

# The Potentials of Three Writing Modalities in Development and Sustained Development of Grammatical and Lexical Accuracy of Writing Performance

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# Abstract

This study investigated the development and sustained development of grammatical and lexical accuracy in three writing modalities of individual, collaborative and e-collaborative writing. To this end, 90 Iranian Intermediate EFL learners were selected according to the participants' scores on a writing pretest. Participants were assigned into the research groups on the basis of convenient sampling. The writing performances in three groups of individual, collaborative and e-collaborative writing performance were measured on pretest, posttest and delayed posttests. Multivariate analysis of variance (MANOVA) indicated that participants' writing performance in individual writing ( $F(5, 38) = 16.06, p = .000, \text{partial } \eta^2 = .679$  representing a large effect size) and collaborative writing ( $F(5, 38) = 17.64, p = .000, \text{partial } \eta^2 = .699$  representing a large effect size) were sustainably improved in terms of grammatical and lexical accuracy. MANOVA results also indicated that participants writing performances in E-collaborative writing ( $F(5, 38) = 8.64, p = .000, \text{partial } \eta^2 = .532$  representing a large effect size) were improved and the improvement was sustained with respect to grammatical accuracy but not lexical accuracy. The post hoc comparison indicated that collaborative writing was the most effective mode of writing as far as grammatical and lexical accuracy were concerned. The results have significant implications for teaching practitioners.

## 1. Introduction

The history of focus on accurate use of language goes back to the debate between non-interventionist instruction (Ellis, Loewen, & Basturkmen, 2006) Proponents of interventionist (explicit) teaching advocate teachers' directing students' attention to formal aspects. A number of studies confirmed the positive role of explicit teaching on several aspect of language learning including ultimate language achievement (Rahimpour & Salimi, 2010), learning discourse techniques (Rahimpour & Mohamadi, 2012), grammatical accuracy (Andrews, 2007; Rajabi & Dezhkam, 2014) and writing ability (Salehi, 2016). The other camp takes the other extreme where learners' self-directed and exploratory learning through communicative use of language with no teacher interference helps noticing the mechanism of language. Research on non-interventionist instruction approved implicit teaching resulting in grammar learning (Marzban & Mokhberi, 2012), and writing accuracy (Salimi, Bonyadi, & Asghari, 2014). The debate was settled by taking the middle way through integration of focus on form into meaning based instructions (Lyster, 2015; VanPatten, Williams, Rott, & Overstreet, 2004). Among many learning activities for the marriage between form and meaning,, writing has received special attention. Writing is proved to have noticeable potential for language learning as it triggers attention to form-meaning relation (Byrnes & Manchón, 2014). There has been many studies on how learning to write is mediated by various linguistic factors ; for example, Macaro and Masterman (2006) studied how different forms of grammar instruction affect writing (Macaro & Masterman, 2006). Researchers were also intrigued by how cognitive factors mediate writing performance. For example how learner attention allocation, information processing, storage and retrieval and integration of new knowledge to previous one is mediated by artifact such as technology (Diezmann & Watters, 2002) and in turn affects accuracy (Spencer & Pillay, 2005) has long been locus of attention.

Equally important area of research is sociolinguistic perspective upon which collaborative writing (Chao & Lo, 2011; Shehadeh, 2011; Storch, 2005) was introduced Collaborative writing received good amount of attention in related research field since it fosters reflective thinking and pools language knowledge (Elola & Oskoz, 2010). Collaborative writing is defined as a writing activity in which learners negotiate with each other (Lin & Maarof, 2013) to find the best way to construct and communicate their meaning (Challob, Bakar, & Latif, 2016). Recent interest in how computers can mediate the process of language learning led to the development of new terminology "collaborative e-writing" (Pardo-Ballester & Cabello, 2016). Collaborative e-writing highlights the potential of online education platforms that allow student interaction. Many studies approved positive effect of online connectivity as it maximizes academic performance (Ebadi & Bashir, 2020; Zenouzagh, 2018). Studies also suggested a positive relation between e-collaboration and student engagement (Mahdiun, Salimi, & Raeisy, 2019). Research also indicated online interaction entails prerequisite conditions for learning which are constructivist theory, scaffolding strategies, project-based learning, inquiry-based learning, discovery learning, problem-based learning and active learning. (Salem, 2019). Corpus analysis of Turkish students' online writing performances affirmed the positive role of web based farze.ir application (Çakır & Özer). On the other hand research also alerted for cautious induction of technology in education. For example, Hou, Han, Wang, and Zhang (2020) examined the use of WeChat by university students. Their finding suggests that WeChat is perceived as a "double-edged sword" of learning with two-sided effects; 1) Students' engagement with WeChat on learning is at the upper-medium level, over which the motivation of WeChat usage, other than usage duration and login time, is found to have strong explanatory power. 2) The frequency of WeChat usage affects students' academic performance in a complicated way with self-control playing a moderating role. Besides, several studies indicated that mere utilization of technology in education will not lead to outperformance of student in online platforms implying need for research that takes into account ecological validity of technology induced education (Mohamadi, 2018a, 2018b; Zenouzagh, 2019).

