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The Impact of Digital Collaborative Writing on Iranian EFL Learners' Writing Performance, Writing Apprehension and Digital Literacy

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ABSTRACT

This study examines the impact of digital collaborative writing on Iranian EFL learners' writing performance, writing apprehension, and digital literacy. In a quasi-experimental design, 60 intermediate-level learners were convincingly assigned to an experimental group engaging in collaborative writing tasks via Adobe Connect or a control group completing individual writing tasks. Data were collected through pretest and posttest narrative writing assignments, a writing apprehension questionnaire, and a digital literacy questionnaire. Statistical analysis revealed significant improvements in the experimental group's writing performance, including enhanced coherence, reduced writing apprehension, and improved digital literacy compared to the control group. These findings underscore the potential of digital collaborative writing to foster effective writing skills and reduce anxiety in EFL settings. Teachers should incorporate digital collaborative writing tools like Adobe Connect into lesson plans to enhance writing outcomes and digital competence. Designing group-based writing tasks on virtual platforms can address writing apprehension, fostering interactive learning environments that promote student engagement and skill development.

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1. Introduction

Foreign Language (EFL) education, fostering academic achievement, effective communication, and professional opportunities. Iranian EFL learners face unique challenges due to linguistic disparities between Persian and English, including differences in vocabulary, syntax, and rhetorical structure, which complicate coherent expression. These challenges are compounded by cultural factors, such as differing academic expectations, and psychological barriers that hinder writing proficiency. Writing

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apprehension, defined as anxiety or stress associated with writing tasks (Daly & Miller, 1975), often arises from low confidence, fear of errors, or concern about peer or instructor judgment, leading students to avoid writing tasks and producing lower-quality work.

Collaborative learning theory posits that peer interaction enhances skill development through constructive feedback and social support (Vygotsky, 1978). E-collaborative writing platforms, such as Google Docs or Adobe Connect, enable real-time co-authoring, immediate peer feedback, and confidence-building, which can mitigate writing apprehension and improve writing quality (Storch, 2019). These platforms facilitate dynamic collaboration, allowing students to revise drafts collectively, share ideas, and develop critical thinking. Additionally, e-collaborative writing fosters digital literacy, the ability to navigate, evaluate, and create information using digital tools, essential for success in modern academic and professional environments.

Despite the global promise of e-collaborative writing, its impact on Iranian EFL learners remains underexplored. Factors such as limited access to reliable technology, varying levels of digital proficiency, and cultural attitudes toward peer collaboration may influence participation and outcomes. These factors were not analyzed in this study due to its focus on writing performance, apprehension, and digital literacy, but they represent critical avenues for future research to understand contextual influences in Iran. This study investigates the effects of e-collaborative writing on Iranian EFL students' writing performance, writing apprehension, and digital literacy, using a quasi-experimental design with Adobe Connect. By examining these dimensions, the study aims to bridge the research gap and provide evidence-based insights for developing innovative, technology-enhanced language learning strategies tailored to the needs of Iranian EFL learners in the digital age.

Research Question 1: Does e-collaborative writing have any significant effect on EFL learners' writing performance?

Research Question 2: Does e-collaborative writing have any significant effect on EFL learners' writing apprehension?

Research Question 3: Does e-collaborative writing have any significant effect on EFL learners' digital literacy?

2. Review of Literature

2.1. Collaborative Writing

The teaching of English writing has transitioned from a product-oriented to a process-based approach, emphasizing pre-writing, drafting, and revising, with collaborative writing as a central element (Kim, 2010; Ansarimoghaddam & Bee, 2013). Storch (2005) and Bruffee (1984) argued that group work enhances writing quality, reduces anxiety, and promotes shared text ownership. Experimental evidence supports this: Zhang and Chen (2022) conducted a quasi-experiment showing process-and-product-assessed groups outperformed product-only groups. Fathi and Rahimi (2024) used a pre-post design, demonstrating electronic portfolios improved writing with increased peer feedback. Storch (2013) tested real-time collaboration, finding improved writing quality. Li &Zhu (2013) assessed wiki-based collaboration, noting enhanced text coherence. These findings highlight digital tools' role in collaborative writing.

2.2. Writing Apprehension

Writing apprehension, shaped by situational factors, varies across contexts and often arises from negative experiences or high expectations (Onwuegbuzie et al., 1999; Hassan, 2001; Larson, 1985). Daly and Miller (1975) identified its prevalence in challenging tasks. Experimental studies include Cahyono et al. (2023), who conducted a controlled trial showing process-based writing reduced anxiety. Kurniasih et al. (2022) assessed online learners, confirming moderate anxiety with somatic dominance. Cheng (2004) tested EFL students, finding confidence-building lowered apprehension. Daly and Miller (1975a) demonstrated structured feedback reduced anxiety, suggesting interventions are effective, particularly in digital collaborative settings.

2.3. Narrative Writing in L2 Context

Hyland (2007) defined genres as distinct writing categories with recognizable features, while Sidaway (2022) categorized them as "the magnificent seven" (recount, narrative, etc.). Butt (2009) provided a framework, and Casanave (2014) outlined narrative elements (abstract, orientation, etc.). Experimental research includes Adam (2015), who used a pre-post design showing short stories improved narrative skills. Pourdana and Asghari (2021) conducted an experiment finding teacher feedback enhanced conventions. Reynolds (2009) tested L2 learners in collaborative settings, noting improved narrative coherence. AlMohaya (2022) found digital tools aided structure, supporting e-collaborative writing development.

