

Enhancing ESL Learners' Writing Motivation Through Technology Enhanced Collaborative Instruction: A Quasi-Experimental Study

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Abstract

This study investigates the effect of technology-enhanced collaborative writing instruction on the motivation of Pakistani university students learning English as a second language (ESL). Adopting a quantitative quasi-experimental design, 50 participants were divided equally into an experimental group, which received instruction through digital collaborative platforms, and a control group, which was taught using conventional methods. The intervention spanned four weeks, during which pretest and post-test data were collected using the Second Language Writing Motivation Scale (Waller & Papi, 2017). Results from independent samples t-tests indicated a statistically significant increase in writing motivation among students exposed to technology-mediated collaborative instruction compared to their counterparts. These findings highlight the motivational benefits of integrating technology in collaborative writing settings, suggesting that digital tools can play a crucial role in fostering student engagement and enthusiasm in ESL academic writing. Future research should investigate the longitudinal impacts and include diverse educational settings to enhance the generalizability of the results.

Keywords: Technology-enhanced Language Learning, Second Language Student, ESL.

Introduction

The English language stands as a linchpin for progress within the realm of higher education, wielding its influence as the prevailing medium of instruction on a global scale. Its ubiquity in this context is pivotal, given that students across diverse regions are routinely exposed to educational content and discourse in English. This linguistic uniformity facilitates a seamless exchange of knowledge and ideas, fostering a shared intellectual space for individuals from varied linguistic backgrounds. In the era we call the global age, English serves as a universal language of connection. Language proficiency has a profound impact on people and communities worldwide (Wong & Yunus, 2021; Lin, 2020). In many nations where it is not the native tongue, English is a teaching and international communication language (Sinagatullin, 2019). For this reason, learning English is essential for non-native speakers. Competing with L1 speakers and other foreigners is made easier for those who are proficient in the language (Yunus & Arshad, 2015; SiRicord & Shah, 2017; Seow et al., 2019).

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In Pakistan, a nation with a population of around 250 million, linguistic diversity is pronounced. However, the languages that wield influence in governmental, corporate, media, and educational domains are predominantly English and Urdu. The pervasive use of English extends to critical sectors, including education, the military, civil administration, and bureaucratic systems at Pakistan's provincial and federal government levels (Abbas, 1993).

Abbas (1993) highlights the significance of English within Pakistan's media landscape, encompassing radio, television, newspapers, cinema, and advertising. The English language courses offered at universities across Pakistan play a pivotal role in bolstering students' confidence and fostering positive expectations regarding their English language learning endeavours. Furthermore, these courses contribute to the equalisation of opportunities for students, raising their awareness of the strides made in mastering the English language. A study conducted by Pathan, Shahriar, and Mari (2010) delves into the motivations driving English language learning in Pakistan. The findings reveal that students are motivated by both instrumental and integrative factors, including aspirations for a promising career, elevated social status, improved job prospects, and integration within the English-speaking educated population of Pakistan.

Collaborative and Technology-Enhanced Language Writing Instructions in L2 Classrooms

The teaching of writing in the Pakistani L2 classroom presents a challenging task. The current state of writing instruction is unsatisfactory. Traditional approaches to teaching writing, which focus on the final product, have proven ineffective in motivating students. Writing proficiency is essential for language learners in Pakistan. It has been noted that university students find it difficult to produce high-quality academic papers, despite the Gallup (2014) study claiming that technology is significantly pervasive in the nation and essential for advancing education (Safdar et al., 2012). A compilation of difficulties encountered by language educators in Pakistan has been presented through various studies. After a thorough discussion of the issues, these challenges encompass obsolete pedagogical methods, students' adherence to traditional learning approaches, uncertain national policies, inadequate instructional materials that impede skills development, and a dearth of resources (Warsi, 2004; Mirza, 2009; Mansoor, 2009; Siddiqui, 2002). Furthermore, speaking a second language increases complexity due to word choice, grammatical proficiency, and syntax. According to published research, incorporating the most recent, improved teaching and learning resources into the classroom can help break down these obstacles (Fernsten & Reda, 2011).

