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The Peer in the Machine: Evaluating the Impact of a "Peer-Like" AI Persona on Writing Motivation in Low-Proficiency L2 Learners

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Abstract

Artificial intelligence (AI) writing tools are often framed as authoritative tutors, prioritizing grammatical accuracy. For low-proficiency L2 writers, who frequently experience high anxiety and demotivation, this approach may be counterproductive. Grounded in theories of motivation and sociocultural learning, this study investigates whether designing an AI with a "peer-like" persona can more effectively foster positive motivational outcomes. This study was conducted with 280 low-proficiency L2 English learners, randomly assigned to interact with either a "Peer-Like" AI, which provided encouraging and suggestive feedback, or a "Tutor-Like" AI, which delivered direct corrective feedback, over a six-week intervention. Quantitative results from pre/post questionnaires indicated that the Peer-Like AI group demonstrated a statistically significant greater increase in intrinsic motivation and a significantly greater reduction in writing anxiety compared to the Tutor-Like AI group. Qualitative analysis of stimulated recall interviews revealed that learners perceived the Peer-Like AI as less intimidating and more supportive, which encouraged risk-taking and sustained engagement with writing tasks. The findings conclude that the strategic design of an AI's social persona is a critical factor in enhancing L2 writing motivation, thereby highlighting the need for pedagogical tools that are designed to support learners' affective states.

Keywords

L2 Writing Motivation, AI Persona, Peer-Like Feedback, Low-Proficiency Learners

1. Introduction

The acquisition of second language (L2) writing skills is a particularly daunting

challenge for low-proficiency learners. Beyond the cognitive load of mastering syntax, lexicon, and discourse conventions, these individuals often grapple with significant affective barriers, including pronounced writing anxiety, fear of negative evaluation, and chronically low motivation [1] [2]. In traditional and technology-mediated learning environments alike, the act of writing can become a source of stress rather than a tool for expression and development. It is within this context that Artificial Intelligence (AI) powered writing tools have emerged as a potential game-changer, offering the promise of instantaneous, personalized feedback. The current landscape of AI-assisted language learning is predominantly populated by tools that function as authoritative tutors. Applications like Grammarly and the default use of Large Language Models (LLMs) are often optimized for error detection and correction, providing direct feedback on grammatical inaccuracies, word choice, and style [3]. While this can be highly effective for learners who already possess a strong foundational confidence, for the low-proficiency learner, such feedback can inadvertently reinforce feelings of inadequacy. The constant highlighting of errors by an infallible "expert" system may amplify anxiety and undermine motivation, shifting the learner's focus from communicative expression to the avoidance of mistakes [4]. This creates a critical gap: an overemphasis on the product of writing (accuracy) at the potential expense of the process and the person (the learner's motivational state). This study posits that the value of an AI writing assistant may lie not only in the content of its feedback but also in its delivered social persona. Grounded in Sociocultural Theory [5], which emphasizes learning through social interaction and scaffolding, and key principles of L2 Motivation [6], particularly the importance of a supportive learning environment, we propose an alternative design: a "Peer-Like" AI. Unlike its tutor-like counterpart, a peer-like AI would provide feedback that is suggestive, encouraging, and ideational. It would frame suggestions as questions ("What if you tried explaining this with an example?") and offer encouragement ("This is a strong start to your argument!"), aiming to lower the affective filter and foster a collaborative, low-stakes writing environment.

While a growing body of research has investigated the efficacy of AI-generated feedback on linguistic accuracy [7] [8], few studies have rigorously examined how the social design of an AI's persona influences the affective dimensions of L2 writing, particularly for low-proficiency learners. The primary question is not merely whether AI can provide feedback, but how the nature of its interaction shapes the learner's motivational and emotional engagement with the writing process. To address this gap, this study sets out to investigate the following research questions: 1) To what extent does interaction with a "Peer-Like" AI persona, compared to a "Tutor-Like" AI persona, impact the writing motivation of low-proficiency L2 learners? 2) How do learners' perceptions of the feedback and their affective experiences differ between the two AI persona conditions? By exploring these questions, this research aims to contribute a more nuanced understanding to the field of Computer-Assisted Language Learning. It argues that for technology to be truly

effective, it must be pedagogically informed not just in its corrective capabilities, but also in its psychological and social alignment with learners' needs.

