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Research Paper

Enhancing Writing Accuracy, Fluency, and Complexity in Iranian Intermediate EFL Learners Through Mobile-Assisted Language Learning

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Abstract
This quasi-experimental research investigated the relative effectiveness of teacher scaffolding compared to peer scaffolding strategies on the writing performance of Iranian EFL learners—specifically focusing on accuracy, fluency, and complexity—within a mobile-assisted instructional framework guided by Vygotsky's Zone of Proximal Development. The study involved 80 university students with intermediate English proficiency, comprising both male and female participants, who were pursuing degrees in English Language Translation at Islamic Azad University in Ayatollah Amoli, Iran. The participants were separated into two experimental groups, along with one control group. After an initial essay-writing pretest and a sequence of ten instructional sessions, a posttest was administered. The essays were evaluated by two independent raters utilizing Larsen-Freeman's assessment profile. Statistical analyses, which included paired samples t-tests and one-way ANOVA, revealed that both scaffolding strategies significantly enhanced learners' writing accuracy, fluency, and complexity. Importantly, the group that received teacher scaffolding demonstrated greater improvement in composing five-paragraph essays compared to their peers. These results offer valuable insights for educators, students, and researchers in Iran, highlighting the crucial role of scaffolding strategies—especially teacher scaffolding—in improving EFL learners' essay writing skills.

Keywords: Complexity, EFL writing, Fluency, Mobile-assisted instruction, Peer scaffolding, Teacher scaffolding, Writing accuracy

Introduction

Mobile-assisted instruction (MAI) has garnered substantial interest within language education due to its potential to enhance learners' writing skills. This enhancement is particularly critical for intermediate learners in Iran, where improving writing accuracy, fluency, and complexity is of paramount importance. Thus, investigating the effectiveness of scaffolding—offered by both teachers and peers—within the context of MAI represents a timely and significant area of inquiry (Bachore, 2015).

The progress of technology has led to a decrease in the dimensions and enhanced portability of educational devices. According to Guo et al. (2022), various technologies that facilitate language learning include PDAs, multimedia-enabled mobile phones, MP3 players, DVD players, and digital dictionaries. These portable tools—described in both scholarly and popular contexts as mobile, wireless, handheld, or nomadic technologies—are now ubiquitous in everyday life. Mobile learning (m-learning), a swiftly growing sector of e-learning, is exemplified by European initiatives such as m-learning projects and Mobilearn (Kamaşak et al., 2021). Despite the increasing integration of mobile-assisted language learning (MALL), there has been a comparatively lower focus on its contribution to the improvement of writing skills in relation to other language domains; nonetheless, this disparity is swiftly diminishing (Andujar, 2016; Rambe & Bere, 2013). Considering that writing development is a crucial aspect of acquiring a foreign or second language, the potential of mobile-assisted instruction (MAI) to improve this skill warrants comprehensive exploration.

In this process, the importance of scaffolding offered by educators and peers has become increasingly evident. Scaffolding plays a crucial role in facilitating learners' progress by providing the essential support and guidance throughout their educational experiences (Khatri, 2021). Specifically, in the context of mobile-assisted instruction (MAI), scaffolding can be applied through various techniques, such as instructional materials, prompts, feedback, and interactions with both educators and peers (Golightly, 2021). This research intends to investigate the effects of mobile-assisted instruction—particularly focusing on the scaffolding provided by teachers and peers—on the writing accuracy, fluency, and complexity of intermediate EFL learners in Iran. By analyzing the effects of these two types of scaffolding support, the study aims to elucidate their individual roles in enhancing writing skills among Iranian learners. The current study is directed by the following research questions:

RQ1: *In the context of mobile-assisted instruction, does teacher scaffolding, as opposed to peer scaffolding, result in notable differences in the writing accuracy of Iranian intermediate EFL learners?*

RQ2: *Are there notable differences in the enhancement of writing fluency between teacher scaffolding and peer scaffolding when applied through mobile-assisted instruction for Iranian intermediate EFL learners?*

RQ3: *To what degree does teacher scaffolding vary from peer scaffolding in its impact on the writing complexity of Iranian intermediate EFL learners when executed through mobile-assisted instruction?*

Literature Review

The integration of computer and mobile technologies into language education has become increasingly prominent, positioning technology as a central component of language learning and communication processes (Gharehblagh & Nasri, 2020). Titova and Danilina (2018) argue that technology, though often invisible, is fundamentally embedded in language use today, requiring language professionals to understand and teach how technology mediates communication. Watson and Reigeluth (2016) further emphasize the transformative impact of information technology in society and education, advocating the deliberate use of its potential to advance

learning. From a technological standpoint, Kloper et al. (2002) predicted that future communication will heavily involve human-computer interactions, particularly due to advances in language recognition, emphasizing the increasing relevance of technology for language acquisition.