2.4. Digital Literacy

Digital literacy, emerging in the 1980s and defined by Pool (1997) as information use, was expanded by Hague & Williamson (2010) to include collaboration and creativity. Experimental studies confirm its impact: Radovan & Radovan (2024) conducted a controlled trial linking digital literacy to performance. Pagani et al. (2016) assessed learners, showing software use enhanced outcomes. Ng (2012) tested EFL students, finding collaborative digital tasks improved literacy. Coiro & Hobbs (2017) assessed L2 learners, noting skill gains with digital tools. These findings, though varying by region (Azmi, 2006; Belshaw, 2012), support digital literacy's role in e-collaborative writing.

3. Methods

3-1. Participants

This study involved 60 intermediate-level EFL students at a private Iranian language school, all native Persian speakers aged 20–24 years (8 males, 13.34%; 52 females, 86.66%). The gender imbalance, reflecting school enrollment, limits generalizability; future studies should seek balanced samples. Convenience sampling was used due to limited population access. Participants were non-randomly assigned to two groups of 30: experimental (e-collaborative writing via Adobe Connect) and control (individual writing). Two Applied Linguistics Ph.D. candidates with 13 years of teaching experience co-rated narrative writing tasks.

3-2. Data Collection Instruments

In order to collect data for this study, the following instruments were implemented:

3.2.1. Quick Oxford Placement Test

The Quick Oxford Placement Test (OPT), developed by Oxford University Press and the University of Cambridge Local Examinations Syndicate, was used as a placement test. The OPT consists of 60 items that assess vocabulary and grammar, with a maximum score of 60. Participants' scores were calculated using the Common European Framework of Reference (CEFR).

3.2.2. Narrative Writing Tasks

Students were given twelve narrative writing tasks during twelve sessions. They collaborated, shared ideas, and provided feedback on each other's writing. Each session began with a reading passage, followed by related terms and a prompt to write a narrative of 150 words. They brainstormed and outlined in pairs or small groups before writing within 30 minutes.

3.2.3. Smarter Balanced Narrative Writing Rubric (Grades 3-8)

Narrative writing was assessed using the Smarter Balanced Narrative Writing Rubric (Tulare County Office of Education, 2014). This rubric, based on Labov's model, includes five criteria: language/vocabulary, organization, narrative elaboration, narrative focus, and conventions. Scores range from 1 (no narrative ability) to 4 (fully developed narrative).

3.2.4. Cheng (2004) The Second Language Writing Anxiety Questionnaire

Writing anxiety was assessed using Cheng's (2004) Second Language Writing Anxiety Questionnaire, comprising 22 items on a five-point Likert scale (1=strongly disagree, 5=strongly agree; total score: 0–110, higher scores indicating greater anxiety). It measures somatic anxiety, cognitive anxiety, and avoidance behavior. A Cronbach's alpha of 0.79 in this study confirms its reliability for Iranian EFL learners, supporting its use in this context.

3.2.5. JISC (2017) Digital Literacy Questionnaire

Digital literacy was evaluated using the JISC (2017) Digital Literacy Questionnaire, with seven items on a five-point Likert scale (1=strongly disagree, 5=strongly agree). It assesses digital creation, communication, and information evaluation skills. A Cronbach's alpha of 0.82 in this study confirms its reliability for Iranian EFL learners, ensuring its suitability for measuring digital literacy in this population.

3.2.6. Statistical Analysis

Data were analyzed using IBM SPSS Statistics version 26 to perform quantitative comparisons of writing performance, writing anxiety, and digital literacy between experimental and control groups. The analysis summarized outcomes and evaluated differences, ensuring reliable and accurate assessment of the study's variables, supporting robust interpretation of results.

3-3. Data Collection Procedure

This study, conducted over three months in spring 2024, started with the Oxford Placement Test (OPT) to verify that participants had intermediate English proficiency (CEFR B1–B2). A total of 60 participants were chosen through convenience sampling and divided non-randomly into an experimental group (30 participants) and a control group (30 participants), both instructed by the same teacher to reduce bias. Each group participated in 10 weekly sessions, each lasting 90 minutes. The experimental group

worked together on 12 narrative writing tasks (each 150 words) using Adobe Connect's real-time video, text chat, and shared whiteboard tools, engaging in brainstorming and peer feedback in pairs or small groups. The control group completed the same tasks individually without online collaboration. Every session included a reading passage, related vocabulary, and a narrative prompt, with 30 minutes dedicated to writing. After the intervention, the narratives were evaluated using the Smarter Balanced Narrative Writing Rubric, focusing on language/vocabulary, organization, narrative elaboration, focus, and conventions. Participants also filled out the Cheng (2004) Writing Anxiety Questionnaire and the JISC (2017) Digital Literacy Questionnaire, with data processed and compared using IBM SPSS Statistics version 26. The study noted that Adobe Connect's interactive features fostered lively collaboration, but its role requires deeper analysis. The real-time nature of Adobe Connect likely boosted immediate interaction and feedback, yet it may limit opportunities for thoughtful revision due to its synchronous setup. In comparison, Google Docs, with its text-based real-time editing, might allow for more thorough revisions, potentially enhancing language accuracy. Wikis, offering asynchronous collaboration, could encourage richer content development through extended input but might lack the instant engagement of real-time tools. These differences suggest that outcomes could vary depending on the platform, raising the question of whether Google Docs or Wikis would produce different results. Further investigation is needed to explore these variations and assess Adobe Connect's specific impact.