2. Literature Review

2.1. The Affective Dimension of L2 Writing for Low-Proficiency Learners

For low-proficiency L2 learners, the inherent complexity of writing is often exacerbated by significant affective barriers, notably high levels of writing anxiety, which can trigger avoidance and hinder development [1] [2]. These challenges directly impact motivation. According to Self-Determination Theory [9], intrinsic motivation is vital for learning but is easily undermined by an excessive focus on errors, which can shift a learner's focus to external compliance [10].

Central to navigating these challenges is the capacity for self-regulation—the ability to manage one's thoughts, behaviors, and emotions throughout the writing process through planning, monitoring, and strategy adaptation [11]. When self-regulation is compromised by anxiety, learners struggle to initiate tasks, persist through difficulties, or effectively use feedback. This failure to self-regulate prevents the positive mastery experiences essential for building confidence, thereby locking learners in a debilitating cycle: anxiety impedes self-regulation, leading to poor performance and frustration, which further diminishes motivation and reinforces anxiety.

2.2. Computer-Mediated Feedback and Intelligent Tutoring Systems

The use of technology to provide writing feedback has a long history in CALL, evolving from early grammar checkers to contemporary automated writing evaluation (AWE) systems. The primary focus of much of this research has been on the impact of feedback on linguistic accuracy [12]. Studies on systems like Grammarly or Criterion have reported positive effects on reducing surface-level errors [7]. However, critics argue that such tools can promote a narrow, "error-hunting" approach to writing and may be less effective for fostering higher-order concerns like organization and argumentation [13]. More recently, Intelligent Tutoring Systems (ITS) have sought to provide more adaptive and personalized instruction. These systems are typically designed as expert systems, modeling an ideal tutor that guides the learner step-by-step. While effective in certain domains, their authoritative nature can sometimes be perceived as rigid or impersonal, potentially replicating the top-down dynamics of traditional instruction that may demotivate less confident learners [14].

2.3. The Emergence of AI-Powered Tools and a Shift in Focus

The advent of Large Language Models (LLMs) like GPT-4 represents a paradigm shift in CALL. Unlike rule-based AWE systems, LLMs can generate more natural, contextual, and diverse forms of feedback, including on content and ideas [15].

Initial research has explored their use for generating reading materials, conversation practice, and writing assistance [8]. However, the current body of research is still in its infancy, with a predominant focus on the utility and accuracy of the feedback provided by these models. The central question has often been, "Is the feedback correct?" rather than "How does the manner in which the feedback is delivered influence the learner?" This overlooks a critical aspect of the pedagogical interaction: the social and affective context of feedback delivery. As noted by Hyland and Hyland (2006), effective feedback is not just about transmission of information but also about the social relationship and interaction between the feedback provider and receiver [16].

3. Methods

3.1. Research Design

This study employed a mixed-methods research design to comprehensively address the research questions. The quantitative component featured a pretest-posttest control-group design to measure the impact of the independent variable on motivational outcomes. The qualitative component utilized stimulated recall interviews and analysis of AI interaction logs to provide depth and context to the quantitative findings, exploring the learners' subjective experiences and perceptions. This convergent mixed-methods approach allowed for triangulation, providing a more complete understanding of the phenomena under investigation [17].

3.2. Ethical Considerations

This study received ethical approval from the Institutional Review Board of the authors' university. Prior to participation, all participants were informed about the study's purpose, procedures, and their right to withdraw at any time without penalty. Written informed consent was obtained from each participant.