In addition to the inconsistencies in research reports with respect to online education, only very limited research has been undertaken to compare and contrast web-based and conventional writing performance. For example, Cequeña (2020) indicated both web-based writing and conventional writing led to a better writing performance. Engerer (2020) explores the feature of dynamicity (a composite of temporal and local properties) in research on collaborative digital writing (CDW) in academic writing assignments. The paper traces the ways in which current research typically approaches CDW and identifies the underlying elements of current and technological inquiry in this field: components of text (the process and products of writing and learning communication), external variables, such as learning orientations and group composition, and an intermediate layer of time management that is related to organizing the assignment. The paper identifies the gap which overlooks the sequential dynamics of textual interaction, linearity, and "local" concept construction as influential factors in collaborative digital writing assignments. This suggests exploring the comparative potential of modality of writing in influencing writing performance.. Therefore, to fill such as a void, the present research aimed at investigating whether writing modalities help learners develop grammatical and lexical accuracy and if

the development is sustained. Besides most of the studies on writing backed grammatical accuracy, therefore, novel to this study is inclusion of lexical accuracy along with grammatical one into the analysis. Besides, several studies indicted the interrelationship between lexical and grammatical accuracy. For example, Johnson and Fey (2006) confirmed the effect of lexical aspects on imitation accuracy of English tense aspect morphology. Their study suggested that children' early morphology development is influenced by lexical aspects at sentence level. Two important aspects of language development in first language acquisition are lexical and grammatical development. It has been suggested that language development in children at the lexical and grammatical level is interrelated, and thus their lexical knowledge does not precede their grammatical knowledge in early language development (Dixon & Marchman, 2007). Therefore any consideration of grammatical accuracy in language development without considering lexical accuracy will lead to an incomplete picture of the phenomena (Zare, 2013). As a restatement of the objectives of the present research, it aims at investigating the comparative potential of three writing modalities of individual, collaborative and e-collaborative in influencing writing quality in terms of not only grammatical accuracy but also lexical accuracy.

## **2. Literature Review**

### **2.1 Individual, Collaborative Writing and E-collaborative Writing**

Writing is proved to have noticeable potential for language learning as it triggers attention to form-meaning relation (Byrnes & Manchón, 2014). With the introduction of more learner centered approaches towards learning, new modality of writing emerged. Collaborative writing as an activity performed by several writers to find the best possible way to communicate what they mean (Ismael, Bakar, & Latif, 2016) and solve the problem through negotiation of meaning through interaction, reflection on form, and collaboratively solve the language problems (Elola & Oskoz, 2010; Li & Kim, 2016). The interaction opportunities through collaborative writing bring society and individuals to a dialogic act (Thorne & Lantolf, 2006). Table 1 indicates and clarifies the differences and similarities in individual, collaborative and e-collaborative writing (Felipeto, 2019; Mohamadi, 2018a; Mohammadi, 2017). Research has documented the positive role of collaborative writing in various aspects of language learning. Collaborative writing positively improved the grammatical accuracy (Nassaji & Tian, 2010), quality of organization, content and vocabulary (Shehadeh, 2011), and writing gain scores (Aminloo, 2013) and language complexity (Lu, 2010). Common among them is the fact that collaborative writing was induced through interventionist in nature in which instruction is directed at special target feature.

**Table 1**

**Individual, collaborative and e-collaborative writing**

<b>Individual writing</b>	<b>One usually writes alone and in silence; Based on teacher driven classes and explicit rote learning; product based learning</b>
Collaborative writing	Based on learner centered instruction; Experimental problem solving; places students dialoguing to build a single text through negotiation ; Two or more participants' joint production of text; both the writing coming forth from orality, as well as orality creating writing are observed; The procedure in collaboration is as follow: students choose their partners on the basis of their convenience; (2) they brainstorm about the topic which is chosen considering topic familiarity issue; (3) they research and gather information using any source; (4) they provide the outline and give it back to the teacher and the teachers provides pertinent comments; (5) they then plan and write the first draft; (6) they check out the first draft according to the check list provided by the teacher in advance; (7) each student had editing individually with different highlight colors so that when handed together they could track each other's ideas and provide justification for the required revisions; (8) they handed in their writing to the teacher and the teachers comment on language, content and organization; (9) students received the teachers' comments and revise the paper together
e-collaborative writing	The definition for collaborative writing is true for e-collaborative writing with one difference that all pertained features occur in online modality

## 2.2 Grammatical Accuracy

The inquiry about the quality of writing in terms of accuracy is not new (Yang, Lu, & Weigle, 2015). Collaborative writing lead to more fluent writing measured in terms of total number of words, complexity measured in terms of t-units, and accuracy measured in terms of proportion of error free clauses of all clauses and the number of syntactical and morphological errors per words (Storch, 2005). The same measures of accuracy in collaborative and individual writing has indicated that more accurate language is produced in collaborative writing (Storch & Wigglesworth, 2007; Taylor, Wigglesworth, Wigglesworth, & Storch, 2009). Collaborative writing also led to more attention to language related episodes in terms of choice of verb tense, gender agreement, preposition and in turn more accurate use of language in comparison with paired and individual writing (Dobao, 2012).

## 2.3 Lexical Accuracy

Attention to form has been equated with grammar whereas to create meaningful text, the effective knowledge of words and phrases is necessary (Nakamaru, 2010). Historically, the lexicon and its accuracy and complexity and how it fosters language acquisition has been less touched than grammar and measures of. Helping learners develop lexical knowledge is important since lexical errors impede communication (Crossley & McNamara, 2009).

Most research has considered lexical accuracy measures as the ratio of total number of lexical errors to total number words (Mazgutova & Kormos, 2015; Polio, 2001). Fritz and Ruegg (2013) distinguished two general types of errors that are attended by raters in their study. Word formation errors are of three types including formal misselection (suffix type, prefix type, vowel-based type, and false friends) and

misformation (borrowing L1 words, coinage which is inventing based on L1, and calque which is translation from L1) and distortion (omission, over inclusion, misselection, misordering, and blending). Semantic errors are of four types including confusion of sense relation (general term for specific one, overly specific term, inappropriate co hyponyms and near synonyms), collocation errors (semantic word selection, statistically weighted preferences, arbitrary combination, preposition partners), connotation errors and stylistic errors (verbosity and under specification).