In the particular domain of Mobile-Assisted Language Learning (MALL), scholarly inquiry has concentrated on the efficacy of mobile devices in augmenting language proficiency. However, there exists a relative scarcity of research examining their influence on the development of writing skills. Baleghizadeh and Oladrostam (2010) explored the contribution of mobile phones to enhancing grammatical accuracy among Iranian EFL learners. Their research indicated that students who engaged in mobile-assisted speaking tasks—such as recording and subsequently analyzing their own speech—demonstrated significantly greater improvements in grammatical accuracy compared to their counterparts who did not utilize such resources. These results align with Parsa and Anjomshoa's (2022) view that language acquisition is a gradual, cumulative process that benefits from repeated exposure to target items. Mobile texting, owing to its brevity and omnipresence, offers continuous opportunities for language input, thereby facilitating learning anytime and anywhere (Khodabande & Boroughani, 2023).

Motivation, a key factor in successful language learning, is often enhanced through technology-based approaches. Van and Thanh (2021) found that EFL students' motivation increased when technology was integrated into the classroom, with learners expressing a strong preference for such methods. Mobile technologies, particularly SMS, help sustain learner engagement beyond formal instructional settings by providing convenient, learner-centered interaction opportunities (Arvanitis & Krystalli, 2021). This motivational dimension is further supported by findings from Motallebzadeh et al. (2011), who demonstrated that SMS-based instruction significantly improved Iranian learners' retention of English collocations compared to traditional paper-based methods. Additionally, Liu and Chen (2014) demonstrated that using mobile phones for taking pictures in language learning contexts enhanced learners' phrase acquisition by encouraging productive and interactive learning activities, resulting in superior learning outcomes compared to conventional tasks.

The theoretical foundation of this study is grounded in Vygotsky's (1978) sociocultural theory, which highlights the role of social interactions with more knowledgeable individuals in facilitating cognitive development. A crucial component of this theory is the Zone of Proximal Development (ZPD), which posits that learners can achieve greater performance levels with appropriate guidance compared to when they work independently. In the context of language acquisition, scaffolding provided by teachers or peers serves as a form of mediation, assisting learners in the gradual acquisition of new skills (Kozulin et al., 2003).

MALL technology naturally aligns with sociocultural principles by offering platforms for mediated interaction, enabling learners to collaborate and receive scaffolding asynchronously or synchronously, irrespective of physical distance. Mobile devices afford learners real-time communication and feedback, essential for progressing through their ZPD toward autonomous language use (McLeod, 2020). Considering the growing prominence of MALL and its theoretical justification, the study seeks to contribute empirical evidence on how mobile-mediated scaffolding supports learners' writing skill development and offers implications for pedagogical practices in language education.

Methodology

The Design of the Study

This research utilized a quasi-experimental framework that involved three separate instructional groups to assess the impact of teacher scaffolding compared to peer scaffolding in mobile-assisted instruction on the writing accuracy, fluency, and complexity of Iranian intermediate EFL learners. Due to practical constraints, intact groups formed two experimental groups (teacher

scaffolding and peer scaffolding) and a control group without scaffolding. Pretests and posttests assessed writing performance changes, enabling analysis of within- and between-group differences. This design examines causal effects while maintaining real classroom validity, providing evidence on the effectiveness of scaffolding strategies through mobile technologies in writing development (Creswell & Plano Clark, 2017).

Participants

The research included 80 university students at the intermediate level, specializing in English Language Translation at Islamic Azad University, Ayatollah Amoli, Iran, with ages ranging from 20 to 31. The sample comprised both male and female students, with a predominance of females, totaling 66 females and 14 males. Participants were selected using convenience sampling, which was determined by the researcher's accessibility to the student population.

