

The Effects of Computer-Assisted Collaborative Writing, Collaborative Prewriting, and Individual Writing on Writing Anxiety and Attitude of Iranian EFL Learners

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Abstract

The goal of this present mixed-methods study was to analyze how three different writing conditions (i.e., collaborative writing, collaborative prewriting, and individual writing) affected the performance and motivation levels of 53 Iranian EFL learners in a computer-mediated communication context. The data collection process encompassed several methods, including the administration of a background questionnaire, a writing anxiety scale, pretest and posttest writing performance assessments, audio-recorded reflections, and individual interviews. Analysis of the quantitative data involved one-way ANOVA and paired-samples t-test, while the qualitative data were carefully examined through a three-phase thematic analysis. The obtained results revealed that the collaborative writing group significantly surpassed the individual writing group on the posttest. In contrast, there was no correlation between collaborative writing and individual writing groups. Additionally, as a consequence of engaging in collaborative writing and prewriting within a computer-mediated communication context, the participants experienced a notable decline in their writing anxiety. Along with presenting further findings, the paper delves into the implications for teaching and learning and proposes future research opportunities.

Keywords: Attitude; Collaborative writing; Collaborative prewriting; Individual writing; Writing anxiety

1. Introduction

The field of English as a Foreign Language (EFL) education has experienced a major shift in recent years, largely attributed to the integration of computer-mediated tools. These tools, such as Google Docs and other Web 2.0 platforms, have revolutionized writing instruction by

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providing innovative avenues for collaborative writing (CW) activities (Hsu, 2019; Shimizu, 2024). The utilization of online CW in language learning environments has garnered substantial interest and has become a prevalent practice in EFL contexts (Zhang, 2018). CW involves the joint effort of two or more writers throughout the entire writing process, offering learners unique opportunities for participation and interaction, ultimately enhancing their writing skills (Storch, 2005). Moreover, collaborative prewriting (CPW) has emerged as a widely adopted practice in EFL classrooms, encouraging collaborative engagement in generating ideas and planning before individual writing tasks (McDonough et al., 2018a). While CW involves students interacting during the various stages of writing, CPW focuses on collaborative idea generation and planning, with students then composing their texts individually. Studies have shown that CPW not only fosters collaboration but also aids in the development of writing skills among language learners (McDonough et al., 2018b; Shadiev et al., 2024).

Research on CW in second language (L2) contexts has provided valuable insights into its effectiveness on various aspects of L2 writing. CW tasks have been found to positively impact the accuracy, complexity, and overall quality of L2 texts (Sang & Zou, 2022). By engaging in joint production, learners are encouraged to deliberate on language choices and grammatical accuracy, leading to improved writing outcomes (Storch, 2018). Additionally, collaborative prewriting discussions have been shown to enhance students' evaluation of ideas and writing planning, thereby benefiting their L2 writing performance (Neumann & McDonough, 2015). Studies have also highlighted the motivational aspect of group writing activities in mediating L2 learning, further underlining the positive effects of collaborative writing on L2 proficiency (Kim & Kim, 2021). CW not only aids in language development but also promotes learner autonomy, cooperative learning, and self-efficacy in L2 writing (Bhowmik et al., 2018; Zhou et al., 2022). Overall, CW activities have been recognized as instrumental in fostering language skills, communicative abilities, and engagement among L2 learners (Lu & Kim, 2021; Khatib & Meihami, 2015). Nevertheless, there are lingering questions about whether CPW shares the same advantages as CW (McDonough et al., 2018a). Furthermore, in L2 literature, much attention has been given to the benefits of individual prewriting, without much consideration for CPW (Naghavi & Nakhleh, 2019). Furthermore, past studies have investigated the increased syntactical complexity, as well as the lexical and grammatical accuracy, of texts written collaboratively

(Abrams, 2019). However, there is an inadequacy of research on the empirical effects linked with CPW, noticeably in the absence of teacher monitoring, as well as on the juxtaposition of CPW and IW to investigate whether CPW planning exerts more positive impact on learner-generated texts than individual planning (McDonough & De Vleeschauwer, 2019), making the comparison between the three (i.e., CW, CPW, and IW) a preferable research direction to accompany with.

In addition to the aforementioned gaps, there is another deficiency in the existing literature that this current study aims to address. The difficulty of writing for language learners has been widely acknowledged (Bhatti et al., 2023), and different studies highlight the crucial role that anxiety plays in the writing process. Additionally, studies have shown that L2 learners' attitudes toward collaborative writing can influence their participation and performance in such activities (Chen & Hapgood, 2019). Although it is widely accepted that a minimal amount of anxiety is necessary for effective writing (Kurniasih et al., 2020), the exploration of writing anxiety in EFL settings has received scant attention (Abdullah et al., 2018), suggesting that this area is still in its nonage.

2. Literature Review

2.1. Collaborative Writing and Collaborative Prewriting

CW has gained prominence as a promising research domain in face-to-face and computer-mediated communication due to the transition from product-oriented to process-oriented writing approaches (Li, 2018; Zhang et al., 2021; Zhang & Plonsky, 2020). Consequently, EFL teachers and researchers have shown great interest in exploring this area (Selcuk et al., 2019). The foundation of CW is built upon Vygotsky's (1978) sociocultural theory, which emphasizes the role of social interaction in learning and the importance of speech and communication in language and cognitive development. According to Yang (2017), in the context of CW, there is a focus on promoting social interaction among learners. During writing tasks, individuals who possess greater knowledge provide scaffolding and feedback to those with less knowledge in order to support their learning process. It was initially assumed that only experts were capable of providing such support, but research, such as Donato (1994), has revealed that L2 learners also scaffold each other during collaborative activities.