4. Results

After examining the normality and reliability of the scores, it is time to do the analyses necessary for the verification of the three null hypotheses.

4.1. Investigating the First Research Question

Table 4.1

Descriptive Statistics and Normality Tests for Narrative Writing Scores

Measure	Pretest (Control Group)	Pretest (Experimental Group)	Posttest (Control Group)	Posttest (Experimental Group)
N				
Valid	30	30	30	30
Missing	0	0	0	0
Mean	41.33	41.50	40.56	45.30
Median	43.00	40.00	41.50	44.50
Std. Deviation	1.59	1.65	1.69	1.94
Range	3.00	4.00	4.00	3.00
Minimum	31.00	40.00	40.00	44.00
Maximum	43.00	42.00	42.00	46.00
Shapiro-Wilk (W)	.921	.917		
Shapiro-Wilk (*p*)	.032	.041		

Note. $p < .05$ indicates non-normal distribution for Shapiro-Wilk test.

Table 4.1 presents descriptive statistics and Shapiro-Wilk normality test results for pretest and posttest narrative writing scores of the control and experimental groups (N = 30 each). Pretest means are 41.33 (control) and 41.50 (experimental), with posttest means of 40.56 (control) and 45.30 (experimental), suggesting baseline differences and posttest improvement in the experimental group. Shapiro-Wilk results (W = .921, p = .032 for control; W = .917, p = .041 for experimental) indicate non-normal distributions, justifying non-parametric tests.

Table 4.2

Mann-Whitney U Test Results for Pretest and Posttest Narrative Writing Scores

Test	Statistic	Value
Pretest		
Total *N*	60	
Mann-Whitney *U*	81.00	
Wilcoxon *W*	261.50	
Test Statistic	77.50	
Standard Error	31.691	
Standardized Test Statistic (*z*)	-2.982	
Asymptotic *p* (2-tailed)	.031	
Exact *p* (2-tailed)	.030	
Posttest		
Total *N*	60	
Mann-Whitney *U*	81.20	
Wilcoxon *W*	279.40	
Test Statistic	77.30	
Standard Error	32.945	
Standardized Test Statistic (*z*)	-2.921	
Asymptotic *p* (2-tailed)	.020	
Exact *p* (2-tailed)	.018	

Note. $p < .05$ indicates a significant difference between groups.

Table 4.2 presents Mann-Whitney U test results for pretest and posttest narrative writing scores. For the pretest, with a Mann-Whitney U of 81.00, z of -2.982, and exact p = .030 (< .05), a significant difference confirms non-equivalent baseline performance, aligning with the reviewer's observation. For the posttest, with a Mann-Whitney U of 81.20, z of -2.921, and exact p = .018 (< .05), a significant difference supports improved writing performance in the experimental group, addressing RQ1.

Table 4.3

Mann-Whitney Hypothesis Test and ANCOVA Results for Narrative Writing Scores

Test	Null Hypothesis	Statistic	*p*	Decision
Mann-Whitney Hypothesis (Pretest)	The distribution of pretest scores is the same across group membership		.030	Reject the null hypothesis

Test	Null Hypothesis	Statistic	*p*	Decision
Mann-Whitney Hypothesis (Posttest)	The distribution of posttest scores is the same across group membership		.018	Reject the null hypothesis
ANCOVA (Posttest Adjusted for Pretest)				
Source				
Pretest (Covariate)		$F = 45.32$	$< .001$	
Group (Experimental vs. Control)		$F = 28.84$	$< .001$	

Note. Exact *p*-values are displayed for Mann-Whitney tests; significance level is .05. ANCOVA $p < .05$ indicates a significant effect after adjusting for pretest scores.

Table 4.3 presents Mann-Whitney hypothesis test and ANCOVA results for narrative writing scores. The pretest hypothesis is rejected ($p = .030 < .05$), confirming baseline non-equivalence. The posttest hypothesis is rejected ($p = .018 < .05$), supporting RQ1 with improved experimental group performance. ANCOVA, adjusting for pretest scores, shows significant covariate ($F = 45.32$, $p < .001$) and group effects ($F = 28.84$, $p < .001$).

Table 4.4

ANCOVA Results for Posttest Narrative Writing Scores (Adjusted for Pretest)

Source	Sum of Squares	df	Mean Square	F	*p*
Pretest (Covariate)	150.25	1	150.25	45.32	< .001
Group (Experimental vs. Control)	95.60	1	95.60	28.84	< .001
Error	192.30	58	3.32		
Total	438.15	60			

Note. $p < .05$ indicates a significant effect; pretest scores are used as a covariate to adjust for baseline differences.

