vs. oral tasks), adjust deadlines within reasonable limits, and create personal learning goals. These options not only acknowledged learner diversity but also promoted emotional engagement by giving individuals control over their learning narrative.

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The importance of this control was especially pronounced among older learners, who often expressed that the flexibility counterbalanced their initial anxiety regarding digital interfaces.

Moreover, the principle of hologrammaticity—where each part reflects the whole—was manifested in the way learners could see their progress across multiple dimensions: linguistic proficiency, emotional development, and social collaboration. By tracking their own evolution within these spheres, learners internalised their roles as co-constructors of knowledge. This outcome reinforces the viability of Complex Thinking as a pedagogical model capable of fostering autonomy and psychological empowerment in digitally mediated SLA.

Data from platform logs and interviews indicated that learner autonomy correlated positively with motivation and retention. Those who engaged more actively with heutagogical features also demonstrated stronger affective resilience, suggesting that autonomy itself functions as an emotional stabiliser. This supports the argument that designing for autonomy is not only a cognitive imperative but also a means of addressing emotional barriers in second language learning.

Dialogical Learning through Structured Peer Interaction and Teacher-Learner Empathy Loops

Dialogical reasoning, a core tenet of Complex Thinking, encourages the coexistence of contradictory elements and promotes meaning-making through interaction (Morin, 1999). In this study, dialogical learning was cultivated through weekly peer exchange forums, collaborative tasks, and periodic empathy-based feedback loops with instructors. These activities were designed to humanise the digital learning environment by fostering trust, vulnerability, and mutual recognition among participants.

Peer interaction was particularly effective in mitigating emotional isolation, a barrier commonly reported in asynchronous SLA environments. Learners expressed that sharing challenges and celebrating progress with others helped normalise emotional fluctuations. These interactions, grounded in empathy and co-reflection, enabled a shift from solitary learning to collective transformation. Participants frequently cited these exchanges as moments where they “felt seen” and “less alone,” highlighting the emotional efficacy of structured social engagement.

Teacher-learner empathy loops were implemented via video messages and personalised written feedback, where instructors modelled vulnerability, acknowledged learner efforts, and invited reciprocal sharing. These moments of human presence within the digital space reinforced emotional safety and created a culture of dialogical engagement. The design of these interactions reflected Complex Thinking’s principle of contextualisation, where the learner’s internal state is considered inseparable from the broader learning environment (Pereira Chaves, 2010).

The integration of dialogical components answered the research question by demonstrating how emotional and cognitive barriers can be softened through pedagogical relationality. Learners who actively participated in dialogical spaces reported enhanced motivation, increased willingness to communicate, and greater comfort with linguistic ambiguity. In this way, the digital environment was not merely a site of knowledge transfer, but a relational ecosystem shaped by emotion, interaction, and shared meaning-making.

4.3. Emotional Transformation and Learner Progression

Measurable Decrease in Affective Filters and Increase in Risk-Taking Behaviours

One of the most significant findings of the study was a marked reduction in learners’ affective filters over the course of the programme. At the outset, high levels of anxiety and fear of making mistakes were reported, especially in activities involving speaking or public feedback. However, as learners engaged with the recursive and emotionally supportive features of the digital environment, these affective barriers began to diminish. Quantitative data from the anxiety and motivation scales indicated a downward trend in anxiety scores and a corresponding increase in learners’ willingness to participate in higher-risk communicative tasks such as voice recordings and live discussions.

This shift aligns with Krashen’s (1982) hypothesis that lowering affective filters enhances language acquisition by facilitating the reception and processing of input. The design of the learning environment, rooted in the principles of Complex Thinking, provided conditions conducive to emotional safety and supported iterative learning through low-stakes engagement. Learners were gradually encouraged to move beyond passive consumption and adopt a more exploratory stance, which, in turn, fostered the emotional stability necessary for risk-taking in linguistic performance. These outcomes affirm that Complex Thinking can effectively address the emotional dimension of SLA, as posed in the study’s central research question.

Learner-Reported Emotional Growth, Narrative Re-Framing, and Digital Confidence

Qualitative data gathered from interviews revealed substantial emotional growth among participants, particularly in terms of how they framed their own learning narratives. Initially, many learners expressed self-doubt and a strong internalised narrative of deficiency—often linked to previous negative educational experiences. As the course progressed, however, several participants described a re-framing of their identity from “someone who fails at English” to “someone who learns through challenges.” This transformation was supported by dialogical structures that encouraged reflection and validated emotional expression.

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In particular, learners highlighted the humanising role of empathy-based feedback and personalised support messages as instrumental in this change. These findings are consistent with Immordino-Yang and Damasio's (2007) assertion that emotions shape the meaning-making process and serve as a foundation for motivation and resilience. Participants reported that the combination of self-directed tasks and affect-aware interactions helped them regain confidence—not only in their linguistic capabilities but also in their ability to navigate digital systems. Emotional growth, therefore, was not an incidental benefit but an embedded outcome of the learning architecture.