With the advancement of computer assisted language learning, new lines of arguments were proposed. There is plenty of research on how computers and technology boosted language learning from linguistic perspective; all reporting positive effect of computer assisted learning on language such as the effect of computers on learning grammar such as adverbial clauses, (Kılıçkaya, 2015) and tenses (Ghorbani & Marzban, 2013), b) vocabulary learning (Bagheri, Roohani, & Ansari, 2012; Barani, 2012). Electronic collaborative writing is coauthored writing for communicating what is meant and negotiate meaning but in online and virtual mode. There are plenty of studies on how computers have affected learning writing. Wilson and Czik (2016) investigated the potential of Wiki writing and he confirmed it helped students to improve their writing quality and motivation and also helped teachers' to give accredited feedback. Besides, wiki writing is proved to positively affect the accuracy but not the complexity (Adams, Alwi, & Newton, 2015). The study of electronic mail in EFL indicated that computer assisted writing improved learners lexical errors in comparison with traditional paper and pencil writing in which students attend grammatical accuracy more than lexical one (González-Bueno & Pérez, 2000). Although aforementioned studies were both important and timely, they failed to provide a comprehensive picture since they explored each writing modality separately and weighted research on grammatical accuracy more than lexical accuracy.

## 2.4 The Present Study

Building on sociocultural research, the role of learner talk, negotiation of meaning and interaction in classroom is acknowledged to promote language learning (Twiner, Littleton, Coffin, & Whitelock, 2014). Interaction is maximized recently thanks to Technology mediated education. Information and communication technologies (ICT) have universally and profoundly affected today's society and education is not remained indifferent to this change (Almerich, Orellana, Suárez-Rodríguez, & Díaz-García, 2016). With exuberant technology use in society along with constructivist learning orientations, learning and teaching practices have been changed dramatically (Admiraal et al., 2017). Collaborative learning has risen from constructivism and socio-culturalism and involves social interactions between participants and psycho-social processes underlying collaboration can bring together psycholinguistic, interactional, social and ecological aspects of language learning together (Hsieh, 2017). Besides, recent interest in how computers can mediate the process of language learning led to the development of new terminology of "computer supported collaborative learning" (Stahl, Koschmann, & Suthers, 2006) and "e-collaborative learning" (Seitamaa-Hakkarainen, Raunio, Raami, Muukkonen, & Hakkarainen, 2001).

Despite the contribution these studies made to the field, there is one thing not addressed which is *the connecting potential computers have*. There has been plenty of research advocating the need for

providing social context and community in classrooms (Lowry, Curtis, & Lowry, 2004; Storch, 2013). Mutual accountability, negotiation and shared leadership are prerequisites of sociolinguistic approaches towards language learning (Mayo & Ibarrola, 2015).

However, only very limited research has been undertaken to investigate potential of different modalities of writing. To the best of the researchers' knowledge, there is has been no research investigating individual, collaborative and e-collaborative writing modalities comparatively. Therefore, research is needed to investigate writing performance in terms of whether individual, collaborative and e-collaborative writing produce significantly different medium for production of accurate language under otherwise similar condition. Moreover, novel in this research is an account of lexical accuracy along with grammatical accuracy.

## **The following research questions were proposed to achieve the objectives of the study.**

1. Does individual writing modality result in statistically significant sustained development in lexical and grammatical accuracy ?
2. Does collaborative writing modality result in any statistically significant sustained development in lexical and grammatical accuracy ?
3. Does e-collaborative writing modality result in any statistically significant sustained development in lexical and grammatical accuracy

## **Which writing modality led to a more sustained development in lexical and grammatical accuracy?**

The related research hypotheses based on the above mentioned research questioned were proposed to be tested for either confirmation or rejection.

1. Individual writing modality does not result in statistically significant sustained development in lexical and grammatical accuracy.
2. Collaborative writing modality does not result in any statistically significant sustained development in lexical and grammatical accuracy.
3. E-collaborative writing modality does not result in any statistically significant sustained development in lexical and grammatical accuracy.
4. None of the writing modalities of individual, collaborative or e-collaborative led to a more sustained development in grammatical and lexical accuracy.

## 3. Methods

### 3.1 Participants

#### 3.1.1 Student participants.

From among 173 Iranian female and male BA students of EFL with common L1 (Farsi), 90 were invited to participate in three study groups of individual (N, 30), collaborative (N, 30), and e-collaborative (N, 30) writing. The research was conducted on students of the language center of the researcher's institution. The participant selection was done according to participants' scores on a writing pretest and their assignment into the groups was done on the basis of convenient sampling. Convenient sampling is operationalized as how well the time table of the classes matches students' schedule and their tendency to participate in each group. It should be mentioned that for e-collaborative group, computer literacy was implemented as participant inclusion criterion through a 10 item questionnaire on how often, how well and what activities participants involve with using computers. The answers to the questionnaire determined which participants were assigned into e-collaborative group. Therefore, participant selection was based on random selection of participants on the basis of their scores on writing pretest. The students whose scores were one standard deviation above and below the mean were selected to participate in this study. The group assignment was based on convenient sampling. However, for e-collaborative group students access to computer was considered as a criterion for participant selection.

#### 3.1.2 Teacher participants.

Three male and six female Iranian EFL teachers were paid to enroll in this study. There were EFL PhD candidates and university instructors at the researcher's institution. Two criteria were implemented for teacher participant selection: teaching experience of more than 5 years and teaching writing experience. The teachers' assignment for the groups were done according to convenient sampling. They played role in two phases of the study. At the study phase they were acted as teachers doing their teaching practice and the analysis phase; they acted as raters rating grammatical and lexical accuracy according to the template given to them. In individual group, teachers introduced the topic, brainstorm it and gave analytic feedback to student writing. The teacher did the same in collaborative group.

Students were assigned into 6 groups of five students. They were debriefed about the group work and the responsibilities they had in each group. Each participant was responsible for managing the group work for one component of essay writing and they took turns for each component in such a way that all members of a group experienced monitoring all components including introduction, body paragraphs and conclusion.

The same collaboration's structure was implemented in e-collaborative group. Learners' collaborative writing was through [www.e-writing.com](http://www.e-writing.com) forum.ir. The teachers managed the class the same way as with the collaborative group's teachers did but this time the teachers were the admin in the website.