Numerous studies have shown empirical evidence to support the substantial advantages of peer interaction in L2 learning contexts, as established by a considerable body of literature (Sippel, 2024). It is widely acknowledged that the co-construction of L2 knowledge heavily relies on

collaborative interaction, which has been proven to be an effective tool in enhancing L2 learning (Lialikhova, 2019). Neumann and McDonough (2014) conducted an experiment on English L2 university students and concluded that paragraphs written in a CPW condition were given higher ratings than those written in separation. McDonough et al. (2018a) conducted a study to evaluate the accuracy of texts written in a face-to-face environment under three situations: CPW, CW, and IW. The findings revealed that texts written collaboratively received significantly higher ratings compared to those written individually or with a partner. Despite the fact that CPW was used, it did not result in any statistically significant difference in accuracy when compared to IW. McDonough and De Vleeschauwer (2019) conducted a follow-up study where they aimed to examine and compare the impacts of collaborative and individual pre-writing planning on a group of 60 EFL writers. This study took place in a face-to-face setting, where half of the participants engaged in individual planning while the other half collaborated with their peers. Following the planning phase, the students then worked independently to compose their written texts. It was observed that those who engaged in collaborative planning demonstrated a significant increase in accuracy, while individual planners experienced an improvement in the analytic rating of their texts. When taking into account prior research, there is an argument that collaborative tasks, where students are placed at the forefront of the learning process, have the potential to enhance learners' autonomy and authentic engagement. Additionally, these tasks can reduce anxiety levels and foster interaction among students (McDonough, 2004). Nevertheless, the question regarding the applicability of these benefits to CPW, specifically in CMC contexts, remains unresolved.

2.2. Anxiety in L2 Writing

Anxiety in L2 writing has been a topic of interest in language learning research. Studies have shown that writing anxiety can significantly impact L2 writing performance (Zabihi, 2017). While writing apprehension has been linked to weaker writing skills, the role of writing anxiety in L1 writing has been extensively studied, but there is a gap in understanding its implications in L2 contexts (Zabihi, 2017). Writing anxiety in L2 learners can manifest as mental distress, physiological responses, and avoidance behaviors, affecting their writing processes and outcomes (Bailey, 2019). Understanding the nature of L2 writing anxiety is crucial for educators to address learners' emotional and psychological needs in writing instruction.

Research has explored various factors influencing writing anxiety among L2 learners. Studies have investigated the relationship between motivation, writing anxiety, and writing achievement on writing performance (Sabti et al., 2019). Additionally, investigations into L2 learners' writing self-efficacy and anxiety have highlighted the impact of peer reviewing on reducing writing anxiety levels (Kırmızı & Kırmızı, 2015). Difficulties in self-expression, lack of writing habits, low self-confidence, and challenges in organizing ideas for content development have been identified as sources of L2 writing anxiety (Yu, 2020). By examining these factors, researchers aim to provide insights into effective strategies for alleviating writing anxiety and enhancing L2 writing proficiency.

Moreover, the interplay between writing anxiety, self-efficacy, and motivation in L2 writing has been a focus of recent studies. Structural equation modeling approaches have been employed to explore how epistemological beliefs, writing self-efficacy, and writing anxiety predict L2 writing anxiety levels (Heidarzadi et al., 2022). Furthermore, investigations into the impact of academic factors on L2 writing have highlighted the facilitating role of writing anxiety in L2 writing performance (Zhang & Zhang, 2022). Understanding the complex relationships between cognitive factors, affective states, and writing outcomes is essential for developing targeted interventions to support L2 learners in managing writing anxiety and improving their writing skills. While L2 anxiety has been widely examined in studies addressing oral skills (Bielak, 2022; Pérez Castillejo, 2019), little research concern has been organized toward writing anxiety in L2 research until recently (Güvendir & Uzun, 2023; Tahmouresi & Papi, 2021).

Based on our current knowledge, we have not come across any published work that specifically addresses the questions regarding whether CPW experiences the same advantages as CW in a CMC setting or if the three writing conditions - CPW, CW, and IW - have different impacts on language learners' writing performance and anxiety levels. In order to fill the gaps in the existing literature, this study was conducted as an initial effort to investigate the varying impacts of CW, CPW, and IW on the writing performance and anxiety levels of 50 intermediate EFL learners. In order to provide structure and direction to this study, the following research questions have been formulated:

1. Do computer-assisted CW, CPW, and IW have any significant effect on Iranian EFL learners' writing performance?

2. Do computer-assisted CW, collaborative prewriting, and individual writing have any significant effect on Iranian EFL learners' writing anxiety?
3. What are Iranian EFL learners' attitudes and perceptions toward computer-assisted CW?

3. Methods

In order to address the research inquiries, this investigation employed a sequential explanatory mixed-methods approach, adhering to the framework proposed by Creswell et al. (2003). The initial phase consisted of gathering and analyzing quantitative data, followed by an examination of qualitative data to enhance and clarify the initial numerical results.