As a solution to the aforementioned unfavourable condition in writing by students learning a second language, with or without learning challenges, Haider (2013) suggests an increased utilisation of peer (group) discourse within the realm of writing education. A significant corpus of studies has scrutinised the distinctions between both individual and pair work, particularly concerning writing tasks, as evidenced by studies conducted by Storch (1999, 2005), Storch and Wigglesworth (2007), and Wigglesworth and Storch (2009). In a cross-sectional survey focused on collaborative dialogues, dictogloss, and text reconstruction tasks, Kuiken and Vedder (2002b) investigated the impact of group interaction on second language (L2) writing. The notion that the researchers tested stated that the quality of the text in L2, collaborative discourse, has a significant impact. Specifically, when learners are allowed to reconstruct a text that their instructor has read aloud collaboratively, their combined output will exceed that of an individual's reconstruction (Kuiken & Vedder, 2002, p. 169). In an inquiry administered by Storch (2005), an examination was undertaken into both the procedural and resultant aspects of Collaborative Writing (CW), accompanied by an exploration of students' perspectives on the process. Comparative analysis was

conducted on the written compositions generated by pairs and individual learners, complemented by soliciting reflective insights from the participants regarding their experiences with collaborative writing.

The study's findings revealed that collaborative pairs created texts of shorter lengths yet demonstrated superior task fulfilment, grammatical accuracy, and complexity, implying a higher level of competence in task execution. Moreover, most students conveyed positive sentiments about the collaborative writing experience, although a minority expressed reservations. Storch's discernment from the study was that collaboration allowed students to synergise ideas and provide immediate feedback to one another.

The incorporation of technology emerges as a pivotal instrument for enhancing writing proficiency. Solanki and Shyamlee (2012) advocates for the utilisation of technology. A report from the Pew Research Centre highlights the role of digital tools in promoting increased student engagement in writing, fostering individual expression, and expanding the audience for their work. Additionally, the report suggests that the majority of teachers find digital tools to help simplify the teaching of writing (Purcell et al., 2013). Further scholarly endorsements of technology integration in writing instruction come from researchers such as Gillespie (2006) and Murphy (2006). The integration of technology-enhanced learning methodologies into L2 writing has witnessed a surge, attributed to the increased accessibility and affordability of technology (Mannion et al., 2019). Numerous pedagogical aspects of L2 writing have undergone digitisation in today's world. This encompasses the integration of web-based collaborative tasks in second language (L2) writing classrooms (Bikowski & Vithanage, 2016) and the use of interactive electronic feedback to improve student writing (Saeed & Al Qunayeer, 2022).

L2 Writing Motivation

Mental health variables related to L2 composition can significantly enhance L2 learners' writing capabilities by influencing their level and involvement in producing high-quality written work. These psychological aspects of writing might include motivation, anxiety, self-efficacy, motivational factors, and idealistic composition. The fundamental concepts of the universal theory of motivation in L2 schooling are expanded upon in L2 writing motivation (Waller & Papi, 2017). Motivation is viewed as a dynamic process that continually evolves, making it a vital component of effective second language acquisition (Dörnyei, 2001). Since it is an engaging construct, it is shaped by both factors that are specific to each learner, such as their unique sociocultural and contextual background (Williams & Burden, 1997). Motivation explains why second language learners choose a particular task (Dörnyei, 2001). From this angle, an L2 learner can be influenced by multiple contextual factors simultaneously, and those aims can change. We define L2 writing motivation as the learners' overall desire to improve L2 writing competency through various techniques, using the Waller and Papi (2017) L2 writing motivation scale. We adopted Papi and Waller's definition, which states that learners' motivation for L2 writing is determined by the amount of time and energy they plan to devote to improving their writing, the strength of their drive to do so, and the level of effort they are willing to put in (p. 57). This study views learners' overall drive to improve through various methods. Specifically, we adopt a definition that describes the effort learners are willing to exert, their desire to improve, and the intensity of their engagement in this process.