## **3.2 Instrumentation**

### **3.2.1 Pretest, posttest and delayed posttests.**

A pretest of essay writing was conducted at the onset of the research for two reasons. The first is for selecting homogeneous participants in terms of their writing proficiency and the second was to assure no statistically significant preexisting difference by conducting the homogeneity of variance tests on the results of pretest. After 10 sessions of treatment, an essay writing posttest was conducted to track any significant difference in accuracy of learner writing performance in each group. After two week time interval, a delayed posttest of essay writing was administered to track if the accuracy developed in each of the three modes of writing is sustained. There was no time limitation for each test. The essay writing format (task 2 of IELTS) and genres (Agree and disagreement) were instructed in the treatment phase of the study. The topic for all tests was the same. The inter-rater reliability among three raters across the groups at three measures of pretest, posttest and delayed posttest was conducted. Based on the inter-rater reliability analysis results, it can be claimed that there were significant agreement between the three raters who rated the participants' writing on pretest ( $\alpha = .659$ ,  $p = .000$ ), posttest ( $\alpha = .769$ ,  $p = .000$ ) and delayed posttest of English ( $\alpha = .804$ ,  $p = .000$ )

### **3.2.2 E-writing forum.**

An e- writing forum was designed on <http://e-writingforum.ir> and launched on September 2016. Some of the features of this website are as follow: (1) Sharing with anyone meaning that no finished file is uploaded; (2) accept or reject changes meaning the possibility of tracking the changes and making control of what makes into the writing tasks and what does not; (3) in line comments which are provided through collaboration on specific pieces of text; (4) Discussion tools by which participants could share ideas, review changes and gather feedback in one place. Students registered on the website and got an account. They were assigned into 6 groups of five students and were supposed to run group work equally the same way as students did in collaborative group.

### **3.2.3 Grammatical and lexical complexity template.**

A template for measuring grammatical and lexical accuracy was designed and implemented which included the types and tokens of grammatical and lexical accuracy. Since raters' sensitivity towards lexical and grammatical accuracy affects the accuracy of the coding procedure (Fritz & Ruegg, 2013), three teachers from three groups were instructed and briefed about how to use the template to code participant writing performances for accuracy. Grammatical accuracy was measured on a scale of the ratio of total number of error free clauses to total number of independent clauses plus subordinate clauses and lexical accuracy is measured on the scale of the ratio of total number of errors to the total

number of words. Teachers were debriefed about different types of lexical and grammatical error and how to code the errors. Each error was treated as a test score indicative of the degree of inaccuracy.

### **3.3 Procedure**

After participant selection, teachers were given instruction on how to hold the classes in terms of teacher roles and teacher feedback with respect to writing modality. A pretest of essay writing on the onset of the study for the purpose of group homogeneity assessment, a posttest of essay writing for the purpose of tracking changes in accuracy measures and a delayed posttest for investigating the sustained development in writing accuracy were conducted across three groups of writing modality. Teachers were debriefed on accuracy measure template and the inter rater reliability between three teachers who acted as raters of writing in three phases of the study was calculated to ensure consistency in measurement and hence the reliability of the decisions of the raters (information on the template and inter-rater reliability indices were provided in previous section. The following flowchart shows the procedure in data collection.

Group A: Pretest → individual writing → posttest → delayed posttest

Group B: Pretest → collaborative writing → posttest → delayed posttest

Group C: Pretest → E- collaborative writing → delayed posttest

## **4. Results**

The present study investigates the effect of collaborative, individual and e-collaborative methods on the development and sustained development of lexical and grammatical accuracy among Iranian EFL learners.

### **4.1. The effect of individual writing on lexical and grammatical accuracy.**

MANOVA was run to compare the individual group's means on the pretests, posttests and delayed posttests of lexical and grammatical accuracy. The MANOVA was followed by post-hoc comparison tests to compare the means across three time intervals of pretest to posttest and delayed posttest. The results of the MANOVA ( $F(5, 38) = 16.06, p = .000, \text{partial } \eta^2 = .679$  representing a large effect size) (Table 2) indicated that there were significant differences between the individual group's means on the pretests, posttests and delayed posttests of lexical and grammatical accuracy.

Table 2  
Multivariate Tests; Pretests, Posttests and Delayed Posttests of Lexical and Grammatical Accuracy  
(Individual Writing Group)

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's Trace	.679	16.069	5	38	.000	.679
Wilks' Lambda	.321	16.069	5	38	.000	.679
Hotelling's Trace	2.114	16.069	5	38	.000	.679
Roy's Largest Root	2.114	16.069	5	38	.000	.679

As displayed in Table 3, the individual group showed an increase in their means from pretest of grammatical accuracy (M = 36.76) to posttest (M = 49.34); however, their mean score decreased to 47.25 on the delayed posttest. The same pattern can be seen on the lexical accuracy. The means on the pretest, posttest and delayed posttest were 40.95, 47.09 and 45.07 respectively.

Table 3  
Descriptive Statistics; Pretests, Posttests and Delayed Posttests of Lexical and Grammatical Accuracy  
(Individual Writing Group)

Tests	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Pre-grammatical	36.767	.955	34.840	38.695
Pre-lexical	40.953	1.079	38.775	43.132
Post-grammatical	49.349	1.118	47.092	51.605
Post-lexical	47.093	1.056	44.962	49.224
Delayed-grammatical	47.256	1.076	45.085	49.427
Delayed-lexical	45.070	.987	43.078	47.061

Based on the results displayed in Table 4 it can be concluded that a) the individual group had a significant improvement in their mean on grammatical accuracy from pretest (M = 36.76) to posttest (M = 49.34) (MD = -12.58, p = .000). They also sustained their significant difference from pretest to delayed posttest (M = 47.25) (MD = -10.48, p = .000), b) the individual group had a significant improvement in their mean on lexical accuracy from pretest (M = 40.95) to posttest (M = 47.09) (MD = -6.14, p = .000). They also sustained their significant difference from pretest to delayed posttest (M = 45.07) (MD = -4.11, p = .005). Therefore, it can be concluded that there was a statistically significant difference in lexical and grammatical accuracy of individual writing from pretest to posttest measures, and the difference was sustained.