3.1. Participants

Convenience sampling was utilized as the recruitment method to gather participants for this study. Shahreza University students studying general English were specifically chosen for this opportunity. Following the announcement, a total of 53 intermediate EFL learners who were enthusiastic about improving their writing skills were selected to take part in the study. People of various genders, spanning from 19 to 32 years old, make up the attendees of this event. To be eligible for participation in this event, all individuals had to meet the requirement of being born in Iran and having Persian as their first language, and we are pleased to announce that every participant has fulfilled these criteria. An Oxford Placement Test was administered in order to evaluate the proficiency levels of the participants. In order to confirm the comparability in L2 writing and its dimensions, the researchers took the necessary step of pretesting the participants. Once the comparability in L2 writing was established, the participants were randomly allocated to one of three writing conditions. Every student was actively involved in one of the three writing conditions, namely CW, CPW, or IW, throughout the entire study. Members of the CW (N = 15) group were assumed to work cooperatively to plan and produce texts; the CPW (N = 15) group collaboratively planned but independently composed texts, and the IW (N = 20) group both planned and composed in isolation. The regular classes provided a satisfactory experience for all participants in the areas of CW, CPW, and IW. Within the realm of a CMC context, no individual had the necessary experience.

3.2. Instruments

In this research, the researcher used Google Docs for a computer-mediated environment, and Skype Messenger was selected as a

communication tool for the participants. A comprehensive background questionnaire was developed to gather participant information. This questionnaire covered various aspects, including years of study, academic discipline, native language, familiarity with CMC platforms, previous experience with L2 writing using Google Docs, and involvement in CW, CPW, and IW.

The degree to which students feel anxious in L2 writing was measured using *the Writing Anxiety Inventory (SLWAI) Questionnaire*, which is widely recognized as valid and reliable in studies on second language writing anxiety (Cheng, 2004). As Cheng noted, the reliability of this questionnaire is .91. This questionnaire includes two parts. The first part intends to collect the students' personal information, gender, and the study stream. The second part is SLWAI which consists of 22 items, including seven items on *Somatic anxiety* (Items 1, 2, 3, 4, 5, 6, 7), eight items on *Cognitive anxiety* (Items 15, 16, 17, 18, 19, 20, 21, 22), and seven items on the *Avoidance behavior* (Items 8, 9, 10, 11, 12, 13, 14) scored on a five-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). The 22 items of the SLWAI were divided into three categories of anxiety: Cognitive Anxiety, Somatic Anxiety, and Avoidance Behavior. For each item, respondents will be required to respond with an answer like *strongly agree, agree, undecided, and strongly disagree*. Thus, higher scores show a higher level of writing anxiety.

During the pretest, the participants were given the task of demonstrating their writing skills in a second language. They were required to summarize a captivating story that they had recently heard. Following the completion of the posttest, the participants were instructed to provide a brief and succinct summary of a story they had come across either in written form, such as a novel, or through visual media, like a film. The selection of short story writing tasks in this study was justified by Bräuer (1997) for two main reasons. Engaging in short story writing is widely recognized as a fun and experimental way to explore the target language. It is worth mentioning that this resource has a significant impact on motivating EFL learners, making it exceptionally valuable. The participants in both the pretest and posttest were instructed to complete their written assignments within a time frame of 60 minutes. The requirements included submitting their work as a Word document and ensuring that it consisted of 250-300 words. As a final step, the researchers conducted a semistructured interview to obtain the participants' viewpoints and attitudes toward this unique experience.

3.3. Procedure

The process of collecting data was carried out over a span of approximately eight weeks. In compliance with ethical guidelines, the participants were given prior notice that they would be invited to participate in a research project, and their informed consent was obtained before any data gathering occurred. During the first week, the participants were given both the background questionnaire and the writing anxiety scale. To tackle the issue of the CW group's unfamiliarity with Google Docs, the researcher made arrangements to conduct an orientation session for them in the same week. Afterward, a trial page was shaped with the intention of giving students the chance to practice vital skills like commenting, revising, chatting, and composing texts.

The intervention, which commenced during the second week, persisted for a continuous duration of five weeks, encompassing a total of ten sessions occurring twice a week. Throughout the intervention, the first author assumed the role of the coordinator and fulfilled it efficiently. To lessen off-task behaviors, the researcher proactively took the initiative to gather all the participants together at the start of each session. The main rationale behind dividing participants in the CW and CPW groups into groups of three instead of pairs was mainly centered around a specific purpose. The evidence reinforcing this claim derives from studies conducted by Fernández Dobao (2014).

To ensure the best selection of short story topics for the treatment, the university sought the input and guidance of the regular teachers of the participants. During every intervention session, the participants were afforded a collection of sentences that depicted a hypothetical scenario. Their task was to transform these sentences into a complete story, with a recommended length of 200-250 words, using their own creativity and imagination. The CW members took advantage of Google Docs to create dedicated pages to brainstorm ideas, plan out their tasks, and write texts together collaboratively. The CW participants exclusively used Google Docs as the platform for their interactions, primarily through the use of discussion chats. At the start of every session, the researcher would establish groups on Skype Messenger specifically for the CPW members and extend invitations to join through an invite link. Text messaging was the primary method used by the CPW participants to discuss and coordinate their writing endeavors. CW and CPW participants were encouraged to utilize the desktop versions of Google Docs and Skype Messenger to expedite and facilitate the exchange of messages. In order to control the impact of language on performance, the participants were given specific instructions to communicate with each other using their

second language (L2). Just like their counterparts in the other two writing conditions, students across all three conditions allocated a period of 60 minutes to the process of typing and submitting their texts using Word documents. To ensure that time does not heavily affect the task, a specific request was put forth to all participants, asking them to dedicate a total of 60 minutes - 20 minutes for the planning phase and an additional 40 minutes for the writing phase. Because of this particular reason, after the 20-minute planning period had ended, all participants obtained notifications on their personal cellphones, prompting them to finish the planning phase and initiate the writing phase.