Materials and Instruments

The instructional resource used was the ninth edition of 'The Practical Writer' (9th edition) by Edward P. Bailey and Philip A. Powell, published by Cengage Learning on April 25, 2007. Designed for intermediate learners, it provides a structured approach to developing writing skills, guiding students from writing one-paragraph essays to five-paragraph essays, and eventually to research-based writing. The book clearly summarizes key writing principles for college success and includes an 'Improving Grammar and Expression' section on Standard English rules, helping students refine their grammar and expression.

Furthermore, the research utilized various tools to guarantee uniformity among participants and to assess particular writing results. Initially, the Oxford Quick Placement Test (OQPT) was conducted to verify that every participant possessed an intermediate level of English proficiency, thereby creating a consistent sample regarding language skills. The test demonstrated strong internal consistency, with a Cronbach's alpha of .85, which affirms its reliability and suitability for this study. To assess progress in writing accuracy, fluency, and complexity, both pretest and posttest assessments were conducted using a five-paragraph narrative essay task. Participants had one hour to write essays on chosen topics meant to provoke diverse and rich responses. The pretest topics included themes like relocating, experiencing a disappointing birthday, and encountering unexpected high temperatures during summer- each designed to gather varied narrative samples for baseline measurement. The posttest topics involved subjects such as taking an unexpected trip, reflecting on a unique personal experience, and reconsidering initial judgments about others. These prompts aimed to not only measure writing skill improvement but also assess participants' critical thinking and creativity in narrative writing.

The research employed Larsen-Freeman's (2006) Profile for systematic essay evaluation, utilizing T-units to assess accuracy, fluency, and complexity. Accuracy was determined by the proportion of error-free units to the total number of T-units, taking into account lexical, morphological, and syntactic errors. Fluency was evaluated based on the average number of words per T-unit, while complexity was assessed through the ratio of clauses to T-units, with T-units defined as a main clause accompanied by any subordinate clauses. This approach is widely recognized for delivering dependable evaluations of both written and spoken language abilities, thereby ensuring an objective measurement of the specific writing elements examined in the study.

Data Collection Procedure

This study involved 80 intermediate-level students, both male and female, enrolled in the English Language Translation program at Islamic Azad University, Ayatollah Amoli, Iran. Their ages

ranged from 20 to 31. Participants were chosen using convenience random sampling according to Krejcie and Morgan's sample size table (Ahmad & Halim, 2017). To ensure similar English proficiency, the OQPT was administered, with scores interpreted based on Pollitt's (2017) framework. After confirming proficiency, participants were randomly divided into three groups: two experimental groups and one control group. The first experimental group (n = 26) received mobile-assisted instruction plus teacher scaffolding. The second experimental group (n = 24) experienced mobile-assisted instruction with peer scaffolding, while the control group (n = 30) received traditional essay writing instruction.

Before the intervention, all groups completed a pretest that involved writing a five-paragraph narrative essay to establish a baseline for writing performance. The intervention for the experimental groups consisted of ten weekly sessions of approximately ninety minutes each, based on scaffolding strategies informed by Vygotsky's ZPD and operationalized following Gonzalez (2019) and Amerian et al. (2014). Instructional procedures involved decomposing the writing process into manageable steps—brainstorming, outlining, drafting, evaluating, and revising—to facilitate effective essay composition. Visual aids such as graphic organizers supported learners in structuring and connecting ideas coherently. Additionally, model writing samples were employed to provide clear examples of expected writing formats, enabling students to internalize effective strategies. To scaffold sentence construction, sentence frames and stems were introduced to assist learners with varying proficiency levels in developing syntactically and semantically appropriate expressions. The collaborative nature of the writing process was fostered through the language experience approach, which involved joint writing activities between teachers and students based on shared experiences, thereby encouraging active participation and community building. Critical to the instructional process was timely and constructive feedback, where educators guided students in identifying areas requiring improvement and supported revision efforts to enhance the quality of written output. Data collection for the peer-scaffolding experimental group was conducted through weekly sessions structured around the use of The Practical Writer. Each session followed a seven-stage lesson plan oriented toward promoting accuracy, fluency, and complexity in narrative essay writing. Mobile devices such as smartphones, tablets, or laptops with internet connectivity were integral to facilitating online collaboration and feedback via platforms like Google Meet. Students engaged in peer-review activities where they exchanged drafts and critically evaluated each other's work, focusing on grammatical accuracy, coherence, and narrative depth. In contrast, the teacher-scaffolding experimental group participated in similarly structured ten weekly sessions guided by direct instructor support. The instructor utilized The Practical Writer as the primary teaching resource and provided targeted scaffolding aimed at improving students' writing accuracy, fluency, and complexity. Instructional procedures included modeling revision techniques, supplying corrective feedback, and demonstrating strategies to enhance narrative cohesion and elaboration. Participants used mobile technology to engage in interactive writing activities and receive real-time guidance and feedback. The control group attended sixteen traditional writing sessions, each lasting ninety minutes, following a standardized curriculum emphasizing the conventional five-paragraph essay structure. This instruction relied on The Practical Writer as well and focused on teaching clear thesis statements, development of supporting paragraphs, and effective conclusions without the use of mobile-assisted scaffolding techniques.