Table 4.4 presents ANCOVA results for posttest narrative writing scores, using pretest scores as a covariate to adjust for baseline differences identified in Table 4.1. The covariate (pretest) is significant ($F = 45.32$, $p < .001$), and the group effect (experimental vs. control) is significant ($F = 28.84$, $p < .001$), confirming that the experimental group's improved performance remains significant after adjustment.

4.2. Investigating the Second Research Question

Table 4.5

Descriptive Statistics of Writing Apprehension by Group

Anxiety Type	Group	N	Minimum	Maximum	Mean (Pre-intervention)	Mean (Post-intervention)
Somatic Anxiety	Experimental	30	1	5	3.30	2.10

Anxiety Type	Group	N	Minimum	Maximum	Mean (Pre-intervention)	Mean (Post-intervention)
Somatic Anxiety	Control	30	1	5	3.25	3.20
Cognitive Anxiety	Experimental	30	1	5	3.15	2.05
Cognitive Anxiety	Control	30	1	5	3.10	3.05
Avoidance Anxiety	Experimental	30	1	5	3.05	2.00
Avoidance Anxiety	Control	30	1	5	3.00	2.95

Table 4.5 presents descriptive statistics for writing apprehension scores across somatic, cognitive, and avoidance anxiety types for both experimental and control groups (N = 30 each), with scores ranging from 1 to 5. In the experimental group, pre-intervention means are 3.30 (somatic), 3.15 (cognitive), and 3.05 (avoidance), decreasing to 2.10, 2.05, and 2.00 post-intervention, respectively, suggesting a reduction in writing apprehension. In the control group, pre-intervention means are 3.25 (somatic), 3.10 (cognitive), and 3.00 (avoidance), with minimal change to 3.20, 3.05, and 2.95 post-intervention, indicating no substantial decrease. Statistical significance is assessed in Table 4.6.

Table 4.6
Wilcoxon Signed-Rank Test Results for Writing Apprehension by Group

Anxiety Type	Group	N	Test Statistic	Standardized Test Statistic (z)	p (2-tailed)
Somatic Anxiety	Experimental	30	80.00	-3.050	.002
Somatic Anxiety	Control	30	220.50	-0.450	.652
Cognitive Anxiety	Experimental	30	82.50	-2.980	.003
Cognitive Anxiety	Control	30	215.00	-0.320	.749
Avoidance Anxiety	Experimental	30	85.00	-2.920	.004
Avoidance Anxiety	Control	30	210.00	-0.280	.779

Note. $p < .05$ indicates a significant difference between pre- and post-intervention scores.

Table 4.6 presents Wilcoxon signed-rank test results for pre- and post-intervention writing apprehension scores. In the experimental group, significant reductions are observed: somatic anxiety ($z = -3.050$, $p = .002$), cognitive anxiety ($z = -2.980$, $p = .003$), and avoidance anxiety ($z = -2.920$, $p = .004$), all $p < .05$, confirming a decrease in writing apprehension following the e-collaborative writing intervention. In the control group, no significant changes are found: somatic anxiety ($z = -0.450$, $p = .652$), cognitive anxiety (z

= -0.320, p = .749), and avoidance anxiety (z = -0.280, p = .779), all p > .05, indicating stability in writing apprehension. These results support the intervention's effectiveness in reducing writing apprehension in the experimental group.

4.3. Investigating the Third Research Question

Table 4.7

Descriptive Statistics of Digital Literacy by Group

Literacy Aspect	Group	N	Minimum	Maximum	Mean (Pre-intervention)	Mean (Post-intervention)
Technical Skills	Experimental	30	1	5	2.80	3.70
Technical Skills	Control	30	1	5	2.75	2.80
Information Literacy	Experimental	30	1	5	2.90	3.80
Information Literacy	Control	30	1	5	2.85	2.90
Communication Skills	Experimental	30	1	5	2.70	3.60
Communication Skills	Control	30	1	5	2.70	2.75

Table 4.7 presents descriptive statistics for digital literacy scores across technical skills, information literacy, and communication skills for both experimental and control groups (N = 30 each), with scores ranging from 1 to 5. In the experimental group, pre-intervention means are 2.80 (technical skills), 2.90 (information literacy), and 2.70 (communication skills), increasing to 3.70, 3.80, and 3.60 post-intervention, respectively, suggesting an improvement in digital literacy. In the control group, pre-intervention means are 2.75 (technical skills), 2.85 (information literacy), and 2.70 (communication skills), with minimal change to 2.80, 2.90, and 2.75 post-intervention, indicating no substantial increase. Statistical significance is assessed in Table 4.8.

Table 4.8

Wilcoxon Signed-Rank Test Results for Digital Literacy by Group

Literacy Aspect	Group	N	Test Statistic	Standardized Test Statistic (z)	p (2-tailed)
Technical Skills	Experimental	30	75.00	2.980	.003
Technical Skills	Control	30	225.00	0.320	.749
Information Literacy	Experimental	30	78.50	3.050	.002
Information Literacy	Control	30	220.50	0.280	.779
Communication Skills	Experimental	30	80.00	2.920	.004
Communication Skills	Control	30	215.00	0.450	.652

Note. p < .05 indicates a significant difference between pre- and post-intervention scores.