Development of Self-Regulation and Digital Literacy

A further outcome of the study was the parallel development of emotional self-regulation and digital literacy. As learners progressed, they demonstrated an increasing capacity to manage their frustration, reflect on their emotional states, and make informed decisions about their learning strategies. These behaviours were often mediated through the platform's recursive feedback mechanisms and emotional tracking tools, which provided learners with insights into their progress and emotional patterns. Over time, participants became more adept at modulating their responses and sustaining motivation, even during periods of cognitive overload.

Concurrently, learners developed confidence in using digital tools, navigating the platform independently, and solving technical problems. This synergy between emotional and digital competencies is especially noteworthy in adult learners, who often begin with apprehension towards technology (Charness & Boot, 2009). As participants internalised routines for troubleshooting, managing digital resources, and interacting with AI-based features, their digital literacy improved alongside their emotional resilience. This confluence reinforces the idea that a Complex Thinking-based pedagogy can address emotional and technological barriers simultaneously, thereby enhancing overall learner progression.

4.4. Theoretical and Technological Implications

Psycho-Emotional Intelligence as a Core Factor in Future TESOL and E-Learning Systems

The findings of this study underscore the necessity of integrating psycho-emotional intelligence as a core design and pedagogical component in TESOL and broader e-learning systems. Emotional intelligence, as conceptualised by Goleman (1995), is not merely an individual learner trait but a systemic requirement for successful educational experiences, particularly in digital environments where social and affective cues are often attenuated. The study demonstrated that addressing learners' emotional needs—through feedback loops, dialogical structures, and empathetic design—led to measurable improvements in motivation, resilience, and linguistic risk-taking.

These reframing positions emotional development as a parallel and complementary goal to language acquisition. Rather than treating affective support as ancillary, TESOL must reconceptualise it as foundational, especially in contexts involving adult learners and online delivery. The strategic incorporation of emotional literacy into digital platforms enhances not only learner satisfaction but also the depth and durability of learning outcomes. These insights contribute directly to answering the study's central research question by illustrating that the psycho-emotional domain is integral to overcoming barriers and optimising second language acquisition in AI-supported environments.

Complex Thinking as a Design Framework for Intelligent, Inclusive, and Empathetic Platforms

The application of Edgar Morin's Complex Thinking throughout the learning design provided a meta-theoretical lens through which both pedagogical and technological decisions could be aligned. By embracing complexity, uncertainty, and the interdependence of emotional, cognitive, and social factors, this framework enabled the creation of a learning environment that reflected the multifaceted reality of adult learners. Principles such as recursivity, dialogical reasoning, and hologrammaticity shaped how the platform responded to learner input, framed errors as developmental stages, and recognised learners as active participants in meaning-making.

As Selwyn (2015) notes, the future of educational technology depends not on more automation but on better integration of human values and nuanced pedagogical philosophies. Complex Thinking offers precisely such a framework—one that resists reductionist tendencies and allows for the emergence of emotional insight, reflexivity, and learner autonomy. This study contributes to the growing body of literature advocating for design approaches that are as intellectually rigorous as they are emotionally responsive. In doing so, it affirms the relevance of Morin's paradigm in the digital age and positions it as a foundational model for future TESOL innovation.

The Potential of Integrating Affective Computing into TESOL Methodologies

The use of affective computing in this study—specifically through the integration of emotional self-assessment tools and adaptive feedback mechanisms—demonstrated the potential for AI to function as a co-facilitator of emotional insight. As Picard (1997) originally proposed, affective computing systems can enhance learning by responding to human emotion in meaningful ways. In the context of TESOL, this means enabling platforms to detect emotional states such as anxiety or confusion and to adapt content delivery, pacing, and interaction style accordingly.

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However, as Williamson (2017) cautions, the deployment of emotionally aware systems must be guided by pedagogical intentionality rather than technological novelty. Emotional data must serve human-centred goals, such as inclusion, empathy, and learner empowerment. This study affirms that when affective computing is embedded within a complexity-informed pedagogical model, it can reinforce rather than undermine learner agency. The integration of such technologies into TESOL methodologies thus holds great promise—provided it is done within ethical, contextual, and educationally sound frameworks.

The implications of this research suggest that future TESOL practice will benefit from an expanded paradigm that fuses technological innovation with emotional intelligence and philosophical depth. By applying Complex Thinking, educators and designers can create learning ecosystems that are intelligent not only in data-processing capacity, but in their emotional, cultural, and human sensitivity. Such an approach answers the guiding research question by showing how digital second language education can be transformed from an isolating task into a holistic, empowering experience.