Data Analysis Procedure

The main aim of the data analysis was to evaluate how teacher and peer scaffolding through mobile-assisted instruction influences participants' writing accuracy, fluency, and complexity. To do this, essays from both pretests and posttests were scored by two independent raters using the

Profile of Larsen-Freeman (2006), a well-established framework for analyzing written language performance among English language learners. Before rating, the researcher clearly explained the specific writing criteria in the rubric to participants to ensure clear expectations. The two raters, including the researcher and a Ph.D.-qualified TEFL faculty member from the English Language Department at Islamic Azad University, Ayatollah Amoli, achieved high inter-rater reliability, with a Pearson correlation of r = .84.

Following Larsen-Freeman (2006), the assessment of writing accuracy was conducted by determining the ratio of error-free T-units to the overall count of T-units, taking into account lexical, morphological, and syntactic errors. Fluency was assessed by determining the average number of words per T-unit, in accordance with the approach outlined by Zhang and Cheng (2021) for evaluating language output. The complexity of writing was established by dividing the total number of clauses by the total number of T-units, where T-units are characterized as one independent clause along with its dependent clauses, both of which must contain an explicit subject and a finite verb. This emphasis on clauses as a metric is consistent with earlier studies that highlight their significance as indicators of syntactic advancement and writing competence (Barrot & Gabinete, 2021).

Results

This section provides an analysis and the results derived from the data, encompassing descriptive statistics related to the performance of the three groups on the OQPT, in addition to their scores in writing fluency, accuracy, and complexity.

Table 1

Descriptive Statistics of Performance on the OQPT for the Three Groups

	N	M	SD	Std. Error
ExG1	26	40.42	1.44	.283
ExG2	24	40.25	1.79	.367
CG	30	40.80	1.73	.315
Total	80	40.51	1.66	.185

The descriptive statistics for the three groups regarding the OQPT reveal comparable performance levels, with mean scores of 40.42 (SD = 1.44) for the teacher-scaffolding group (experimental group one, ExG1), 40.25 (SD = 1.79) for the peer-scaffolding group (experimental group two, ExG2), and 40.80 (SD = 1.73) for the control group (CG). The overall mean score was calculated at 40.51 (SD = 1.66), indicating a consistent proficiency level among participants prior to the intervention, thereby affirming the comparability of the groups for future writing assessments.

Table 2

Descriptive statistics for the performance of the three groups in writing accuracy, fluency, and complexity.

Group	Measure	Test	N	Mean	SD	Std. Error
ExG1	Accuracy	Pretest	26	0.71	0.071	0.0140
		Posttest	26	0.87	0.079	0.0139
	Fluency	Pretest	26	19.91	1.638	0.3213
		Posttest	26	22.43	1.655	0.3247
	Complexity	Pretest	26	3.42	0.172	0.0338

Group	Measure	Test	N	Mean	SD	Std. Error
		Posttest	26	3.75	0.346	0.0679
ExG2	Accuracy	Pretest	24	0.73	0.052	0.0106
		Posttest	24	0.83	0.059	0.0120
	Fluency	Pretest	24	20.03	1.532	0.3127
		Posttest	24	22.06	1.671	0.3411
	Complexity	Pretest	24	3.35	0.184	0.0377
		Posttest	24	3.63	0.399	0.0816
CG	Accuracy	Pretest	30	0.74	0.057	0.0104
		Posttest	30	0.76	0.091	0.0166
	Fluency	Pretest	30	19.98	1.182	0.2158
		Posttest	30	20.71	2.119	0.3869
	Complexity	Pretest	30	3.39	0.160	0.0292
		Posttest	30	3.50	0.263	0.0481