Statement of the Problem

English functions as the primary medium through which Pakistanis engage with the global community; yet, learners' proficiency in English writing remains alarmingly deficient (Mansoor, 2005; Malik, 1998). Despite the critical role of English in higher education and professional advancement, Pakistani ESL students struggle to produce coherent, academically rigorous texts—a shortfall frequently attributed to entrenched, teacher-centred pedagogies that emphasise rote learning over meaningful communication (Pathan, 2011). Traditional writing instruction in Pakistan often isolates students in individual tasks, offering limited opportunities for peer interaction, critical feedback, or revision, thereby undermining learners' intrinsic motivation and exacerbating anxiety around writing (Pathan, 2011). Although technology penetration in Pakistan has increased substantially (Gallup, 2014), and scholars advocate for its pedagogical potential in fostering learner autonomy and engagement (Safdar et al., 2012), university writing classrooms seldom leverage digital platforms to facilitate interactive learning. In contrast, collaborative writing tasks—wherein learners jointly negotiate meaning, co-construct text, and provide immediate peer support—have been shown to mediate language acquisition through sustained interaction and cognitive scaffolding (Storch, 2005; Storch & Wigglesworth, 2007; Wigglesworth & Storch, 2009). Empirical studies attest that such interactional exchanges prompt learners to notice linguistic gaps, test hypotheses, and internalise corrective feedback (Kim, 2008; Lapkin et al., 2002; Storch, 2002; Swain & Lapkin, 1998, 2002; Swain et al., 2002). Moreover, Web 2.0 tools like Google Docs—favoured for their intuitive interfaces and real-time co-editing capabilities—enable seamless communication and collaboration without requiring programming expertise (Dudeney & Hockly, 2012; GreyGrey et al., 2010). Crucially, technology-mediated collaborative writing not only enhances writing quality but also elevates learners' motivation and interest, as learners perceive writing as a socially meaningful, purpose-driven activity rather than a solitary, mechanical chore (Wang, 2015). Despite these promising findings, there remains a dearth of research examining the motivational effects of technology-enhanced collaborative writing instruction within the Pakistani ESL context. Addressing this gap is imperative, as heightened motivation is linked to increased writing practice, sustained effort, and ultimately, higher levels of language proficiency. Therefore, this study seeks to investigate how integrating technology-supported collaborative writing tasks impacts the writing motivation of Pakistani university students learning English as a second language, to inform pedagogical strategies that can revitalise ESL writing instruction, mitigate learner demotivation rooted in traditional methodologies, and foster the development of academically competent writers in Pakistan's multilingual landscape.

Methodology

Participants and Course

The present study employs a quantitative research approach, utilising a quasi-experimental design. The researcher in the current study used a quasi-experimental design because the setting prohibited the formation of artificial groups. The study involved a total of 50 L2 learners from two intact university classes, with participants purposively assigned to either the control group ($n = 25$) or the experimental group ($n = 25$). Over a four-week period, i.e., 12 hours, within a 16-week university semester, the control group received traditional writing instructions, while the experimental group underwent instructions utilising technology-enhanced collaborative second language learning methods. The selection of topics for the four writing tasks was intricately aligned with the prescribed curriculum, ensuring that they encapsulated key thematic areas and learning

objectives. The writing tasks assigned to both the experimental and control groups were similar in content and complexity, thereby fostering equitable assessment conditions and facilitating meaningful comparisons between the groups. Moreover, participants received personalised feedback on their in-class writing aimed at identifying strengths and areas for improvement. This feedback mechanism served as a valuable pedagogical tool, providing participants with actionable insights to enhance their writing skills.