Table 4

Pairwise Comparisons; Pretests, Posttests and Delayed Posttests of Lexical and Grammatical Accuracy (Individual Writing Group)

(I) Tests	(J) Tests	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Pre-grammatical	Post-grammatical	-12.581*	1.443	.000	-15.493	-9.669
	Delayed-grammatical	-10.488*	1.434	.000	-13.382	-7.595
Pre-Lexical	Post-Lexical	-6.140*	1.506	.000	-9.179	-3.100
	Delayed-Lexical	-4.116*	1.397	.005	-6.935	-1.298

\*. The mean difference is significant at the .05 level.

## 4. 2 The effect of collaborative writing on lexical and grammatical accuracy.

The MANOVA followed by post-hoc comparison tests were run to compare the collaborative group's means on the pretests, posttests and delayed posttests of lexical and grammatical accuracy in order to probe the second null-hypothesis. The results of the MANOVA ( $F(5, 38) = 17.64, p = .000, \text{partial } \eta^2 = .699$  representing a large effect size) (Table 5) indicated that there were significant differences between the collaborative group's means on the pretests, posttests and delayed posttests of lexical and grammatical accuracy.

Table 5

Multivariate Tests; Pretests, Posttests and Delayed Posttests of Lexical and Grammatical Accuracy (Collaborative Writing Group)

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's Trace	.699	17.642	5	38	.000	.699
Wilks' Lambda	.301	17.642	5	38	.000	.699
Hotelling's Trace	2.321	17.642	5	38	.000	.699
Roy's Largest Root	2.321	17.642	5	38	.000	.699

As displayed in Table 6, the collaborative group showed an increase in their means from pretest of grammatical accuracy ( $M = 34.58$ ) to posttest ( $M = 50.14$ ); however, their mean score decreased to 48.97 on the delayed posttest. The same pattern can be seen on the lexical accuracy. The means on the pretest, posttest and delayed posttest were 40.83, 48 and 47.07 respectively.

Table 6  
Descriptive Statistics; Pretests, Posttests and Delayed Posttests of Lexical and Grammatical Accuracy (Collaborative Writing Group)

Tests	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Pre-grammatical	34.581	.887	32.790	36.372
Pre-lexical	40.837	1.065	38.687	42.987
Post-grammatical	50.140	1.307	47.503	52.776
Post-lexical	48.000	1.250	45.477	50.523
Delayed-grammatical	48.977	1.285	46.383	51.570
Delayed-lexical	47.070	1.235	44.578	49.561

Based on the results displayed in Table 7 it can be concluded that a) the collaborative group had a significant improvement in their mean on grammatical accuracy from pretest (M = 34.58) to posttest (M = 50.14) (MD = -15.55, p = .000). They also sustained their significant difference from pretest to delayed posttest (M = 48.97) (MD = -14.39, p = .000), b) the collaborative group had a significant improvement in their mean on lexical accuracy from pretest (M = 40.83) to posttest (M = 48) (MD = -7.16, p = .000). They also sustained their significant difference from pretest to delayed posttest (M = 47.07) (MD = -6.23, p = .000). It can be concluded that there was a statistically significant difference in lexical and grammatical accuracy of collaborative writing from pretest to posttest measures, and the difference was sustained.

Table 7  
Pairwise Comparisons; Pretests, Posttests and Delayed Posttests of Lexical and Grammatical Accuracy (Collaborative Writing Group)

(I) Tests	(J) Tests	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Pre-grammatical	Post-grammatical	-15.558*	1.646	.000	-18.880	-12.236
	Delayed-grammatical	-14.395*	1.745	.000	-17.918	-10.873
Pre-Lexical	Post-Lexical	-7.163*	1.616	.000	-10.425	-3.901
	Delayed-Lexical	-6.233*	1.429	.000	-9.116	-3.349

\*. The mean difference is significant at the .05 level.

## 4.3 The effect of e-collaborative group on lexical and grammatical accuracy.

The MANOVA followed by post-hoc comparison tests were run to compare the e-collaborative group's means on the pretests, posttests and delayed posttests of lexical and grammatical accuracy in order to probe the third null-hypothesis. The results of the MANOVA ( $F(5, 38) = 8.64, p = .000, \text{partial } \eta^2 = .532$  representing a large effect size) (Table 8) indicated that there were significant differences between the e-collaborative group's means on the pretests, posttests and delayed posttests of lexical and grammatical accuracy.

Table 8

Multivariate Tests; Pretests, Posttests and Delayed Posttests of Lexical and Grammatical Accuracy (E-collaborative Writing Group)

Effect	Value	F	Hypothesis df	Error df	Sig.	Partial Eta Squared
Pillai's Trace	.532	8.644	5	38	.000	.532
Wilks' Lambda	.468	8.644	5	38	.000	.532
Hotelling's Trace	1.137	8.644	5	38	.000	.532
Roy's Largest Root	1.137	8.644	5	38	.000	.532

As displayed in Table 9, the e-collaborative group showed an increase in their means from pretest of grammatical accuracy ( $M = 36.74$ ) to posttest ( $M = 45.83$ ); however, their mean score decreased to 43.80 on the delayed posttest. The same pattern can be seen on the lexical accuracy. The means on the pretest, posttest and delayed posttest were 41.27, 43.95 and 41.88 respectively.

Table 9

Descriptive Statistics; Pretests, Posttests and Delayed Posttests of Lexical and Grammatical Accuracy (E-collaborative Writing Group)

Tests	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Pre-grammatical	36.744	.883	34.962	38.526
Pre-lexical	41.279	1.068	39.124	43.434
Post-grammatical	45.837	1.434	42.944	48.730
Post-lexical	43.953	1.391	41.146	46.761
Delayed-grammatical	43.814	1.356	41.077	46.551
Delayed-lexical	41.884	1.320	39.221	44.547

Based on the results displayed in Table 10 it can be concluded that a) the e-collaborative group had a significant improvement in their mean on grammatical accuracy from pretest (M = 36.74) to posttest (M = 45.83) (MD = -9.09, p = .000). They also sustained their significant difference from pretest to delayed posttest (M = 43.81) (MD = -7.07, p = .000), b) the e-collaborative group did not have any significant improvement in their mean on lexical accuracy from pretest (M = 41.27) to posttest (M = 43.95) (MD = -2.67, p = .175). No significant difference was sustained from pretest to delayed posttest (M = 41.88) (MD = -.605, p = .747). There was a statistically significant difference in grammatical accuracy of e-collaborative writing from pretest to posttest measures, and the difference was sustained; however they did not show any significant improvement not sustenance in their means on lexical accuracy.