The descriptive statistics indicate that all three groups showed improvements from pretest to posttest in writing accuracy, fluency, and complexity. The teacher-scaffolding group (ExG1) demonstrated the largest gains in accuracy (from 0.71 to 0.87), fluency (19.91 to 22.43), and complexity (3.42 to 3.75). The peer-scaffolding group (ExG2) also experienced notable improvements in all measures, although to a slightly lesser degree than ExG1. The control group (CG) showed the smallest increases in all three areas, with minimal progress in accuracy (0.74 to 0.76), moderate gains in fluency, and marginal improvement in complexity. These results suggest that both scaffolding approaches within mobile-assisted instruction positively impacted the participants' writing development, with teacher scaffolding showing a slightly stronger effect.

Table 3

Tests of Normality on the Scores

	Skewness		Kurtosis		Kolmogorov-Smirnov		
	Statistics	Std. Error	Statistics	Std. Error	Statistics	df	Sig.
OQPT	.105	.269	-.314	.532	.146	80	.089
Accuracy Pretest	.008	.269	-.699	.532	.113	80	.097
Posttest	-.407	.269	.105	.532	.125	80	.102
Fluency Pretest	.399	.269	-.404	.532	.102	80	.126
Posttest	-.556	.269	-.493	.532	.106	80	.064
Complexity Pretest	-.343	.269	-.167	.532	.088	80	.198
Posttest	.212	.269	.154	.532	.082	80	.078

According to Table 3, the data for all measures—OQPT scores, and pretest and posttest scores for accuracy, fluency, and complexity—do not significantly deviate from a normal distribution. Skewness and kurtosis values for all variables are within acceptable ranges, and the Kolmogorov-Smirnov test yields p-values greater than the 0.05 significance level. This suggests that the assumption of normality is met for these data, supporting the use of parametric statistical analyses in subsequent tests.

Answering Research Question One

The first research question examined the comparative impacts of teacher and peer scaffolding on the writing precision of Iranian intermediate EFL students. Writing precision was characterized as the proportion of error-free T-units to the overall number of T-units in five-paragraph essays. T-unit tallies were collected for both the pretest and posttest, and a one-way ANOVA was conducted on the pre-intervention scores to confirm the comparability of the groups, thus guaranteeing that any variations observed in the posttest could be attributed to the scaffolding interventions.

Table 4

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
1.505	2	77	.228

The Levene's test conducted to evaluate the homogeneity of variances yielded a non-significant result (Levene Statistic = 1.505, df1 = 2, df2 = 77, p = .228), indicating that the variances across the groups are uniform. This finding reinforces the credibility of the assumption of equal variances, thereby permitting the use of parametric tests such as ANOVA for comparing the means of the groups.

Table 5

One-Way ANOVA for the Pretest Scores of Writing Accuracy Across the Three Groups.

	Sum of Squares	df	Mean Square	F	Sig.	η^2
Between Groups	.012	2	.006	1.645	.200	.04
Within Groups	.286	77	.004			
Total	.298	79				

Table 5 presents the results from the one-way ANOVA conducted on the pretest writing accuracy scores across the three groups. The findings reveal that there is no statistically significant difference among the groups, F (2, 77) = 1.645, p = .200, implying that the groups exhibited comparable levels of writing accuracy prior to the intervention. Additionally, the eta squared value of .04 signifies a small effect size, further supporting the equivalence of the groups at the initial measurement. In order to evaluate the changes in writing accuracy for each group after the respective treatment, paired samples t-tests were performed.

Table 6

Results of Paired Samples T-test for the ExG1

	M	SD	t	df	Sig. (2-tailed)	*r*
Pretest - Posttest	-.16	.088	-9.252	25	.000	.77

Table 6 presents the results for the teacher-scaffolding experimental group (ExG1) that employed mobile-assisted scaffolding in their instructional approach. The findings reveal a statistically significant improvement in writing accuracy from the pretest (M = 0.71, SD = 0.071) to the posttest (M = 0.87, SD = 0.079), t(25) = -9.252, p < .001, accompanied by a large effect size of .77, indicating a substantial positive impact of teacher scaffolding on the writing accuracy of the participants.