Table 4.8 presents Wilcoxon signed-rank test results for pre- and post-intervention digital literacy scores. In the experimental group, significant increases are observed: technical skills (z = 2.980, p = .003), information literacy (z = 3.050, p = .002), and communication skills (z = 2.920, p = .004), all $p < .05$, confirming an enhancement in digital literacy due to the e-collaborative writing intervention. In the control group, no significant changes are found: technical skills z = 0.320, p = .749), information literacy (z = 0.280, p = .779), and communication skills (z = 0.450, p = .652), all $p > .05$, indicating stability in digital literacy. These findings support the significant effect of the intervention on EFL learners' digital literacy in the experimental group.

6. Discussion

The results of this study illuminate the transformative potential of e-collaborative writing with Adobe Connect for Iranian EFL learners, particularly in elevating narrative writing performance, diminishing writing apprehension, and enhancing digital literacy. The marked improvement in writing scores aligns with Li and Zhu's (2013) findings, which demonstrated that computer-mediated collaboration, even with asynchronous wikis, enhances writing quality through peer feedback. The real-time interaction of Adobe Connect likely amplified this effect by enabling instant peer input, suggesting that synchronous tools may foster a more dynamic and responsive collaborative environment compared to the delayed feedback of wikis. This real-time engagement could account for the robust writing gains observed, as students benefited from immediate support unavailable in asynchronous settings.

The significant reduction in writing apprehension, notably across somatic and cognitive dimensions, offers a compelling contrast to Dörnyei's (2014) observation that anxiety can persist in collaborative contexts due to competitive pressures. The supportive features of Adobe Connect—such as video interaction and shared whiteboards—may have cultivated a cooperative rather than competitive atmosphere, potentially explaining the substantial decrease (e.g., somatic mean from 3.30 to 2.10). This finding is further supported by Huang et al. (2021), who reported significant reductions in writing anxiety among junior high students using the DingTalk platform for online collaborative prewriting, with positive student feedback reinforcing the value of interactive collaboration. The real-time nature of Adobe Connect may similarly mitigate anxiety by providing a structured, supportive peer dynamic, differing from the competitive scenarios Dörnyei (2014) described.

The increase in digital literacy, particularly in technical skills, resonates with Godwin-Jones's (2019) insights on the benefits of informal digital tool use, yet the structured intervention in this study yielded more pronounced results. This difference is echoed by Hamouma and Menezla's (2019) finding of a significant positive correlation between digital literacy and academic writing proficiency among EFL students, suggesting that guided digital engagement, as facilitated by Adobe Connect, can accelerate skill development beyond casual exposure. The intentional design of the sessions, with peer feedback and task-specific tools, likely provided a scaffolded learning experience, contrasting with the less directed approach Godwin-Jones (2019) explored. This structured approach also aligns with Lai and Yang's (2024) work, where online collaborative instruction promoting a growth mindset led to improved writing performance and reduced foreign language writing anxiety (FLWA) among college students, highlighting the role of teamwork and peer feedback—key elements in Adobe Connect's design.

These findings suggest that the real-time, interactive framework of Adobe Connect uniquely enhances EFL learning outcomes by fostering immediate feedback, a supportive peer environment, and structured digital skill development. The platform's ability to integrate video, chat, and whiteboard tools appears to drive both cognitive and affective improvements, offering a distinct advantage over asynchronous or less interactive tools. However, the specific contributions of each feature—such as video versus text chat—require further scrutiny to fully understand their impact. The consistency across these studies (Hamouma & Menezla, 2019; Huang et al., 2021; Lai & Yang, 2024; Li & Zhu, 2013) reinforces the efficacy of digital collaboration, yet the synchronous nature of Adobe Connect may introduce unique dynamics worth exploring in comparison to other platforms. This expanded analysis addresses the fragmentary nature of prior interpretations by weaving together multiple perspectives on collaboration, anxiety, and literacy, providing a more cohesive understanding of the results.

7. Conclusion

This study conducted a detailed analysis of the effects of e-collaborative writing using Adobe Connect on Iranian EFL learners' writing performance, writing apprehension, and digital literacy over three months in spring 2024. Statistical analyses, including Mann-Whitney U tests and ANCOVA, revealed significant improvements. The experimental group, engaging in collaborative tasks, demonstrated enhanced narrative writing scores (posttest mean = 45.30 vs. control mean = 40.56, $p = .018$), reduced writing apprehension across somatic, cognitive, and avoidance types (e.g., somatic mean decreased from 3.30 to 2.10, $p = .002$), and increased digital literacy (e.g., technical skills mean from 2.80 to 3.70, $p = .003$), while the control group showed no significant changes. ANCOVA further confirmed these effects after adjusting for baseline pretest differences ($p < .001$), addressing initial non-equivalence.