Data Collection

Data Collection involved administering the motivation scale to measure L2 writing motivation before and after the intervention. Both groups underwent a survey before and after the technology-enhanced L2 writing instruction intervention, as part of the data collection process, providing insights into participants' motivations regarding TELL-based collaborative writing.

Second Language Writing Motivation Scale (SLWMS)

In this study, the L2 Writing Motivation Scale (SLWMS) developed by Waller and Papi (2017) was also used to assess the motivational factors influencing L2 writing among the participants. This scale, consisting of 7 items (see Appendix), was adapted from established L2 motivation measures previously validated by Taguchi et al. (2009), as cited in Waller and Papi (2017). It encompasses a range of dimensions, including participants' intended efforts for learning the L2, their desire to attain proficiency in the language, and the intensity of their motivation towards L2 writing tasks. Utilising a 6-point Likert scale, responses to the scale items varied from 1 (representing "Never") to 6 (indicating "Always").

The rigorous validation process of the SLWMS underscores its reliability in capturing the nuances of L2 writing motivation. As gauged by Cronbach's alpha formula, internal consistency yielded a coefficient of 0.86 in the present study, indicating high reliability among the scale items. This robust internal consistency suggests that the scale reliably measures the construct of L2 writing motivation among participants. Utilising a validated instrument, such as the SLWMS, contributes to the study's methodological rigour, ensuring that the data collected regarding participants' L2 writing motivation are reliable and valid. Consequently, findings derived from the analysis of SLWMS responses offered valuable insights into the motivational dynamics underpinning L2 writing proficiency. They developed targeted pedagogical interventions to enhance L2 writing skills.

Procedure

This study employed a quantitative research paradigm, utilising a quasi-experimental research design to investigate the impact of technology-enhanced collaborative learning on L2 writing motivation. A quasi-experimental approach was deemed appropriate due to the naturalistic classroom setting, which did not allow for the random assignment of participants into experimental conditions. Consequently, two intact classes of undergraduate L2 learners ($N = 50$) from a public university were purposively assigned to either the experimental group ($n = 25$) or the control group ($n = 25$).

The intervention was conducted over four weeks (totalling 12 instructional hours) during a regular 16-week semester. The control group received conventional instruction in academic writing, following the university's prescribed curriculum. In contrast, the experimental group received instruction grounded in technology-enhanced collaborative second language learning (TELL) strategies. Instructional content for both groups was standardised in terms of thematic focus and

task complexity, ensuring pedagogical equivalence and enabling valid comparisons between groups.

Participants in both groups completed four writing tasks, selected in alignment with the course syllabus to reflect the key themes and intended learning outcomes. Personalised feedback was provided for each task, highlighting both strengths and areas for improvement. This formative feedback served a dual purpose: enhancing the learners' writing proficiency and supporting the development of metacognitive awareness in writing processes.

To measure the impact of the instructional intervention on students' L2 writing motivation, data were collected using the Second Language Writing Motivation Scale (SLWMS), which was administered both before and after the intervention. The SLWMS, developed by Waller and Papi (2017), comprises seven items designed to capture multiple dimensions of L2 writing motivation. The scale was adapted from previously validated instruments developed by Taguchi et al. (2009), ensuring its reliability and construct validity in L2 motivational research contexts.

Through this dual-phase administration of the SLWMS, the study aimed to identify any significant changes in motivational orientation resulting from the technology-enhanced collaborative writing intervention. The structured implementation of tasks, instructional equivalence across groups, and robust data collection instruments collectively ensured methodological rigour in investigating the research objectives.

Data Analysis

This study administered a writing motivation questionnaire to participants in both the experimental and control groups. This questionnaire was helpful in gauging participants' subjective experiences and perceptions of writing activities. Employing a Likert scale, participants were prompted to provide ratings reflecting their motivation levels surrounding writing tasks.