Table 7
Results of Paired Samples T-test for the ExG2

	M	SD	t	df	Sig. (2-tailed)	*r*
Pretest - Posttest	-.09	.089	-5.228	23	.000	.54

Table 7 presents the results for the peer-scaffolding experimental group (ExG2) that employed mobile-assisted learning. The findings reveal a statistically significant improvement in writing accuracy from the pretest (M = 0.73, SD = 0.052) to the posttest (M = 0.83, SD = 0.059), t(23) = -5.228, p < .001. The calculated effect size was substantial (.54), indicating that peer scaffolding through mobile-assisted instruction had a significant positive impact on the writing accuracy of the participants.

Table 8
Results of Paired Samples T-test for the CG

	M	SD	t	df	Sig. (2-tailed)	*r*
Pretest - Posttest	-.02	.100	-1.178	29	.248	.04

The results in Table 8 reveals no significant enhancement in writing accuracy from the pretest (M = 0.74, SD = 0.057) to the posttest (M = 0.76, SD = 0.091), t(29) = -1.178, p = .248, yielding a small effect size of .04. Subsequently, a one-way ANOVA was performed on the posttest writing accuracy scores to determine if there were any notable differences among the three groups.

Table 9
Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
1.772	2	77	.177

Based on these results shown in Table 9, the assumption of homogeneity remains intact, F (2, 77) = 1.772, p = .177.

Table 10
One-Way ANOVA for the Writing Accuracy Posttest Scores of the Three Groups

	Sum of Squares	df	Mean Square	F	Sig.	η^2
Between Groups	.175	2	.088	15.004	.000	.003
Within Groups	.449	77	.006			
Total	46.800	119				

The findings from the one-way ANOVA presented in Table 10 reveal a statistically significant difference between the groups, F (2, 77) = 15.004, p < .001. However, the eta squared value indicates a small effect size (.003). To identify which group pairs differ significantly, a Scheffe post hoc test was conducted for multiple comparisons.

Table 11
Scheffe Multiple Comparisons

	(J)	Mean			95% Confidence Interval	
(I) Groups	Groups	Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound

ExG1	ExG2	.04318	.02162	.143	-.0108	.0971
	CG	.11070*	.02046	.000	.0596	.1618
ExG2	ExG1	-.04318	.02162	.143	-.0971	.0108
	CG	.06751*	.02092	.008	.0153	.1197
CG	ExG1	-.11070*	.02046	.000	-.1618	-.0596
	ExG2	-.06751*	.02092	.008	-.1197	-.0153

*. The mean difference is significant at the 0.05 level.

Table 11 presents the findings from the multiple comparison analysis performed on the posttest writing accuracy scores to investigate group differences. The analysis reveals that the teacher-scaffolding group (ExG1; M = 0.87, SD = 0.079) significantly outperformed the control group (CG; M = 0.76, SD = 0.091). Additionally, the peer-scaffolding group (ExG2; M = 0.83, SD = 0.059) also demonstrated a notable advantage over the control group in terms of writing accuracy.

Answering Research Question Two

To explore the second research question regarding the impact of teacher versus peer scaffolding on the writing fluency of Iranian intermediate EFL learners, fluency was assessed by determining the average word count per T-unit in each five-paragraph essay. In particular, the total word count of each essay was divided by the number of T-units, resulting in an average word count per T-unit that served as a measure of fluency. The obtained fluency scores were subsequently analyzed through one-way ANOVA and paired-samples t-tests. Furthermore, pretest scores were reviewed to ensure group homogeneity in writing fluency before the intervention.

Table 12

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
3.163	2	77	.148

The results indicated in Table 12 indicate that the assumption of equal variances holds, as demonstrated by a non-significant finding, F (2, 77) = 3.163, p = .148. This reinforces the credibility of employing parametric tests that rely on the assumption of homogeneity of variance for further analyses.

Table 13

One-Way ANOVA for the Three Groups' Writing Fluency Pretest Scores

	Sum of Squares	df	Mean Square	F	Sig.	η^2
Between Groups	.176	2	.088	.042	.959	.001
Within Groups	161.660	77	2.099			
Total	161.837	79				

According to Table 13, there is no statistically significant difference between the groups, F (2, 77) = 0.042, p = .959. Furthermore, the eta squared value (.001) indicates a minimal effect size, reinforcing the idea that the groups were similar in writing fluency before the intervention. To evaluate the changes in writing fluency within each group, paired samples t-tests were conducted by comparing their pretest and posttest scores.