In each writing condition, the researcher made a conscious effort not to intervene in the student's performance, and it was observed that the participants did not approach the tasks alone. Following the conclusion of each session, the participants would record their thoughts and impressions of that specific session in the Persian language and then share these recordings with the researcher through the Skype messenger platform. To help them in capturing their reflections, guiding questions were given. In order to minimize the impact of practice on performance, the participants were not given any starting sentences during the posttest. However, their approach was different as they chose to write a brief overview of an engaging book that they had recently encountered. The participants completed the anxiety scale for the second time directly after the posttest, which took place in week seven.

As part of the study, the researcher scheduled individual semistructured interviews with 25 participants who willingly volunteered. These interviews were carried out during the eighth week and aimed to uncover the participants' perceptions and attitudes towards the three writing conditions. In order to ensure mutual understanding, the interviews were conducted in Persian. It was ensured that every interview session was recorded in audio format.

3.4. Data Analysis

Two different types of data analysis were conducted in this study, namely quantitative data analysis and qualitative data analysis, and the results were analyzed accordingly.

In the quantitative data analysis to assess the participants' writing performance, the IELTS writing rating scale was employed for the

quantitative aspect. No matter which language is being examined, this rubric assesses writing based on several criteria, including task achievement, coherence and cohesion, lexical resource, and grammatical range and accuracy. The evaluation results are then presented using band descriptors that range from 0 to 9. While both authors utilized this rubric to assess EFL learners' compositions, they recognized the importance of clarifying and resolving inconsistencies by engaging in a detailed discussion. Once they found common grounds, both authors independently graded all electronic texts. In order to minimize bias in the scoring process, the texts were evaluated without any identifying information. SPSS 26 was the software program employed for the analysis of the data. In order to evaluate the participant's performance on the pretest and posttest, the researchers carried out one-way ANOVA and Factorial ANOVA tests respectively. Additionally, the measurement of writing anxiety among the participants at Time 1 (*T1*) involved the use of paired samples *t*-tests. The authors ensured the validity of their findings by including different participants in each writing condition, which upheld the assumption of independent observation and increased the credibility of their study. The absence of any significant differences in the *p* values obtained from Levene's test leads to the conclusion that the variances were indeed homogeneous.

The qualitative data analysis process involved transcribing the audio-recorded interviews and reflections exactly as they were spoken into a Word document. In order to ensure the credibility of the transcriptions, the researchers implemented a process called member checking, as described by Cohen et al. (2007). This involved letting the participants review the transcribed data, make any necessary modifications, and verify its accuracy. Once the participants' comments, interview transcriptions, and reflections were received, a three-phase process, as Merriam (2014) outlined, was used to thematically analyze them. The authors began the first phase by carefully reviewing the transcriptions, a process that allowed them to become acquainted with the data and gain insights into the participant's attitudes toward the writing conditions. Additionally, this step involved the identification of broad themes, which were then used to construct categories for further analysis. As a next step, the emerging themes were carefully reviewed and underwent revisions, removals, or mergers; ultimately, those with comparable content were grouped within sorting categories. Lastly, each theme was assigned a label to accurately represent its underlying content, which involved categorization. To maintain objectivity, both authors individually read and coded the data.

Based on the inter-rater reliability estimates, it can be concluded that there was a high level of consistency, as indicated by a correlation coefficient of .93. The participants engaged in discussions about the areas of ambiguity and disagreement until they were able to reach a consensus.

4. Results

4.1. Results Obtained from the Quantitative Phase

The researchers utilized factorial ANOVA tests to investigate the influence of distinct writing settings on the writing performance of the participants, specifically addressing the research question: Do computer-assisted collaborative writing (CW), collaborative prewriting (CPW), and individual writing (IW) have any significant effect on Iranian EFL learners’ aspects of writing, including task achievement, coherence/cohesion, lexical resources, and grammatical accuracy?

In the initial phase, the learners' performances on the writing pretest were analyzed both descriptively and inferentially. Table 1 presents the descriptive statistics for the pretest writing scores of the three groups.

Table 1. Descriptive Statistics of The Participants’ Pretest Writing Scores

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
CW	20	35.8000	7.79377	2.01234	31.4840	40.1160	20.00	44.00
CPW	17	35.8667	6.93713	1.79116	32.0250	39.7083	24.00	45.00
IW	16	36.2000	2.39643	.61875	46.8729	49.5271	45.00	52.00
Total	53	39.9556	8.43951	1.25809	37.4200	42.4911	20.00	52.00

The mean scores for the pretest writing performance were relatively similar across the three groups. The CW group had a mean score of 35.80, the CPW group had a mean score of 35.87, and the IW group had a slightly higher mean score of 36.20.

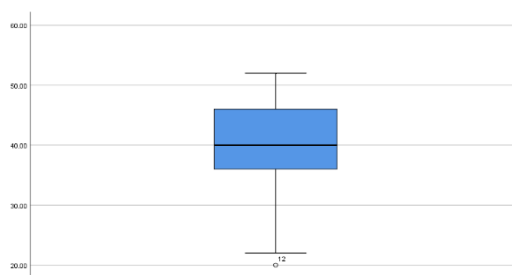
To ensure the validity of the statistical tests applied, it was crucial to verify the normality of the pretest writing scores. The Kolmogorov-Smirnov and Shapiro-Wilk tests were used to assess the normality of the data. The results are presented in Table 2.