3.3. Participants

A total of 280 low-proficiency L2 English learners were recruited from first-year general English courses at a public university in China. Participants were selected based on their scores in the College English Test (CET-4), a standardized national test, with students scoring below the passing mark of 425, a level broadly corresponding to the CEFR band of B1 or below, chosen to take part in this study. They were randomly assigned to one of two experimental conditions:

The Peer-Like AI Group (n = 140): This group received feedback from an AI with a peer-like persona. The Tutor-Like AI Group (n = 140): This group received feedback from an AI with a tutor-like persona.

3.4. The AI Intervention: Design and Implementation

The core manipulation was the social persona of the AI, controlled entirely through the system prompt. The same underlying LLM was used for both groups to isolate the effect of the persona. Over the six-week intervention, participants

completed a total of six writing assignments, one per week. For each assignment, participants were required to interact with their assigned AI system at least twice: once after drafting their initial text to receive feedback, and again after revising their text based on that feedback. Peer-Like AI Condition: The system prompt was designed to simulate a supportive, collaborative peer. System Prompt Example: "You are a friendly and helpful peer who is also learning English. Your goal is to help your classmate improve their essay by being encouraging and asking thoughtful questions. Focus on their ideas and organization first. Use phrases like 'I really liked your point about...', 'Maybe you could try...', 'What if you added an example here?' Do not act like an expert. Do not provide direct corrections for grammar unless it's absolutely necessary to understand the meaning. Your tone should be positive and collaborative." Tutor-Like AI Condition: The system prompt was designed to simulate a knowledgeable, corrective tutor.

System Prompt Example: "You are a strict and professional English writing tutor. Your goal is to provide direct, corrective feedback to improve grammatical accuracy, vocabulary, and academic style. Identify errors clearly and provide the correct form. Focus on precision and correctness. Use phrases like 'This is incorrect.', 'You should revise this to...', 'A better word choice would be...' Your tone should be authoritative and instructive."

A pilot study was conducted with 10 learners (not part of the main study) to refine the system prompts and ensure they reliably produced the distinct personas as intended. The prompts were adjusted iteratively based on the feedback output.

3.5. Instruments and Materials

3.5.1. L2 Writing Motivation Questionnaire

The questionnaire used in this study was adapted from the writing motivation questionnaire (WMQ) developed by Graham *et al.* (2022), comprising a total of 28 items [18]. The questionnaire assesses students' writing motivation across three dimensions: intrinsic motivation, extrinsic motivation, and self-regulatory motives. Responses were measured using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Reliability analysis indicated that all dimensions demonstrated Cronbach's alpha coefficients exceeding 0.8, confirming the questionnaire's good reliability.

3.5.2. Stimulated Recall Interview Protocol

A semi-structured interview protocol was developed. Selected participants were shown logs of their own AI feedback and revisions and asked questions like, "Can you talk me through what you were thinking when you read this feedback?" and "How did this comment make you feel?"

4. Results

4.1. Quantitative Results

4.1.1. Pre-Test Analysis of English Writing Motivation and Anxiety

Prior to the experiment, an independent samples t-test was conducted on the pre-

test motivation scores to ensure baseline equivalence between the different intervention groups. As illustrated in Table 1, no statistically significant differences were found between the Tutor-Like AI group and the Peer-Like AI group across the three motivational dimensions: Intrinsic Motivation ($p = 0.356$), Extrinsic Motivation ($p = 0.186$), and Self-regulatory Motives ($p = 0.062$), or for Writing Anxiety ($p = 0.421$). This initial equivalence confirms that any observed post-intervention differences in motivation can be more reliably attributed to the experimental treatments rather than pre-existing disparities.

Table 1. Independent samples t-test of pre-test data on college students' English writing motivation and anxiety.