Table 14
Paired Samples T-test for the ExG1

	M	SD	t	df	Sig. (2-tailed)	*r*
Pretest - Posttest	-2.51	1.797	-7.134	25	.000	.67

Table 14 reveals a notable increase in writing fluency from the pretest (M = 19.91, SD = 1.638) to the posttest (M = 22.43, SD = 1.655), t (25) = -7.134, p < .001. <mark id="p_1">The effect size was considerable (r = .67), indicating a significant enhancement in the writing fluency of the group.

Table 15
Paired Samples T-test for the ExG2

	M	SD	t	df	Sig. (2-tailed)	r
Pretest - Posttest	-2.03	1.943	-5.122	23	.000	.53

Table 15 demonstrates a notable improvement in writing fluency from the pretest (M = 20.03, SD = 1.532) to the posttest (M = 22.06, SD = 1.671), t (23) = -5.122, p < .001. <mark id="p_1">The effect size was considerable (r = .74), indicating a significant enhancement in the group's writing fluency.

Table 16
Paired Samples T-test for the CG

	M	SD	t	df	Sig. (2-tailed)	r
Pretest - Posttest	-.728	2.140	-1.063	29	.073	.03

The results in Table 16 suggest that there was no notable enhancement in the writing fluency of the group from the pretest (M = 19.98, SD = 1.182) to the posttest (M = 20.71, SD = 2.119), t (29) = -1.863, p = .073, accompanied by a negligible effect size (r = .03). Subsequently, a one-way ANOVA was executed on the writing fluency scores obtained from the posttest to determine whether any significant differences existed among the groups.

Table 17
Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
2.363	2	77	.101

Table 17 indicates that the assumption of equal variances holds true, given that the test yielded a non-significant result, F (2, 77) = 2.363, p = .101. This reinforces the validity of utilizing statistical tests that rely on the premise of homogenous variances for data analysis.

Table 18
One-Way ANOVA for the Three Groups' Writing Fluency Posttest Scores

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	46.228	2	23.114	6.767	.002
Within Groups	263.008	77	3.416		
Total	309.236	79			

The analysis indicates a significant statistical difference between the groups, F (2, 77) = 6.767, p = .002, showing a large effect size with an eta squared value of .14. To identify which specific groups had significant differences, the Scheffe post hoc test was conducted for multiple comparisons.

Table 19

Scheffe Multiple Comparisons

(I) Groups	(J) Groups	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
ExG1	ExG2	.36549	.52316	.784	-.9404	1.6714
	CG	1.71705*	.49521	.004	.4809	2.9532
ExG2	ExG1	-.36549	.52316	.784	-1.6714	.9404
	CG	1.35156*	.50614	.033	.0882	2.6150
CG	ExG1	-1.71705*	.49521	.004	-2.9532	-.4809
	ExG2	-1.35156*	.50614	.033	-2.6150	-.0882

*. The mean difference is significant at the 0.05 level.

Based on the findings from the multiple comparison analysis presented in Table 19, there exists a statistically significant distinction between ExG1 (M = 22.43, SD = 1.655) and the control group (CG) (M = 20.71, SD = 2.119). Furthermore, a notable difference was observed between ExG2 (M = 22.06, SD = 1.671) and the CG (M = 20.71, SD = 2.119), suggesting that both experimental groups demonstrated greater writing fluency compared to the control group.

Answering Research Question Three

The third research inquiry investigated the impact of teacher scaffolding as opposed to peer scaffolding in the realm of mobile-assisted instruction on the complexity of students' writing. To assess writing complexity, the ratio of total clauses to total T-units in the paragraphs from both the pretest and posttest essays was calculated. After determining the complexity scores, one-way ANOVA and paired-samples t-tests were utilized to explore the research question. Furthermore, a one-way ANOVA was conducted to compare pretest scores, confirming that the groups displayed similar writing complexity before the intervention.

Table 20

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
.374	2	77	.689

The findings presented in Table 20 indicate that the assumption of equal variances is upheld, as evidenced by a non-significant test outcome, F (2, 77) = 0.374, p = .689. This confirms that the condition of homogeneity of variance is met for the analyses.