Table 2. Tests of Normality

	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Pretest Writing Scores	.129	53	.060	.932	53	.071

In the assessment of normality for pretest writing scores, the Kolmogorov-Smirnov Test yielded a test statistic of 0.129 and a p-value of 0.060, while the Shapiro-Wilk Test resulted in a test statistic of 0.932 with a p-value of 0.071. Given that both p-values exceed the conventional alpha level of 0.05, there is insufficient evidence to reject the null hypothesis, which posits that the data is normally distributed. Consequently, it can be inferred that the pretest writing scores conform to the assumption of normality, which is a prerequisite for inferential statistical analyses.

Figure 1. *Pretest writing scores*



The plot indicates that the majority of the pretest writing scores were concentrated around the median, with a relatively symmetrical distribution as inferred from the nearly equal lengths of the whiskers. This symmetry suggests that there is no significant outlier, although, at least one participant scored significantly lower than their peers.

Table 3. *Test of Homogeneity of Variances*

		Levene Statistic	df1	df2	Sig.
Pretest Writing Scores	Based on Mean	5.932	2	50	.065
	Based on Median	2.729	2	50	.077
	Based on Median and with adjusted df	2.729	2	27.655	.083
	Based on trimmed mean	5.238	2	50	.069

Upon conducting Levene’s test to evaluate the equality of variances across groups, the resulting p-values for the mean, median, median with adjusted degrees of freedom, and trimmed mean were all found to be above the threshold of 0.05. This outcome suggests that there is no significant difference in variances between the groups, thereby fulfilling the assumption of homogeneity of variances. This assumption is critical for certain statistical tests that require equivalent variability among groups to ensure the validity of the results.

A one-way ANOVA was performed to evaluate the equivalence of pretest writing scores among three distinct groups. The analysis, detailed in Table 4, yielded an F-statistic of 20.016 and a p-value of 0.079. Given that the p-value surpasses the alpha level of 0.05, the null hypothesis, which posits no significant difference in pretest writing scores across the groups, cannot be rejected.

Table 4. *ANOVA Results for Pretest Writing Scores*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1529.378	2	764.689	20.016	.079
Within Groups	1604.533	50	38.203		
Total	3133.911	48			

This finding suggests uniformity in writing performance among the groups labeled CW, CPW, and IW. Consequently, the one-way ANOVA substantiates the initial hypothesis of no significant disparity in L2 writing skills among the groups prior to the intervention, aligning with the non-significant p-value. Thus, it is concluded that the pre-intervention writing abilities of the participants were statistically indistinguishable across the three groups.

The descriptive statistics for the posttest writing scores of the three groups (CW, CPW, and IW) are presented in Table 5. These statistics provide a preliminary overview of the participants' writing performance after the intervention.

Table 5. *Descriptive Statistics of The Participants' Posttest Writing Scores*

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
IW	20	35.884	1.429	1.01234	32.999	38.770	3300	43.00
CPW	17	38.288	1.557	2.79116	35.143	41.432	32.00	42.00
CW	16	49.036	1.597	.61875	45.810	52.262	45.00	51.00

In an analysis of posttest writing performance, the IW group exhibited a mean score of 35.884 with a standard deviation of 1.429, while the CPW group presented a mean score of 38.288 with a standard deviation of 1.557. Notably, the IW group achieved a significantly higher mean score of 49.036, accompanied by a standard deviation of 1.597. This statistical evidence clearly indicates that the IW group's performance surpassed that of both the IW and CPW groups, suggesting a marked distinction in writing proficiency among the groups.

Prior to executing the Factorial ANOVA, a series of assumptions were methodically verified to ensure the validity of the analysis. Firstly, it was confirmed that the residuals on the dependent variable were randomly and independently drawn from the population of residuals, which is essential for the independence of observations. Secondly, the normal distribution of residuals was ascertained, a prerequisite for the application of parametric tests. Lastly, the assumption of homogeneity of population residuals was satisfied, indicating uniform variance across the groups.

The results of the Factorial ANOVA are detailed in Table 6. This table examines the effects of different writing groups (CW, CPW, and IW) on the posttest writing aspect scores.

Table 6. *Tests of Between-Subjects Effects*

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared	Noncent. Parameter	Observed Power ^b
Corrected Model	1882.188 ^a	11	171.108	4.191	.000	.529	46.101	.995
Intercept	88321.626	1	88321.626	2163.291	.000	.981	2163.291	1.000
Aspects	10.004	3	3.335	.082	.970	.006	.245	.063
Groups	1673.405	2	836.703	20.494	.000	.500	40.987	1.000
Aspects * Groups	204.573	6	34.095	.835	.550	.109	5.011	.291
Error	1673.925	41	40.827					
Total	91198.872	52						
Corrected Total	3556.113	52						

The analysis of the posttest writing scores reveals that the corrected model exerts a significant influence, as evidenced by an F-statistic of 4.191 and a p-value of less than 0.001. This indicates that the writing settings have a considerable impact on the scores. Furthermore, the groups (CW, CPW, IW) demonstrate a significant effect, with an F-statistic of 20.494, a p-value of less than 0.001, and a partial eta squared of 0.500. This suggests that half of the variance in post-test writing scores is attributable to the differences in writing groups. Conversely, the interaction effect between writing aspects and groups (Aspects * Groups) is not significant, with an F-statistic of 0.835 and a p-value of 0.550, implying that the combined influence of writing aspects and group membership does not significantly alter the writing scores.