Scale Dimension	Group	Mean	Standard Deviation	Standard Mean	Error	
					F	p
Intrinsic Motivation	Tutor-Like AI	2.89	0.78	0.11	0.774	0.356
	Peer-Like AI	2.92	0.82	0.13	0.256	0.729
Extrinsic Motivation	Tutor-Like AI	3.32	0.65	0.13	0.689	0.186
	Peer-Like AI	3.58	0.78	0.13	0.001	0.154
Self-regulatory motives	Tutor-Like AI	3.3	0.76	0.11	0.053	0.062
	Peer-Like AI	3.68	1.26	0.18	0.648	0.567
Writing Anxiety	Tutor-Like AI	3.81	0.71	0.1	0.882	0.421
	Peer-Like AI	3.72	0.69	0.09	0.115	0.735

4.1.2. Post-Test Analysis of English Writing Motivation and Anxiety

Following the instructional intervention, significant changes in motivational profiles were observed. The post-test data, presented in Table 2, reveals that the AI-assisted feedback system had a differentiated impact on the various motivational constructs.

Table 2. Independent samples t-test of post-test data on college students' English writing motivation and anxiety.

Scale Dimension	Group	Mean	Standard Deviation	Standard Mean	Error	
					F	p
Intrinsic Motivation	Tutor-Like AI	3.25	0.78	0.12	0.964	0.026
	Peer-Like AI	3.67	0.82	0.13	0.386	0.009
Extrinsic Motivation	Tutor-Like AI	3.43	0.75	0.12	1.062	0.366
	Peer-Like AI	3.76	0.68	0.15	4.651	0.659
Self-regulatory motives	Tutor-Like AI	3.56	0.79	0.12	4.853	0.042
	Peer-Like AI	3.78	0.86	0.12	0.128	0.367
Writing Anxiety	Tutor-Like AI	3.65	0.75	0.11	0.557	0.048
	Peer-Like AI	3.12	0.7	0.1	1.224	0.001

In the domain of Intrinsic Motivation, both AI feedback models demonstrated a significant positive effect. The Tutor-Like AI group showed a significant increase ($p = 0.026$), and an even more pronounced effect was observed in the Peer-Like AI group ($p = 0.009$). This suggests that the AI feedback, particularly when framed in a more collaborative manner, effectively stimulated students' inherent interest and enjoyment in English writing by satisfying their needs for autonomy and competence.

Conversely, for Extrinsic Motivation, neither the Tutor-Like AI ($p = 0.366$) nor the Peer-Like AI ($p = 0.659$) groups exhibited statistically significant improvements. This indicates that while the AI feedback successfully addressed internal drives, it was less effective in enhancing motivation driven by external rewards or recognition, which may rely more on social interaction and institutional incentives typically provided by human teachers.

Regarding Self-regulatory Motives, a significant effect was found for the Tutor-Like AI group ($p = 0.042$), but not for the Peer-Like AI group ($p = 0.367$). This result implies that the more structured, guidance-oriented feedback from the Tutor-Like AI was particularly effective in helping students develop strategies to manage their writing process, set goals, and persist through challenges. The Peer-Like AI's collaborative style, while boosting intrinsic interest, may have provided less of the structured scaffolding necessary for building self-regulation skills.

4.1.3. Analysis of Writing Anxiety

A key finding of this study pertains to the differential impact of the AI personas on writing anxiety. As shown in Table 2, while both groups showed a reduction in anxiety from the pre-test, the Peer-Like AI group demonstrated a significantly greater decrease. The reduction in the Tutor-Like AI group was modest but statistically significant ($p = 0.048$). In contrast, the Peer-Like AI group showed a much larger and highly significant reduction in writing anxiety ($p = 0.001$). This provides quantitative evidence that the supportive, low-stakes environment created by the Peer-Like AI was more effective at alleviating the anxiety commonly associated with L2 writing.

4.2. Qualitative Findings

Thematic analysis of the stimulated recall interviews with 15 participants from each condition revealed distinct experiential patterns, which we have organized into three key themes.

4.2.1. Theme 1: A Safe Space for Experimentation (Peer-Like Condition)

Learners in the Peer-Like group consistently described the feedback environment as low-pressure and psychologically safe. They felt permission to make mistakes and focus on expressing ideas before worrying about correctness. Representative Quote (P 05): "When it said, 'This is an interesting idea, can you tell me more?' it didn't feel like I was wrong. It felt like a conversation. I wasn't scared to write my next sentence." Representative Quote (P 12): "The tutor AI feels like a judge. This

Peer AI felt like a friend reading over my shoulder. I was more willing to try using new words I wasn't sure about."