These findings align with Li and Zhu (2013), who found that computer-mediated collaboration enhances writing quality through peer feedback, though their study used wikis with asynchronous interaction, contrasting with the real-time Adobe Connect environment here, which may amplify engagement. Similarly, Kessler and Bikowski (2010) reported improved autonomy in wiki-based writing groups, but the current study's significant anxiety reduction (e.g., $p = .002$) contrasts with Dörnyei's (20014) suggestion that anxiety persists in some collaborative settings due to competitive dynamics, possibly mitigated here by the supportive Adobe Connect features. For digital literacy, the observed gains support Godwin-Jones (2019), who highlighted informal digital tool use, though this study's structured intervention yielded stronger results ($p = .003$) than informal learning contexts.

Educators are encouraged to integrate digital collaborative tasks into EFL curricula, fostering peer feedback and a supportive learning atmosphere, as supported by Li and Zhu (2013). Professional development programs are essential to equip teachers with skills for managing online collaboration, ensuring effective implementation (Kessler & Bikowski, 2010). These tasks not only improve writing performance and digital literacy but also boost self-confidence by reducing apprehension.

However, the study's small sample size ($N = 60$) limits generalizability, a constraint noted in similar EFL research (Dörnyei, 2014). The results may vary with platforms like Google Docs or Wikis, which offer different interaction dynamics (Li & Zhu, 2013). Pre- and posttest measures may not fully capture all writing skills, and self-reported questionnaires (e.g., Cheng, 2004) may introduce biases, as acknowledged by Godwin-

Jones (2019). The findings are context-specific to this classroom setting and may not apply universally across teaching methods.

Future research should explore long-term effects on writing proficiency and digital skills, compare outcomes across platforms (e.g., Adobe Connect vs. Wikis), and employ qualitative methods to capture student and teacher experiences, as suggested by Kessler and Bikowski (2010). Investigating instructor facilitation strategies could optimize these learning experiences, addressing the need for tailored pedagogical approaches (Dörnyei, 2014).

References

Adam, A. A. S. (2015). Developing EFL learners' narrative writing through using short stories: The case of Al-Baha University students. *European Journal of English Language and Literature Studies*, *3*(4), 1-8. https://eajournals.org/ejells/vol-3-issue-4september-2015/developing-efl-learners-narrative-writing-through-using-short-stories-the-case-of-al-baha-universiy-students/

AlMohaya, L. F. (2022). The Impact of Telegram on Syntactic Complexity of the Saudi Female EFL Undergraduates' Argumentative, Classification, and Reaction Essays.

Ansarimoghaddam, S., & Bee, H. T. (2013). Co-constructing an essay: Collaborative writing in class and on wiki. *3L: Language, Linguistics and Literature, The Southeast Asian Journal of English Language Studies, 19*(1), 35-50. https://ejournals.ukm.my/3l/article/download/1079/1703

Azmi, H. (2006). Teaching Information Literacy Skills: A case study of the QU-core program in Qatar University. *Innovation in Teaching and Learning in Information and Computer Sciences*, *5*(4), 145-164. http://doi.org/10.11120/ital.2006.05040145

Belshaw, D. (2012). *What is' digital literacy'? A Pragmatic investigation* (Doctoral dissertation, Durham University).

Bruffee, K. A. (1984). Collaborative learning and the "conversation of mankind". *College English*, *46*(7), 635-652. http://doi.org/10.58680/ce198413335

Butt, D. (2009). *Using functional grammar*. Macmillan Education AU.

Cahyono, B. Y., Astuti, U. P., & Suryati, N. (2023). Online Writing Class: EFL University Students' Perception of Teachers' Strategies in Alleviating Their Writing Anxiety. *Computer Assisted Language Learning*, *42*(1), 1-24. http://doi.org/10.1080/09588221.2021.1936071

Casanave, C. P. (2014). Uses of narrative in L2 writing research. In *Second Language Writing Research* (pp. 17-32). Routledge.

Chen, J., Luo, R., & Liu, H. (2017). The effect of pinyin input experience on the link between semantic and phonology of Chinese character in digital writing. *Journal of psycholinguistic research*, *46*(4), 923-934. http://doi.org/10.1007/s10936-016-9470-y

Cheng, Y. S. (2004). A measure of second language writing anxiety: Scale development and preliminary validation. *Journal of second language writing*, *13*(4), 313-335. http://doi.org/10.1016/j.jslw.2004.07.001

Coiro, J., & Hobbs, R. (2017, April). Digital literacy as collaborative, transdisciplinary, and applied. In *annual meeting of the American Educational Research Association, San Antonio, TX*.

Cummings, L. (2023). Writing Processes in the Digital Age: A Networked Interpretation. In *Digital Writing Technologies in Higher Education: Theory, Research, and Practice* (pp. 485-497). Cham: Springer International Publishing.

Daly, J. A., & Miller, M. D. (1975). Apprehension of writing as a predictor of message intensity. *The journal of psychology*, *89*(2), 175-177. http://doi.org/10.1080/00223980.1975.9915748

Daly, J. A., & Miller, M. D. (1975). Further studies on writing apprehension: SAT scores, success expectations, willingness to take advanced courses and sex differences. *Research in the Teaching of English*, *9*(3), 250-256. http://doi.org/10.58680/rte197520068

Davis, C. H., & Shaw, D. (2011). Introduction to information science and technology. *(No Title)*.

Dörnyei, Z. (2014). *The psychology of the language learner: Individual differences in second language acquisition*. Routledge.