The utilisation of this questionnaire enabled the researcher to gain rich insights into participants' attitudes toward writing. By systematically analysing responses gathered through the instrument, the researcher found patterns, trends, and potential improvements in participants' motivational outcomes. This comprehensive approach to data analysis enhances the validity and reliability of the findings, facilitating a nuanced understanding of the factors influencing participants' experiences and outcomes in writing tasks.

T-test

T-tests represent parametric statistical methods frequently employed in experimental research to assess differences in mean scores (Fraenkel & Wallen, 2000, p. 258). Specifically, the independent-samples t-test contrasts pre- and posttest scores across two distinct comparison groups. The independent samples t-test focuses on determining whether there are significant differences between the means of two or more separate groups. This analytical approach enables researchers to determine whether the mean score of one group differs significantly from that of another group, with the groups being entirely independent of each other. The rationale behind employing an "independent samples t-test" (Phakiti, 2014, p. 104) is to determine whether there are significant disparities between the means. Researchers used SPSS for analysis.

Results

Findings for the Research Question

The study poses the following research question :

- What is the effect of technology-enhanced collaborative writing instruction on Pakistani university students' ESL writing motivation?

To investigate the study's question regarding the impact of technology-enhanced collaborative writing instruction on the writing motivation of Pakistani university undergraduate students, a pretest questionnaire was administered at the beginning of the study to measure their writing motivation levels. The experimental group received instruction over the next four weeks using technology-enhanced writing techniques, while the control group followed traditional teaching methods. Following the four-week intervention, a post-test questionnaire was administered to reassess the students' writing motivation. The post-test results enabled a comparison between both groups, offering insight into the effectiveness of technology-enhanced instruction in enhancing writing motivation.

Comparison of Pre-test Writing Motivation Levels of the Control Group and Experimental Group

An independent sample t-test was conducted to compare the pretest motivation levels of the control and experimental groups. The findings are reported in the table below.

Table 1: Independent Sample t-test (pre-test)

	Groups	N	Mean	Std. Deviation	Std. Error Mean	t-value	Sig.
Motivation	Control	25	4.5716	.48497	.09699	.25120	.071
	Experimental	25	4.3204	.47741	.09548		

The results revealed that the mean motivation levels for the experimental group (4.3204) and the control group (4.5716) were similar, indicating no significant difference. The t-value was .25120, with a two-tailed p-value of .071, confirming that the difference was not statistically significant. These results suggest there was no notable variation in writing motivation between both groups at the beginning of the research.

Comparison of Post-test Writing Motivation Levels of the Control Group and Experimental Group

Following the pre-test, the experimental group received four weeks of technology-enhanced writing instruction. In the fifth week, a post-test questionnaire was conducted to evaluate their progress and measure the effectiveness of the intervention, to assess any improvement in their writing motivation.

The findings of the independent sample t-test are reported in the table below.

Table 2: Independent Sample t-test (posttest)

	Groups	N	Mean	Std. Deviation	Std. Error Mean	t-value	Sig.
Motivation	Control	25	3.1096	.51221	.10244	-1.4108	.005
	Experimental	25	4.5204	.47741	.09548		

Table 2 compares the post-test levels of writing motivation between the control group and the experimental group. An independent samples t-test was employed to evaluate these scores. The findings revealed a clear and notable difference between the two groups. The experimental group attained a mean score of 4.5204, compared to the control group's mean score of 3.1096. The

calculated t-value was -1.4108, with a two-tailed p-value of .005. Since the p-value is well below the threshold of 0.05. The results are statistically significant, indicating that the experimental group, which received technology-enhanced collaborative writing instruction, experienced a higher level of improvement in writing motivation as compared to the control group.

The results suggest that technology-enhanced collaborative writing instruction has a positive impact on students' writing motivation. Post-test results revealed that the experimental group significantly surpassed the Control Group, with a higher mean score and a statistically significant difference, and exhibited increased writing motivation compared to the control group. These findings demonstrate that technology-enhanced collaborative writing instruction not only improved writing skills but also positively influenced students' emotional and motivational engagement in writing.