4.2.2. Theme 2: Perception of Feedback: Collaborative Suggestion vs. Authoritative Correction

The manner of feedback delivery fundamentally shaped how learners perceived the AI's role and their own agency.

Peer-Like Group: Feedback was framed as collaborative. Participants used words like "helping," "suggesting," and "guiding." They felt they retained ownership of their text. Representative Quote (P 08): "It asked me questions that made me think. I had to figure out the answer myself, so the final essay still felt like mine." Tutor-Like Group: Feedback was perceived as definitive and authoritative. Participants often described simply accepting the corrections without deeper reflection, leading to a sense of the AI taking over. Representative Quote (P 23): "It just told me what was wrong and gave me the right answer. I copied it because it was the expert. I didn't really think about why it was wrong."

4.2.3. Theme 3: Emotional and Motivational Resonance

The interviews provided clear emotional correlations to the quantitative motivation data. The Peer-Like AI was associated with positive effects, while the Tutor-Like AI triggered more negative emotions. Peer-Like Group: Emotions reported included "encouraged", "confident", "happy", and "relieved".

Representative Quote (P 14): "Seeing 'Great start!' at the beginning made me feel good and want to keep writing." Tutor-Like Group: Emotions reported included "nervous", "frustrated", "discouraged", and "pressured". Representative Quote (P 26): "When I saw the red corrections, I immediately thought I had failed again. It made me not want to write the next essay."

4.3. Integration of Quantitative and Qualitative Findings

The quantitative and qualitative data converge to present a coherent picture. The significant quantitative advantages for the Peer-Like AI group in intrinsic motivation and reduced anxiety are directly explained by the qualitative themes. Learners interacting with the Peer-Like AI experienced a more supportive and less threatening environment (Theme 1), perceived the feedback as a collaborative tool rather than a judgment (Theme 2), and reported positive emotional responses that fostered a willingness to engage (Theme 3). In contrast, the Tutor-Like AI, while not damaging extrinsic motivation, failed to foster the positive intrinsic drive and emotional safety that the Peer-Like AI provided.

5. Discussion

5.1. Summary of Key Findings

This study sets out to investigate the impact of an AI's social persona on the L2 writing motivation of low-proficiency learners. The results provide a clear and consistent answer: the design of the AI's interactional stance matters profoundly.

Quantitatively, learners who interacted with a "Peer-Like" AI demonstrated significantly greater gains in intrinsic motivation and a significantly greater reduction in writing anxiety than those who interacted with a "Tutor-Like" AI, while no significant difference was found in extrinsic motivation. Qualitatively, these findings were illuminated by the learners' experiences; the Peer-Like AI was perceived as creating a psychologically safe space for experimentation, offering collaborative suggestions that preserved learner agency, and eliciting positive emotional responses that fostered engagement.

5.2. Interpretation and Theoretical Implications

The findings strongly support the study's theoretical grounding. From the perspective of Sociocultural Theory [5], the Peer-Like AI successfully functioned as a more sympathetic "More Knowledgeable Other". Its suggestive, question-based scaffolding (e.g., "What if you added an example here?") effectively mediated the learning process without imposing authority, allowing learners to remain active agents in the co-construction of their texts. In contrast, the Tutor-Like AI's direct corrections, while efficient, replicated a more traditional, transmissive model of feedback that positioned the learner as a passive recipient of knowledge, thereby limiting the potential for collaborative knowledge building.

Furthermore, the results align powerfully with Self-Determination Theory [9]. The significant boost in intrinsic motivation within the Peer-Like condition can be interpreted as the result of better support for learners' basic psychological needs. The encouraging language and focus on ideas likely enhanced feelings of autonomy (ownership over their writing) and relatedness (a connection to a supportive peer). Conversely, the Tutor-Like AI's focus on errors may have undermined these needs, shifting the locus of control externally.