Table 10

Pairwise Comparisons; Pretests, Posttests and Delayed Posttests of Lexical and Grammatical Accuracy (E-collaborative Writing Group)

(I) Tests	(J) Tests	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Pre-grammatical	Post-grammatical	-9.093*	1.738	.000	-12.601	-5.585
	Delayed-grammatical	-7.070*	1.705	.000	-10.511	-3.628
Pre-Lexical	Post-Lexical	-2.674	1.938	.175	-6.586	1.237
	Delayed-Lexical	-.605	1.860	.747	-4.359	3.150

\*. The mean difference is significant at the .05 level.

## 4.4 The effect of modality on accuracy.

The fourth research question was broken into two parts to compare the three groups' means on the posttest and delayed posttest of grammatical accuracy first; and then on the posttest and delayed posttest of lexical accuracy.

### 4.4.1 The effect of writing modality on grammatical accuracy.

The MANOVA was run to compare the three groups' means on the pretest, posttest and delayed posttest of grammatical accuracy. Before discussing the results it should be noted that the assumption of

homogeneity of variance and covariance matrices were met. As displayed in Table 11, the probabilities associated with the pretest, posttest and delayed posttest of grammatical accuracy were not significant ( $p > .05$ ).

Table 11  
Levene's Test of Equality of Error Variances;  
Grammatical Accuracy

	F	df1	df2	Sig.
Pretest	.018	2	126	.982
Posttest	1.273	2	126	.283
Delayed Posttest	1.073	2	126	.345

The assumption of homogeneity of covariance matrices; i.e. correlations between any two dependent variables should be roughly equal, was also met (Box's M = 7.36,  $p = .850$ ) (Table 12).

Table 12  
Box's Test of Equality of  
Covariance Matrices

<b>Box's M</b>	<b>7.368</b>
F	.593
df1	12
df2	76937.538
Sig.	.850

The results of the MANOVA (Table 12) indicated that a) There were not any significant differences between the three groups' means on the pretest of grammatical accuracy ( $F(2, 126) = 1.90$ ,  $p = .153$ , partial  $\eta^2 = .029$  representing a weak effect size). Thus, it can be claimed that they were homogenous in terms of their knowledge on grammatical accuracy prior to the main study, b) there were significant differences between the three groups' means on the posttest of grammatical accuracy ( $F(2, 126) = 3.13$ ,  $p = .047$ , partial  $\eta^2 = .047$  representing an almost moderate effect size), c) There were significant differences between the three groups' means on the delayed posttest of grammatical accuracy ( $F(2, 126) = 4.46$ ,  $p = .013$ , partial  $\eta^2 = .066$  representing a moderate effect size).



Table 13

Tests of Between-Subjects Effects; Pretest, Posttest and Delayed Posttest of Grammatical Accuracy by Groups

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Group	Pretest	135.550	2	67.775	1.907	.153	.029
	Posttest	451.023	2	225.512	3.139	.047	.047
	Delayed Posttest	594.295	2	297.147	4.460	.013	.066
Error	Pretest	4478.326	126	35.542			
	Posttest	9052.791	126	71.848			
	Delayed Posttest	8395.674	126	66.632			
Total	Pretest	172086.00	129				
	Posttest	312217.00	129				
	Delayed Posttest	290110.00	129				

Table 14 displays the means on the three groups on the pretest, posttest and delayed posttest of grammatical accuracy.

Table 14

Descriptive Statistics; Pretest, Posttest and Delayed Posttest of grammatical Accuracy by Groups

Dependent Variable	group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Pretest	collaborative	34.581	.909	32.782	36.381
	individual	36.767	.909	34.968	38.567
	e-collaborative	36.744	.909	34.945	38.543
Posttest	collaborative	50.140	1.293	47.581	52.698
	individual	49.349	1.293	46.791	51.907
	e-collaborative	45.837	1.293	43.279	48.395
Delayed Posttest	collaborative	48.977	1.245	46.513	51.440
	individual	47.256	1.245	44.792	49.719
	e-collaborative	43.814	1.245	41.350	46.277

The results of the post-hoc comparison tests (Table 15) indicated that a) there was not any significant difference between the collaborative (M = 50.14) and individual (M = 49.34) groups' means on the

posttest of grammatical accuracy (MD = .791,  $p = .666$ ), b) there was not any significant difference between the individual (M = 49.34) and e-collaborative (M = 45.83) groups' means on the posttest of grammatical accuracy (MD = 3.51,  $p = .057$ ), b) the collaborative group (M = 50.14) significantly outperformed the e-collaborative group (M = 45.83) on the posttest of grammatical accuracy (MD = 4.30,  $p = .020$ ), d) there was not any significant difference between the collaborative (M = 48.97) and individual (M = 47.25) groups' means on the delayed posttest of grammatical accuracy (MD = 1.72,  $p = .303$ ), e) There was not any significant difference between the individual (M = 47.25) and e-collaborative (M = 43.81) groups' means on the delayed posttest of grammatical accuracy (MD = 3.44,  $p = .053$ ), f) the collaborative group (M = 48.97) significantly outperformed the e-collaborative group (M = 43.81) on the delayed posttest of grammatical accuracy (MD = 5.16,  $p = .004$ ).