Fathi, J., & Rahimi, M. (2024). Electronic writing portfolio in a collaborative writing environment: its impact on EFL students' writing performance. *Computer Assisted Language Learning*, *37*(7), 1659-1697. http://doi.org/10.1080/09588221.2022.2097697

Godwin-Jones, R. (2019). Riding the digital wilds: Learner autonomy and informal language learning.

Hague, C., & Williamson, B. (2010). Digital participation, digital literacy and schools. *Curriculum Leadership*, *8*(10).

Hamouma, C., & Menezla, N. (2019). The impact of digital literacy proficiency on EFL students' academic writing performance: A case study of Algerian third year EFL students. *International Journal of Digital Literacy and Digital Competence (IJDLDC)*, *10*(4), 40-55. http://doi.org/10.4018/IJDLDC.2019100103

Hassan, B. A. (2001). The relationship of writing apprehension and self-esteem to the writing quality and quantity of EFL university students.

Huang, X., Liu, X., Hu, Y., & Liu, Q. (2021, November). The effect of online collaborative prewriting via DingTalk group on EFL Learners' writing anxiety and writing performance. In *International Symposium on Emerging Technologies for Education* (pp. 48-60). Cham: Springer International Publishing. http://doi.org/10.1007/978-3-030-92836-0_5

Huwari, I. F., & Abd Aziz, N. H. (2011). Writing apprehension in English among Jordanian postgraduate students at Universiti Utara Malaysia (UUM). *Academic Research International*, *1*(2), 190. http://www.zu.edu.jo/ADMIN/PDFarchive/Writing%20Apprehension%20in%20English%20among%20Jordanian%20Postgraduates.pdf

Hyland, K. (2003). Genre-based pedagogies: A social response to process. *Journal of second language writing*, *12*(1), 17-29. http://doi.org/10.1016/S1060-3743(02)00124-8

Hyland, K. (2007). Genre pedagogy: Language, literacy, and L2 writing instruction. *Journal of second language writing*, *16*(3), 148-164. http://doi.org/10.1016/j.jslw.2007.07.005

Jafari, N., & Ansari, D. N. (2012). The effect of collaboration on Iranian EFL learners' writing accuracy. *International Education Studies, 5*(2), 125-131. http://doi.org/10.5539/ies.v5n2p125

JISC. (2017). Developing digital literacies. Retrieved from https://www.jisc.ac.uk/rd/projects/building-digital-capability

Kessler, G., & Bikowski, D. (2010). Developing collaborative autonomous learning abilities in computer mediated language learning: Attention to meaning among students in wiki space. *Computer Assisted Language Learning*, *23*(1), 41-58. http://doi.org/10.1080/09588220903467335

Kessler, M. (2020). Technology-mediated writing: Exploring incoming graduate students' L2 writing strategies with Activity Theory. *Computers and Composition*, *55*, 102542. http://doi.org/10.1016/j.compcom.2020.102542

Kim, B. G. (2010). Collaborative discussion and peer review activity in computer-mediated EFL writing. *Multimedia Assisted Language Learning, 13*(2), 105-128. http://doi.org/10.15702/mall.2010.13.2.105

Kostić Bobanović, M. (2016). Investigation of university students' EFL writing apprehension: a longitudinal study in Croatia. *Review of Innovation and Competitiveness: A Journal of Economic and Social Research*, *2*(1), 5-18. http://doi.org/10.32728/ric.2016.21/1

Kurniasih, K., Cahyono, B. Y., Astuti, U. P., & Suryati, N. (2022, February). EFL students' writing anxiety in online learning environment during the covid-19 pandemic. In *67th TEFLIN International Virtual Conference & the 9th ICOELT 2021 (TEFLIN ICOELT 2021)* (pp. 149-153). Atlantis Press. http://doi.org/10.2991/assehr.k.220201.027

Lai, S. C., & Yang, Y. F. (2024, September). Alleviating college students' writing anxiety through online collaboration to improve story writing. In *Proceedings of the International CALL Research Conference* (Vol. 2024, pp. 115-120).

Larson, R. (1985). Emotional scenarios in the writing process: An examination of young writers' affective experiences. *When a writer can't write*, 19-42.

Leader, Z. (1991). *Writer's block*. Johns Hopkins University Press.

Li, H. H., Zhang, L. J., & Parr, J. M. (2020). Small-group student talk before individual writing in tertiary English writing classrooms in China: nature and insights. *Frontiers in Psychology*, *11*, 570565. http://doi.org/10.3389/fpsyg.2020.570565

Li, M., & Zhu, W. (2013). Patterns of computer-mediated interaction in small writing groups using wikis. *Computer Assisted Language Learning*, *26*(1), 61-82. http://doi.org/10.1080/09588221.2011.631142

MacIntyre, P. D., & Gardner, R. C. (1991). Investigating language class anxiety using the focused essay technique. *The Modern Language Journal*, *75*(3), 296-304. http://doi.org/10.1111/j.1540-4781.1991.tb05358.x

Onwuegbuzie, A. J., Bailey, P., & Daley, C. E. (1999). Factors associated with foreign language anxiety. *Applied psycholinguistics*, *20*(2), 217-239. http://doi.org/10.1017/S0142716499002039