Figure 2. Posttest writing scores

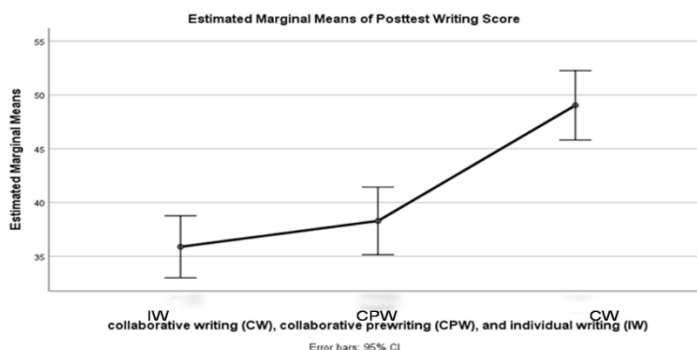


Figure 2 provides a visual depiction of the distribution of post-test writing scores across three groups. The graphical representation clearly illustrates that the CW group achieved consistently higher scores relative to the IW and CPW groups. This observation corroborates the findings obtained from the descriptive statistics and ANOVA, reinforcing the conclusion that the CW group’s performance was significantly superior. The visual data underscores the efficacy of individual writing practices in improving the writing proficiency of EFL learners, as the CW group’s elevated scores are indicative of enhanced writing capabilities. This coherent synthesis of the graphical and statistical data aligns with the principles of academic writing, presenting a clear and analytical interpretation of the results.

Table 7. Multiple Comparisons

(I) (CW), (CPW), (IW)	(J) (CW), (CPW), (IW)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
IW	CPW	-2.53	2.108	.461	-7.65	2.60
	CW	-13.15*	2.143	.000	-18.36	-7.94
CPW	IW	2.53	2.108	.461	-2.60	7.65
	CW	-10.63*	2.226	.000	-16.04	-5.21
CW	IW	13.15*	2.143	.000	7.94	18.36
	CPW	10.63*	2.226	.000	5.21	16.04

The statistical analysis indicates a pronounced difference in performance between the CW group and the other two groups, IW and CPW. The CW group surpassed the IW group by an average of 13.15 points and the CPW group by 10.63 points, with these disparities being statistically significant, as denoted by a p-value of less than 0.001.

Conversely, the comparison between the IW and CPW groups revealed no significant difference, evidenced by a p-value of 0.461. This suggests that while the individual writing approach of the CW group significantly enhanced performance, the writing approaches of the IW and CPW groups did not result in any notable difference in scores.

To answer the second research question, paired samples t-tests were conducted, addressing the participants’ writing anxiety at T1 and T2. Prior to conducting the tests, all assumptions for the paired samples t-test, including the normality of the distribution of differences, independence of observations, and the scale of measurement being at least interval, were checked and fulfilled. Table 8 presents the descriptive statistics of the participants’ writing anxiety.

Table 8. *Descriptive Statistics of the Participants’ Writing Anxiety*

		Mean	N	Std. Deviation	Std. Error Mean
CW	Time 1 Writing Anxiety	28.118	16	5.152	.705
	Time 2 Writing Anxiety	20.323	16	3.332	.907
CPW	Time 1 Writing Anxiety	27.87	17	4.112	.549
	Time 2 Writing Anxiety	21.23	17	3.728	.821
IW	Time 1 Writing Anxiety	24.250	20	5.92	.734
	Time 2 Writing Anxiety	22.7	20	4.32	.698

Table 8 presents the descriptive statistics for the participants’ writing anxiety at two different time points, T1 and T2. For the group labeled CW, the mean writing anxiety score decreased from 28.118 at Time 1 to 20.323 at Time 2, indicating a reduction in anxiety levels. This group consisted of 16 participants, with a standard deviation decrease from 5.152 to 3.332, suggesting a narrowing in the spread of scores. The standard error mean also decreased, from .705 to .907.

In the CPW group, the mean anxiety score showed a similar decrease, from 27.87 at Time 1 to 21.23 at Time 2, across 17 participants. The standard deviation and standard error mean in this group also reduced, from 4.112 to 3.728 and .549 to .821, respectively.

Lastly, the IW group, which had 20 participants, exhibited a smaller reduction in mean writing anxiety scores, from 24.250 at Time 1 to 22.7 at Time 2. The standard deviation and standard error mean for this group were 5.92 and .734 at Time 1, and 4.32 and .698 at Time 2, respectively.

Overall, all groups experienced a decrease in writing anxiety from Time 1 to Time 2, with the CW and CPW groups showing more significant reductions compared to the IW group. The data suggests that the interventions may have been effective in reducing writing anxiety among the participants.

Table 9. *Paired Samples Test*

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
CW	Time 1 Writing Anxiety - Time 2 Writing Anxiety	7.797	2.837	.634	-3.378	-.722	-3.231	15	.004
	Time 1 Writing Anxiety - Time 2 Writing Anxiety	6.64	3.57	.751	-4.247	-.592	-2.927	16	.005
CPW	Time 1 Writing Anxiety - Time 2 Writing Anxiety	1.550	1.057	.241	-1.957	-.627	-1.086	19	.310
IW	Time 1 Writing Anxiety - Time 2 Writing Anxiety								

Table 9 provides the results of the paired samples t-tests, which assess the significance of the change in writing anxiety from Time 1 to Time 2 for each group.