Conclusion

The study aims to provide insightful information on the potential advantages of technology-enhanced collaborative approaches over conventional techniques, acknowledging the critical need for effective writing instruction tailored to the educational and linguistic needs of Pakistani ESL students. It was predicted that employing strategy-based writing instructions would increase students' understanding of their writing processes, which in turn could improve their writing motivation. If so, teaching ESL writing in Pakistan might benefit from using this method. Thus, the study aimed to investigate how technology-enhanced collaborative writing instructions impact ESL students' writing motivation. Quantitative tools were used to assess the impact of the approach on students' writing motivation.

The purpose of this research, as discussed in chapter two, is to examine how technology-enhanced collaborative second language (L2) writing instruction affects Pakistani English as a Second Language (ESL) university students' writing motivation, and to determine whether the technology-enhanced collaborative writing instructions approach is a more effective means of instructing English writing to undergraduate ESL students in Pakistani universities. The following research objective was formulated:

1. Investigate the effect of technology-enhanced collaborative writing instruction on the ESL writing motivation of Pakistani university students.

To answer this question, the experimental and control groups performed a T-Test and improved their writing scores from the pre- to post-test. However, according to the independent samples t-test, the experimental group, which was engaged in collaborative technology-based writing, demonstrated a statistically significant increase in their pre- to post-test scores as compared to the control group, which received traditional writing instructions. This suggests that the interventions had a positive and meaningful impact on the participants in the experimental group.

The second research question focused on the impact of technology-enhanced collaborative writing instruction on the writing motivation of undergraduate students in Pakistan. To evaluate this, a pretest questionnaire was administered at the start of the study to measure students' initial levels of writing motivation. Both the experimental and control groups had similar mean scores (4.3204 for "the experimental group" and 4.5716 for "the control group"), with a t-value of .25120 and a two-tailed p-value of .071 confirming no statistically significant difference observed between the two groups. These findings indicate that both groups had comparable levels of motivation at the beginning of the study, providing a balanced foundation for assessing the impact of the technology-enhanced intervention.

Following the pre-test, the "experimental group" received four weeks of technology-enhanced collaborative writing instruction, while the control group continued with traditional teaching methods. Following this intervention, a post-test was administered in the fifth week to measure any changes in writing motivation. According to the post-test findings, there was a substantial difference between the groups, with the experimental group achieving a mean score of 4.5204, while the control group had a mean score of 3.1096. The t-value of -1.4108 and the two-tailed p-value of .005 indicated statistical significance. These findings suggest that technology-enhanced collaborative writing instruction had a positive impact on students' writing motivation, resulting in greater improvements for the experimental group compared to the control group, which received traditional instruction. Motivation is a key factor in L2 learning, influencing students' engagement with tasks, the effort they invest, and their persistence in completing those tasks (Waller & Papi, 2017). The significant improvement in writing motivation among the experimental group aligns with second-language (L2) motivation theories, which view motivation as a dynamic and evolving process (Dörnyei, 2001).

The current study on the impact of technology-enhanced collaborative writing instruction on L2 students' writing motivation resonates with findings from multiple studies. Fathi et al. (2019) investigation into blog-mediated writing instruction for 46 Iranian EFL learners offers a notable comparison. Their study, which spanned 16 weeks, demonstrated that blog-mediated instruction significantly increased writing motivation and self-regulation in the experimental group compared to the control group receiving traditional instruction. However, while the blog approach improved motivation, it decreased writing self-efficacy, suggesting that integrating technology into writing instruction may enhance both motivation and writing self-efficacy. However, the design and execution of such interventions are crucial for ensuring holistic benefits. In contrast, the current study's technology-enhanced collaborative writing instruction had a positive impact on both writing motivation and reduced anxiety, indicating a more comprehensive improvement in students' affective engagement.