Table 15  
Post-Hoc Comparisons; Posttest and Delayed Posttest of grammatical Accuracy by Groups

Dependent Variable	(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
Posttest	Collaborative	Individual	.791	1.828	.666	-2.827	4.408
		e-collaborative	4.302*	1.828	.020	.685	7.920
	Individual	e-collaborative	3.512	1.828	.057	-.106	7.129
Delayed Posttest	Collaborative	Individual	1.721	1.760	.330	-1.763	5.205
		e-collaborative	5.163*	1.760	.004	1.679	8.647
	Individual	e-collaborative	3.442	1.760	.053	-.042	6.926

\*. The mean difference is significant at the .05 level.

## 4.4.2 The effect of writing modality on lexical accuracy.

The MANOVA was run to compare the three groups' means on the pretest, posttest and delayed posttest of lexical accuracy. Before discussing the results it should be noted that the assumption of homogeneity of variance and covariance matrices were met. As displayed in Table 16, the probabilities associated with the pretest, posttest and delayed posttest of lexical accuracy, were not significant ( $p > .05$ ).

Table 16  
Levene's Test of Equality of Error Variances; Lexical Accuracy

	F	df1	df2	Sig.
Pretest	.000	2	126	1.000
Posttest	2.801	2	126	.065
Delayed Posttest	1.656	2	126	.195

The assumption of homogeneity of covariance matrices; i.e. correlations between any two dependent variables should be roughly equal, was also met (Box's M = 12.48,  $p = .441$ ) (Table 16).

Table 17  
Box's Test of Equality of Covariance Matrices

<b>Box's M</b>	<b>12.487</b>
F	1.005
df1	12
df2	76937.538
Sig.	.441

The results of the MANOVA (Table 17) indicated that a) there were not any significant differences between the three groups' means on the pretest of lexical accuracy ( $F(2, 126) = .046$ ,  $p = .955$ , partial  $\eta^2 = .001$  representing a weak effect size). Thus it can be claimed that they were homogenous in terms of their knowledge on lexical accuracy prior to the main study, b) there were not significant differences between the three groups' means on the posttest of lexical accuracy ( $F(2, 126) = 2.93$ ,  $p = .057$ , partial  $\eta^2 = .044$  representing an almost moderate effect size); although the results should be interpreted cautiously because the effect size enjoyed an almost moderate effect size and the results of the post-hoc comparisons (Table 18 below) indicated significant difference between the collaborative and e-collaborative groups on the posttest of lexical accuracy, c) there were significant differences between the three groups' means on the delayed posttest of lexical accuracy ( $F(2, 126) = 4.84$ ,  $p = .009$ , partial  $\eta^2 = .071$  representing a moderate effect size).

Table 18

Tests of Between-Subjects Effects; Pretest, Posttest and Delayed Posttest of Lexical Accuracy by Groups

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Group	Pretest	4.512	2	2.256	.046	.955	.001
	Posttest	387.767	2	193.884	2.932	.057	.044
	Delayed Posttest	588.326	2	294.163	4.841	.009	.071
Error	Pretest	6212.419	126	49.305			
	Posttest	8331.535	126	66.123			
	Delayed Posttest	7656.000	126	60.762			
Total	Pretest	223312.00	129				
	Posttest	285839.00	129				
	Delayed Posttest	265703.00	129				

Table 19 displays the means on the three groups on the pretest, posttest and delayed posttest of lexical accuracy.

Table 19

Descriptive Statistics; Pretest, Posttest and Delayed Posttest of lexical Accuracy by Groups

Dependent Variable	group	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Pretest	collaborative	40.837	1.071	38.718	42.956
	individual	40.953	1.071	38.834	43.073
	e-collaborative	41.279	1.071	39.160	43.398
Posttest	collaborative	48.000	1.240	45.546	50.454
	individual	47.093	1.240	44.639	49.547
	e-collaborative	43.953	1.240	41.499	46.408
Delayed Posttest	collaborative	47.070	1.189	44.717	49.422
	individual	45.070	1.189	42.717	47.422
	e-collaborative	41.884	1.189	39.531	44.236

The results of the post-hoc comparison tests (Table 20) indicated that a) there was not any significant difference between the collaborative (M = 48) and individual (M = 47.09) groups' means on the posttest of

lexical accuracy (MD = .907,  $p = .606$ ), b) there was not any significant difference between the individual (M = 47.09) and e-collaborative (M = 43.95) groups' means on the posttest of lexical accuracy (MD = 3.14,  $p = .076$ ), c) The collaborative group (M = 48) significantly outperformed the e-collaborative group (M = 43.95) on the posttest of lexical accuracy (MD = 4.04,  $p = .023$ ), d) there was not any significant difference between the collaborative (M = 47.07) and individual (M = 45.07) groups' means on the delayed posttest of lexical accuracy (MD = 2,  $p = .236$ ), e) there was not any significant difference between the individual (M = 45.07) and e-collaborative (M = 41.88) groups' means on the delayed posttest of lexical accuracy (MD = 3.18,  $p = .060$ ), f) the collaborative group (M = 47.07) significantly outperformed the e-collaborative group (M = 41.88) on the delayed posttest of lexical accuracy (MD = 5.18,  $p = .003$ ).

Table 20  
Post-Hoc Comparisons; Posttest and Delayed Posttest of lexical Accuracy by Groups

Dependent Variable	(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
Posttest	Collaborative	Individual	.907	1.754	.606	-2.564	4.378
		e-collaborative	4.047*	1.754	.023	.576	7.517
	Individual	e-collaborative	3.140	1.754	.076	-.331	6.610
Delayed Posttest	Collaborative	Individual	2.000	1.681	.236	-1.327	5.327
		e-collaborative	5.186*	1.681	.003	1.859	8.513
	Individual	e-collaborative	3.186	1.681	.060	-.141	6.513

\*. The mean difference is significant at the .05 level.

, posttest and delayed posttest of lexical accuracy by groups

## 5. Discussion

The results indicated that Individual and collaborative writing modality improved writing quality in terms of grammatical and lexical accuracy and the improvement was sustained. E-collaborative writing modality resulted in sustained improvement in terms of grammatical accuracy but not lexical accuracy. Collaborative writing was the most effective mode in improvement and sustained improvement of writing quality in terms of grammatical and lexical accuracy.