For the CW group, the mean difference in writing anxiety scores between Time 1 and Time 2 is 7.797, with a standard deviation of 2.837 and a standard error mean of .634. The 95% confidence interval of the difference ranges from -3.378 to -.722, and the t-value is -3.231 with 15 degrees of freedom. The significance (2-tailed) is .004, indicating that the reduction in writing anxiety for the CW group is statistically significant.

In the CPW group, the mean difference is 6.64, with a standard deviation of 3.57 and a standard error mean of .751. The 95% confidence interval of the difference ranges from -4.247 to -.592, and the t-value is -2.927 with 16 degrees of freedom. The significance (2-tailed) is .005, also suggesting a statistically significant reduction in writing anxiety.

However, for the IW group, the mean difference is only 1.550, with a standard deviation of 1.057 and a standard error mean of .241. The 95% confidence interval of the difference ranges from -1.957 to -.627, and the t-value is -1.086 with 19 degrees of freedom. The significance (2-tailed) is .310, which is not below the conventional threshold of .05, indicating that the change in writing anxiety for the IW group is not statistically significant.

These results suggest that while the CW and CPW groups experienced a significant decrease in writing anxiety, the IW group did not show a statistically significant change. This implies that the interventions applied

to the CW and CPW groups were effective in reducing writing anxiety, whereas the intervention for the IW group may not have been as effective.

4.2. Results Obtained from the Qualitative Phase

Through the use of semistructured interviews and reflections, the qualitative analyses revealed a major theme that pertained to the participant's attitudes toward the new writing conditions. In order to provide a comprehensive understanding of the identified themes, the following subsection will delve into an in-depth analysis of them.

- ***Advantages and Disadvantages of CW and CPW***

The merits of using collaborative writing (CW) in Google Docs were highly valued by the participants of this study. They found that it offered them valuable chances to assess and enhance the grammatical range and accuracy of their texts, resulting in a notable improvement in the overall quality of the collaboratively written pieces:

A. *In our current writing phase, it has become evident that texts lacking accuracy are deemed to be of minimal value. Our teachers always focus on highlighting and addressing the grammatical errors that we make in our written assignments. Our primary objective was to ensure the text was both accurate and well-organized.*

Participant B suggested:

B. *In our in-person classes, teachers focus heavily on the grammatical aspects of our texts compared to other elements. We made efforts to establish a consistent plan while in the prewriting stage. The main aspects we prioritized when composing the texts were grammar, punctuation, and capitalization.*

Despite not showing any notable progress in task achievement at T2, the participants in the CW group were still aware of the significance of presenting tasks that were fully developed. A student made a comment, stating:

C. *The emphasis should be on finishing the task, rather than the level of beauty in your writing.*

In addition, the participants of the Collaborative Writing (CW) group were discovered to experience lower levels of anxiety while working together on text composition compared to when they were instructed to write individually. As two participants declared:

- D.** *Our usual practice involves writing individually, but what made this experiment truly fascinating was the fact that there were three of us, allowing us to distribute the responsibility of generating the text. In my opinion, it seemed less threatening to me. My anxiety lessened considerably when it came to the final result.*
- E.** *Over the course of multiple sessions, I noticed a significant decrease in my anxiety levels and a greater inclination to write in the L2 language, not just limited to Google Docs, but in general L2 writing.*

When students collaborate on writing in web-based environments, this discovery indicates that it can boost their autonomy and enable them to have more control over their own writing process. While it is important to recognize the positive effect of CW on the participants' L2 writing skills and reducing anxiety, it is worth noting that not all learners experience the same benefits from CW tasks. A student reflected:

- F.** *I am confused about the rationale behind practicing collaborative writing if we are expected to perform independently during tests and exams.*

The statistical analyses have confirmed that the participants in the CPW group displayed significant improvement in their task achievement, as well as in their coherence and cohesion. According to one student's comment:

- G.** *Given the constraint of a 20-minute interaction window, we opted to prioritize the formulation of a comprehensive action plan to achieve the predetermined objective. Consequently, we deferred discussions pertaining to lexical choices, syntactic structures, and orthographic irregularities.*

Another student asserted:

- H.** *Our main focus is not on discussing specific grammatical or lexical items, but rather on effectively expressing ideas in a coherent manner and structuring the text with logically connected paragraphs.*

Some students reported that they learned from one another during the CPW experiment:

- I.** *Our interactions went beyond mere communication; we were actively exchanging ideas and learning from each other.*

The CPW participants consistently mentioned in their reflections and interviews that they had low levels of writing anxiety. As one claimed:

- J.** *CPW had a significant impact on both my confidence and anxiety, and I strongly believe it was in a positive way. During the planning time, we actively participated in the activities and exchanged precious information. The collaboration and cooperation we experienced significantly enhanced our writing skills in our second language.*

One interesting finding that emerged from the study was that the participants in the CPW group expressed a strong preference for not being required to collaborate with other members of the group when it came to writing. One student indicated:

- K.** *The decision to include a group discussion and idea-sharing session, followed by individual writing, was a strategic and intelligent choice. It fills me with happiness that we were not requested to jointly undertake the writing afterward. This is because, in matters of writing, I would like to emphasize that I may not be without flaws, but I firmly believe in my own competencies.*

It was quite surprising, but also fascinating, to discover that every participant thoroughly enjoyed their CPW experience without any negative aspects accompanying it.