The quantitative and qualitative results also provide strong insights into the development of self-regulatory strategies. The Tutor-Like AI's direct, corrective feedback provided the explicit guidance that helped learners develop self-regulatory skills, as reflected in the significant improvement for that group. The Peer-Like AI, while superior for fostering intrinsic motivation, used a less directive approach. Its strength lay in creating the psychologically safe conditions necessary for self-regulation to flourish—namely, reduced anxiety and a heightened sense of competence and autonomy. By framing feedback as manageable steps and encouraging experimentation, the Peer-Like AI effectively scaffolded the emotional and motivational prerequisites for self-regulated learning, empowering learners to take control of the writing process without the debilitating fear of failure.

This pattern of results complicates a simplistic preference for one person over the other. While the Peer-Like AI was superior for fostering intrinsic motivation and emotional safety, the Tutor-Like AI's structured feedback was more effective for directly building self-regulatory strategies. This key finding directly supports the argument for developing adaptive or selectable AI personas. It suggests that the optimal feedback agent may depend on the specific pedagogical goal: a peer-

like persona is highly effective for building confidence, encouraging experimentation, and sustaining motivation, whereas a tutor-like persona may be more appropriate when the specific aim is to instill foundational self-editing and metacognitive strategies.

5.3. Comparison with Previous Research

Our findings both confirm and extend existing CALL literature. While previous research has established the efficacy of AI for error correction [7] [8], this study demonstrates that an exclusive focus on this metric is incomplete. We found that a tool can be highly accurate (as the Tutor-Like AI was designed to be) yet less effective at promoting key affective learning outcomes. This echoes concerns raised by scholars like Warschauer & Grimes (2008) about the potential limitations of automated feedback, but it also offers a solution: a redesign of the feedback interaction itself [13]. Our research also advances work on pedagogical agents. While the "persona effect" [19] has been observed in broader educational contexts, this study provides robust, empirical evidence specific to L2 writing motivation, demonstrating that a carefully crafted peer persona can be more motivating for vulnerable learners than a default expert persona.

6. Conclusions

The implications of this study are twofold, offering concrete directives for both practice and future research. For CALL practitioners and developers, the findings serve as a critical design directive: the default setting for AI writing assistants should not invariably be "authoritative tutor." Instead, developers should create a spectrum of personas that educators and learners can select based on pedagogical goals and individual needs. For building confidence and intrinsic motivation in struggling writers, a "peer-like" mode is a powerful option, representing a move towards more pedagogically informed and psychologically intelligent CALL tools. For L2 writing instructors, this study provides an evidence-based strategy for integrating AI to address the affective dimensions of writing. Instructors can guide students to use AI not just as a proofreader, but as a collaborative writing partner, thereby shifting the classroom culture from one of error-avoidance to one of idea exploration and confident self-expression.

This study is not without its limitations. The sample was drawn from a single linguistic and educational context, and the intervention was relatively short-term. Furthermore, the observed motivational gains may be partly attributable to a novelty effect, wherein participants' engagement was initially heightened simply by interacting with a new technology, independent of the specific AI persona. While the comparative design (Peer-Like vs. Tutor-Like) helps mitigate this concern, the overall positive effects might diminish over time as the technology becomes familiar. Future research should therefore: 1) investigate the long-term effects of AI persona use on motivation and writing development, which would help determine whether the benefits persist beyond the initial novelty phase; 2) explore whether

the optimal persona differs for learners of varying proficiency levels, cultural backgrounds, or personality types; and 3) examine the impact of allowing learners to choose their preferred AI persona.

In conclusion, this study firmly establishes that the "peer in the machine" is more than a superficial feature; it is a pivotal factor in fostering a positive and motivating L2 writing environment for low-proficiency learners. By demonstrating that a Peer-Like AI persona can significantly enhance intrinsic motivation and reduce anxiety, we argue for a paradigm shift in AI-assisted language learning. The true potential of this technology lies not only in its computational power but in its capacity for empathetic and pedagogically nuanced interaction. Future development must prioritize the affective architecture of these tools to fully support the journey of the L2 writer.

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Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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