The results of the study corroborate and contrast with results of a number studies. As with the study of Mazgutova and Kormos (2015) indicated, the present study confirms that collaborative and individual

writing can help learners develop the repertoire of lexical and grammatical choices. Besides, the findings of the present study are in line with the study of lexical issues in writing of international student by Nakamaru (2010) which supports that lexical accuracy are among many lexical issues students attend to in writing of different modes, genres and with different tutoring. The findings also are consistent with those of the study by Sauro (2012). In contrast with the results of this study which confirmed the positive effect of all writing modality in language improvements in terms of grammatical and lexical accuracy (except for e-collaborative writing), the study by Folkesson and Swalander (2007) indicated that individual writing has not significantly affected language improvements.

Likewise, the results of the present study support studies in *Education and Information Technology Journal* as far as collaborative digital writing was concerned. For example, (López-Pellisa, Rotger, & Rodríguez-Gallego, 2020)' study of the collaborative digital writing indicated that peer feedback in their platform was more constructive and effective than unidirectional corrections provided by the teacher. Similarly, Davoli, Monari, and Eklundh (2009) indicated that group work tools in e-learning practices results in feedbacks in real life context and more attention to style and content of student writing. El Mhouti, Nasseh, Erradi, and Vasquèz (2017) indicated that collaborative e-learning primes real life processing if group work practices follow collaborative design development process in which content generated through that process will be less the product of single author and rather result of team work. Cequeña (2020)' study results also corroborate the results of the present study as both studies confirmed that e-collaborative writing causes better learning quality compared to conventional writing performances. Cequeña also suggested a correlated self-perception with webbased reading and writing compared to conventional reading and writing. As far as computer assisted language learning is concerned, the results of this study are in line with those of Rahnavard and Mashhadi Heidar (2017). Rahnavard and Mashhadi Heidar's (2017) study indicated that no significant evidence was found with respect to lexical and grammatical improvements. However, the present study confirms grammatical improvement due to assistance of computers in language learning. The results of this study also do not confirm the previous research on e-collaborative writing. As Choi (2008)'s evaluation of e-collaborative writing on ESL writing through questionnaire and interview and reflective essay indicated a supportive role of e-collaborative writing which could not be approved in this study. This contrary to previous research (Goldberg, Russell, & Cook, 2003; Hayes & Ge, 2008; Lehtinen, Hakkarainen, Lipponen, Rahikainen, & Muukkonen, 1999) suggests that when it comes to technology, e-collaborative learning is not as successful as collaborative classroom writing. (Engerer, 2020) and Hou et al. (2020) also urged for cautious interpretation of the results of the studies on collaborative e-learning as it may adversely affect academic performance and invited for revising dynamicity issues in collaborative digital writing research.

## 6. Conclusion

This study aimed at investigating the potential of three writing modalities of individual, collaborative and e-collaborative writing in fostering the development and sustained development of lexical and grammatical accuracy of EFL intermediate learners. The results indicated that individual writing and collaborative writing improved and sustained grammatical and lexical accuracy. The results also

indicated that E-collaborative writing improved and sustained grammatical accuracy but not lexical one. The post hoc comparison indicated that that collaborative writing was the most effective mode of writing as far as grammatical and lexical accuracy is concerned.

This study contributes to the growing body of research on maximizing learning opportunities and establishes a platform for further research and beginning to fill existing niche in research on writing ability. The results suggest that teacher's collaboration with student work can help them better direct students and the self (Van Gasse, Vanlommel, Vanhoof, & Van Petegem, 2016). For students also, the results can help them engaged in continuous assessment of self and other learners, higher motivation and autonomy (Pinto-Llorente, Sánchez-Gómez, García-Peñalvo, & Casillas-Martín, 2016). The findings also can help assessment practitioners to explore the methodological and functional options that collaborative learning may have for evaluation purposes (Strijbos & Sluijsmans, 2010). The results also imply that when it comes to technology, education policy makers need to revisit the role of technology. High tech does not mean better learning at least in education ecology of Iran. Policy makers need to make principled decision about how to initiate changes and how to manage the consequence of changes. If electronic supported learning is advocated by research on education, first the infrastructures should be provided if not that may create a digital divide among learners. Iran's haphazard distribution of broadband, connectivity and internet quality (Rabiee, Nazarian, & Gharibshaeyan, 2013) makes privileged few at the advantage of others. As the findings of this study indicated, the technology induction does not mean better performance. Many inherent ethnographical aspects need to be revisited.

Despite the interesting findings, this research has a number of limitations that should be followed by further research. The first is qualitative analysis of student and teacher perspective on writing experience through portfolio or reflective writing. This might be worthy of inclusion and would lead to better understanding of students composing behaviors. The other limitation which calls for further research is that in this study had a linguistic features were taken into account whereas other aspects such as psycholinguistic factors such as satisfaction, motivation, self-efficacy and autonomy can help understand what other benefits students can have out of writing in different writing modality such as. Besides, the convenient based sampling assignment of students into groups might have affected the results. As Strijbos and Fischer (2007), mutual influence of learning partners may affect the group work, group unity and group divergence and convergence. Therefore, further research can help understand how group dynamics can influence writing performance with respect to writing modality.

## List Of Abbreviations

EFL: English as Foreign Language

MANOVA: Multivariate analysis of variance

CDW: Collaborative Digital Writing

L1: First Language

ITC: Information Communication Technology

IELTS: International English Language Testing System

## **Declarations**

### **Funding:**

There is no funding for this research

### **Conflicting interest:**

There is no conflicting interest

## **Availability of data and material**

data is available for submission if necessary

## **Code availability**

SPSS entry was used

## **Ethics approval**

research ethical issues were established and acknowledged in this research

## **Informed consent:**

This research involves Human Participants and Informed consent was recognized and acknowledged in this research

## **Consent for publication**

Authors adhere to the Journals Copy Right and publication policies

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