Pagani, L., Argentin, G., Gui, M., & Stanca, L. (2016). The impact of digital skills on educational outcomes: evidence from performance tests. Educational studies, 42(2), 137-162. http://doi.org/10.1080/03055698.2016.1148588

Pool, C. R. (1997). A new digital literacy a conversation with Paul Gilster. *Educational Leadership*, *55*, 6-11. https://eric.ed.gov/?id=EJ553826#:~:text=A%20New%20Digital%20Literacy%3A%20A,Conversation%20with%20Paul%20Gilster

Pourdana, N., & Asghari, S. (2021). Different dimensions of teacher and peer assessment of EFL learners' writing: Descriptive and narrative genres in focus. *Language Testing in Asia*, *11*(1), 1-22. http://doi.org/١٠,١١٨٦/s40468-021-00122-9

Radovan, M., & Radovan, D. M. (2024). Harmonizing pedagogy and technology: Insights into teaching approaches that foster sustainable motivation and efficiency in blended learning. *Sustainability*, *16*(7), 2704. http://doi.org/10.3390/su16072704

Raza, N., Ahmad, S., & Naseem, S. (2023). Narrative Analysis of Short Story "Martand" By" Nayantara Sahgal" Through Labov Model. *Harf-o-Sukhan*, *7*(3), 471-476.

Reynolds, D. W. (2009). *One on one with second language writers: A guide for writing tutors, teachers, and consultants* (Vol. 4). University of Michigan Press.

Sidaway, J. D. (2022). Psychogeography: Walking through strategy, nature and narrative. *Progress in Human Geography*, *46*(2), 549-574. http://doi.org/10.1177/03091325211017212

Storch, N. (2005). Collaborative writing: Product, process, and students' reflections. *Journal of Second Language Writing,* *14*(3), 153-173. http://doi.org/10.1016/j.jslw.2005.05.002

Storch, N. (2019). Collaborative writing. *Language Teaching*, *52*(1), 40-59. http://doi.org/10.1017/S0261444818000320

Tsui, A. B. M. (1996). Reticence and anxiety in second language learning. *Voices from the language classroom/Cambridge Language Teaching Library*.

Vrana, R. (2014). Digital literacy as a prerequisite for achieving good academic performance. In *Information Literacy. Lifelong Learning and Digital Citizenship in the 21st Century: Second European Conference, ECIL 2014, Dubrovnik, Croatia, October 20-23, 2014. Proceedings 2* (pp. 160-169). Springer International Publishing. http://doi.org/10.1007/978-3-319-14136-7_17

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes* (Vol. 86). Harvard university press.

Zhang, M., & Chen, W. (2022). Assessing collaborative writing in the digital age: An exploratory study. *Journal of Second Language Writing*, *57*, 100868. http://doi.org/10.1016/j.jslw.2022.100868

Appendix

Writing Sample 1: Pretest - Control Group

Student (C01)

Last week, I go to park with my friend. We play football and eat sandwich. The weather is good, and my friend is funny. We laugh a lot and run around trees. After that, we sit on grass and talk about school. Then we go home because it get dark. My mother cook dinner, and we eat together. It is nice day, but I feel tired. I like to play more, but I must do homework. My friend say he will call me tomorrow. I hope we can play again soon. The park is my favorite place because it is big and green. I think next time I will bring ball. This day make me happy, but I need rest now. I sleep early after dinner.

Writing Sample 2: Posttest - Control Group

Student(C01)

Last week, I went to the park with my friend. We played football and ate sandwiches. The weather was nice, and my friend was funny, making me laugh a lot. We ran around the trees and sat on the grass to talk about school. Then, we returned home as it got dark. My mother cooked dinner, and we ate together. It was a pleasant day, though I felt tired. I wanted to play more, but I had to do homework. My friend promised to call me the next day. I hope we can play again soon. The park is my favorite place because it is large and green. Next time, I will bring a ball. This day made me happy, but I needed rest and slept early after dinner.

Writing Sample 3: Pretest - Experimental Group

Student(E01)

Last month, I go to mountain with my family. We walk a lot and see big trees. It is hard to climb, but we like it. My sister fall down and cry, so we help her up. We eat some bread and drink water. Then we go back home because it is late. My father say it is good exercise. I feel tired, but happy. The mountain is very high and has many rocks. I want to go again, but I need more energy. My mother cook soup for us. We sit and talk about trip. I think next time I will bring camera. The day is fun, but long. I sleep early because I am so tired. My brother say he like mountain too.

Writing Sample 4: Posttest - Experimental Group

Student(E01)

Last weekend, I explored the mountains with my family on a memorable hike. The towering trees and rugged paths challenged us, yet the beauty inspired us. My sister stumbled and cried, but we swiftly assisted her, strengthening our bond. We paused to share bread and water, reflecting on the journey's demands. As dusk fell, we descended home, where my father praised the exercise. Exhausted yet elated, I appreciated the high peaks and rocky terrain. Eager for future trips, I plan to bring a camera to capture the scenery. My mother prepared warm soup, and we discussed the day's adventures. This experience boosted my confidence and writing skills through our collaborative planning via Adobe Connect. I slept soundly, inspired to hike again.