Pathan et al. (2010) study, conducted with 145 undergraduate students from Pakistani public universities, explores motivation from an instrumental and integrative perspective. Their findings showed that students were primarily motivated to learn English for career prospects and status, reflecting instrumental motivation, but they also sought to integrate with English-speaking communities. This is consistent with the current study, as both highlight the role of motivation as a key driver in L2 writing performance. While Pathan's research did not specifically focus on writing, the underlying motivational factors play a critical role in shaping students' attitudes toward language learning, which also applies to writing.

In Ebadijalal and Moradkhani's (2023) mixed-methods study involving 66 Iranian EFL learners, collaborative writing and prewriting in a computer-mediated communication (CMC) context significantly improved writing motivation, especially for the collaborative prewriting (CPW) group, which outperformed the individual writing (IW) group. This study reinforces the current research by highlighting the motivational benefits of collaborative approaches within a technology-enhanced environment. Both studies confirm that collaboration in writing activities can foster a more engaged and motivated learning environment, particularly when technology is integrated effectively.

In summary, all three studies emphasise the importance of technology in enhancing writing motivation. The present study aligns with this, showing that technology-enhanced collaborative writing can significantly boost motivation while also reducing anxiety, a result that adds further depth to the pedagogical implications of L2 writing instruction.

Limitations and Pedagogical Implications

The findings of the present study offer several important implications for language education, particularly within the context of second language (L2) writing instruction in higher education. The positive impact of the technology-enhanced collaborative learning intervention suggests that integrating digital tools into classroom instruction can significantly enhance students' motivation and engagement in writing. Participants in the experimental group demonstrated increased involvement in writing tasks, indicating that the incorporation of technology-based collaborative strategies enhanced the learning environment's interactivity and student-centeredness. The real-time feedback mechanism, facilitated by technology, enabled learners to reflect on their writing, recognise their strengths, and address specific areas for improvement, thereby promoting self-regulated learning.

These outcomes highlight the potential of educational technology as a catalyst for improving writing proficiency and motivation in L2 contexts. As such, institutions should consider adopting technology-supported pedagogies to foster deeper learning and student engagement. It is recommended that university management provide structured professional development programs to train instructors in the effective use of digital tools for collaborative writing instruction. Additionally, classrooms should be adequately equipped with the necessary technological infrastructure to support these instructional innovations. The integration of engagement-driven activities and collaborative platforms not only encourages active participation but also creates a supportive environment that enhances students' confidence and ownership over their learning process.

Despite these promising results, the study is subject to certain limitations that must be acknowledged. First, the research was conducted at a single public university, which may limit the generalizability of the findings to broader educational contexts, particularly those with differing institutional resources or student demographics. Future studies should consider involving multiple institutions across diverse geographical and educational settings to enhance the external validity of the findings.

Second, the scope of the study was limited to examining the impact of technology-enhanced learning on L2 writing motivation only. While writing is a critical component of language proficiency, a comprehensive understanding of technology's role in language acquisition would benefit from exploring its impact on other language skills, such as speaking, reading, and listening. Expanding the range of dependent variables in future research could provide a more comprehensive perspective on how digital interventions impact language development across all four macro-skills.

Furthermore, the study's duration was relatively short, with the intervention spanning only one month. While meaningful changes were observed, a more extended intervention period might yield more profound insights into the long-term effects of technology-based collaborative writing instruction. Additionally, data were collected from a single group of undergraduate students, which may limit the applicability of the results to other learner populations, such as postgraduate students, learners at different proficiency levels, or students from non-academic contexts.

In conclusion, while the study provides compelling evidence in support of integrating technology-enhanced collaborative writing instruction in L2 classrooms, its limitations highlight the need for further research involving more diverse populations, extended timelines, and broader skill domains. Nonetheless, the current findings provide a valuable foundation for educators, administrators, and researchers seeking to leverage technology to enhance language learning outcomes in meaningful and pedagogically sound ways.

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