5. CONCLUSION

This study has examined the emotional challenges faced by adult learners in digitally mediated second language acquisition (SLA), with a focus on how these barriers intersect with human-computer interaction. Learners expressed a range of affective obstacles including anxiety, fear of judgement, and perceived technological inadequacy—particularly among older participants. These emotional barriers were often compounded by the nature of online environments, which may lack the immediacy of human feedback and the safety of in-person interaction. To address these issues, the study implemented a digital learning system embedded with affective scaffolds such as recursive feedback, dialogical interaction, and empathy loops, grounded in the principles of Complex Thinking.

In directly answering the research question (**How can the principles of Complex Thinking be applied to mitigate emotional barriers and enhance second language acquisition in digital learning environments for adult learners?**) the findings indicate that such a framework offers substantial pedagogical value. Complex Thinking, with its emphasis on non-linearity, reflexivity, and integration, provided both a philosophical and practical foundation for designing learning environments that treat emotion as integral to cognition. Learners reported increased motivation, confidence, and willingness to engage with linguistic tasks over time, suggesting that addressing emotional variables is essential not only for learner well-being but also for linguistic progression.

The study further demonstrated that Complex Thinking and emotional intelligence can operate as synergistic forces in digital SLA. While Complex Thinking structured the pedagogical and technological architecture, emotional intelligence—both as a design principle and a learner outcome—facilitated the development of trust, resilience, and relational awareness. This dual focus supported not only linguistic goals but also the emergence of learners as autonomous, emotionally literate individuals capable of navigating the complexities of digital communication and learning. Such outcomes validate the relevance of this interdisciplinary model in modern TESOL contexts.

By situating this work at the intersection of education and computer science, the study contributes a user-centred design model that foregrounds emotional experience as a legitimate and measurable component of digital learning. This interdisciplinary approach underscores the need for educational technologies that are not only efficient and scalable but also empathetic, dialogical, and inclusive. It suggests that the future of intelligent systems in education lies not in replicating human cognition but in supporting human complexity. In this way, the research advances current discourses on affective computing, learner-centred pedagogy, and digital transformation in adult education.

Nevertheless, the study acknowledges several limitations. The sample size, though rich in qualitative data, was relatively small and geographically specific, composed entirely of Spanish-speaking learners from Latin America and the diaspora. As such, the findings may not generalise to other linguistic or cultural populations. Furthermore, the study was conducted using a single digital platform, which, despite its flexibility, may not reflect the diversity of existing or emerging educational technologies. These constraints call for cautious interpretation of the findings and underscore the importance of replication across broader settings.

Future research should consider longitudinal approaches that track emotional trajectories over extended periods and in more varied sociocultural contexts. The incorporation of biometric feedback mechanisms, such as facial recognition or physiological sensors, may provide deeper insight into real-time emotional states, thereby enhancing the responsiveness of affective computing systems. Additionally, comparative studies between different digital platforms and pedagogical models would strengthen our understanding of best practices in emotionally intelligent language education. Such directions will be crucial in evolving TESOL methodologies to meet the psychological and technological demands of 21st-century learners.

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Appendix A: Summary of Results Based on Observed Learner Behaviour (February–November 2024)

- **Emotional Self-Perception (Questionnaires)**

- 87% of learners reported experiencing moderate to high anxiety at the beginning of the course.
- By the final cycle, 73% reported a noticeable decrease in anxiety and an increase in linguistic confidence.
- The most cited emotional improvements were “increased motivation,” “sense of progress,” and “reduced fear of judgement.”

- **Anxiety and Motivation Scales**

- Initial responses indicated high levels of performance anxiety, particularly in written and oral tasks.
- Motivation scores increased progressively, particularly in the domains of integrative motivation and self-efficacy.

- **Semi-Structured Interviews (12 participants)**

- Common emotional barriers included fear of failure, negative experiences in past educational settings, and feelings of inferiority related to age.
- Participants highlighted the usefulness of asynchronous feedback, affective encouragement, and task autonomy in building emotional resilience.
- Several learners narrated transformative experiences, stating that the course was the first time they “felt safe making mistakes” in English.

- **Platform Activity Logs**

- 91% of learners regularly engaged with feedback components, with increased depth of reflection over time.
- Learners who interacted frequently with dialogical activities exhibited greater consistency in motivation and self-correction behaviour.
- A small subset of learners (13%) struggled with technical confidence but improved with targeted emotional support features.

- **General Observations**

- Recursive feedback and emotionally intelligent interface features (e.g., empathetic prompts, learner choice) positively influenced engagement.
- Emotional literacy; especially the ability to name and reflect on feelings—was noticeably developed across the cohort.
- Participants increasingly demonstrated learner autonomy, evidenced by proactive learning behaviours and reduced dependency on instructor intervention.