5. Discussion

According to the statistical data, the implementation of computer-mediated CW in Google Docs had a substantial impact on the overall writing proficiency of EFL learners. Such improvement in EFL writers, as a result of CW, has been found in the literature (e.g. Ebadijalal & Moradkhani, 2023; Hosseinpou & Biria, 2014). The study's findings revealed that CW texts were considered to be more correct than IW texts, which aligns with Elabdali's (2021) study while contradicting previous research conducted by Ebadijalal and Moradkhani (2023). A potential explanation for this finding could be that the participants who were exposed to CW training perceive grammar to be an inherent aspect of the writing process. It was determined that the CW texts demonstrated a higher level of coherence and cohesion than the texts written separately.

In comparison to their face-to-face classes, the participants discovered that CW was less likely to provoke anxiety. This finding is consistent with previous studies that have also found that CW can effectively alleviate anxiety among L2 learners (Wu, 2015; Qiu & Lee, 2020). The majority of

The CW interviewees, however, voiced their complaints about the requirement of collaborative text writing, deeming it a futile utilization of their time and energy. Their discontent arose from the contrast with their usual individual writing approach during formal exams.

The use of CPW had a positive influence on the participants' performance in task achievement, coherence, and cohesion, but it did not have a noticeable effect on their grammatical range, accuracy, or lexical resource. This result aligns with Ebadijalal and Moradkhani's (2023) findings and contradicts McDonough and De Vleeschauwer's (2019) conclusion that CPW enhances accuracy. Differences in research settings, such as this study being conducted in a CMC context and McDonough and De Vleeschauwer's (2019) study in regular classes, could explain the divergent findings. Additionally, the participants were given clear instructions and visual aids to enhance their collaboration. In simpler terms, there was a structured approach to task performance. Despite this, the research conducted by McDonough et al. (2018a) suggests that collaborating during the prewriting stage does not yield significant differences in grammatical range and accuracy.

When the results were analyzed collectively, they demonstrated that CPW had the capability to enhance the writing skills of the students in their second language. This empirical evidence lends support to the argument made by Neumann and McDonough (2015) that CPW, as a variable in task implementation, positively impacts students' writing abilities. During the interactions, the CPW participants often emphasized that their discussions went beyond just brainstorming; they were actively learning from each other. The findings from previous studies indicate that web-based CW is an effective method for students to gain new knowledge and acquire insights from the work of their fellow classmates (Al Abri et al., 2021; Bikowski & Vithanage, 2016), which suggests relating to CPW as well.

The combined use of CW and CPW writing conditions in the present study proved to be highly effective in enhancing the participants' L2 writing skills, leading to noteworthy improvements in both their writing performance and their ability to regulate their anxiety levels. On the other hand, IW did not show any notable improvement in writing anxiety, nor in the overall quality of writing and its different dimensions. Vygotsky's (1978) sociocultural perspective, which emphasizes the role of social interactions in learning and the importance of language acquisition through interaction with others, is supported by this finding. The role of interaction in knowledge-building has become increasingly important as

it provides learners with valuable opportunities to seek assistance from others through verbal communication. It is important to note that this finding, although not completely contradictory, does differ to some extent from the perspective presented by Amiryousefi (2017). The latter argues that incorporating both collaborative and individual activities in computer-mediated language learning courses is advantageous and should be implemented. It should be emphasized that these findings lend support to Ziegler's (2016) assertion that conducting studies in CALL environments can yield different outcomes, partially as a result of the effect of technology. It is worth mentioning that this study does not suggest replacing individual activities with collaborative ones, which is particularly important. More research is needed in CALL environments to harness technological opportunities and address inconsistent outcomes.

6. Conclusion

In this research study, the focus was on exploring the influence of computer-assisted CW, CPW, and IW on the writing anxiety levels and attitudes of Iranian EFL learners. To summarize, the findings of the research indicated a substantial enhancement in the writing performance of both the CW and CPW groups by the conclusion of the experiment. Nevertheless, it is worth noting that the anxiety experienced by the EFL learners decreased considerably in the CW and CPW. In simpler words, it seems that both computer-mediated CW and CPW have the ability to positively impact the writing abilities of those involved. In contrast, the absence of collaboration seems to have a different effect on EFL learners' writing anxiety compared to IW participants, as writing in the same context does not seem to have a negative impact. When considering the findings as a whole, it can be concluded that CPW has the potential to yield comparable advantages to CW in terms of overall L2 writing for EFL learners. The findings of this study align with the existing literature, which suggests that language learners can derive advantages from engaging in effective interaction and active participation (Zhang & Zhou, 2022).

The field can benefit from considering the implications that arise from this study. It can be concluded from the findings that collaborative activities in CMC environments play a significant role in providing EFL learners with abundant chances for meaningful interaction and language practice, leading to the improvement of their L2 writing abilities. The results obtained from this study can be used as a starting point for L2 researchers who are interested in conducting further investigations and making comparisons between web-based CW, CPW, and IW in EFL

contexts. Additionally, it is important to note that language teaching is closely tied to learners' anxiety and achievement. Moreover, the study revealed that computer-mediated CW and CPW activities enhance learning. Therefore, EFL teachers and practitioners should seriously consider incorporating these activities into their classroom practices as they can be highly rewarding.

The need for further research with larger and more diverse learner groups is underscored by the limitations of this study, which include a small sample size and a focus on a specific population. In addition to this, it is important to conduct further research on the long-term effects of collaborative writing methods on the development of writing skills. It would also be beneficial to explore how these methods can be modified to cater to learners of various proficiency levels. To summarize, the findings of this study recommend that both computer-assisted and traditional collaborative writing and prewriting methods show the potential to reduce writing anxiety, improve student attitudes, and possibly enhance writing performance among Iranian EFL learners.

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