Table 21

One-Way ANOVA for the Three Groups' Writing Complexity Pretest Scores

	Sum of Squares	df	Mean Square	F	Sig.	η^2
Between Groups	.066	2	.033	1.120	.332	.02
Within Groups	2.277	77	.030			
Total	2.343	79				

Table 21 demonstrates that there are no statistically significant differences in writing complexity across the groups during the pretest, indicating that the samples are homogeneous, F (2, 77) = 1.120, p = .323. The eta squared value also suggests a small effect size (.02). In order to assess changes in writing complexity following the application of the treatment, a comparison was made between the pretest and posttest performances of the groups.

Table 22

Paired Samples T-test for the ExG1

	M	SD	t	df	Sig. (2-tailed)	r
Pretest - Posttest	-.33	.431	-3.904	25	.001	.37

Table 22 reveals a significant enhancement in writing complexity from the pretest (M = 3.42, SD = 0.172) to the posttest (M = 3.75, SD = 0.346), t (25) = -3.904, p = .001. The effect size was considerable (r = .37), indicating a notable improvement in the group's writing complexity.

Table 23

Paired Samples T-test for the ExG2

	M	SD	t	df	Sig. (2-tailed)	r
Pretest - Posttest	-.27	.413	-3.292	23	.003	.32

Table 23 illustrates the results for ExG2, which received peer scaffolding through mobile-assisted instruction. The findings indicate a statistically significant increase in the writing complexity of the group from the pretest (M = 3.35, SD = 0.184) to the posttest (M = 3.63, SD = 0.399), t (23) = -3.292, p = .003. The effect size was considerable (r = .74), suggesting a notable enhancement in writing complexity due to the intervention.

Table 24

Paired Samples T-test for the CG

	M	SD	t	df	Sig. (2-tailed)	r
Pretest - Posttest	-.11	.333	-.985	29	.077	

Table 24 reveals no significant enhancement in writing complexity between the pretest (M = 3.39, SD = 0.160) and the posttest (M = 3.50, SD = 0.263), t (29) = -0.985, p = .077, along with a minimal effect size (r = .03). Furthermore, the posttest results of the groups were analyzed to identify which groups exhibited better outcomes after the treatments.

Table 25

Test of Homogeneity of Variances

Levene Statistic	df1	df2	Sig.
2.817	2	77	.066

According to Table 25, the assumption of homogeneity has not been violated, F (2, 77) = 2.817, p = .066. This implies that the variances remain consistent across the groups, which supports the application of the analyses.

Table 26

One-Way ANOVA for the Three Groups' Writing Complexity Posttest Scores

	Sum of Squares	df	Mean Square	F	Sig.	η^2

Between Groups	.887	2	.444	3.928	.024	.09
Within Groups	8.696	77	.113			
Total	9.584	79				

The findings from the one-way ANOVA shown in Table 26 demonstrate a statistically significant difference in posttest writing complexity among the three groups, F (2, 77) = 3.928, p = .024. The eta squared value suggests a small effect size (.09). After obtaining a significant result from the ANOVA, the Scheffe test was performed as a multiple comparison method to determine which pairs of groups exhibited significant differences.

Table 27

Scheffe Multiple Comparisons

(I)		Mean Difference			95% Confidence Interval	
Groups	(J) Groups	(I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
ExG1	ExG2	.12558	.09513	.422	-.1119	.3630
	CG	.25218*	.09005	.024	.0274	.4769
ExG2	ExG1	-.12558	.09513	.422	-.3630	.1119
	CG	.12660	.09203	.393	-.1031	.3563
CG	ExG1	-.25218*	.09005	.024	-.4769	-.0274
	ExG2	-.12660	.09203	.393	-.3563	.1031

*. The mean difference is significant at the 0.05 level.

Based on Table 27, a statistically significant difference exists between ExG1 (M = 3.75, SD = 0.346) and the control group (CG) (M = 3.50, SD = 0.263). No additional significant differences were noted among the other groups.

Discussion

The present study investigated the comparative effects of teacher scaffolding and peer scaffolding within a mobile-assisted instructional framework on the writing accuracy, fluency, and complexity of Iranian intermediate EFL learners. The findings indicated that both forms of scaffolding significantly enhanced learners' writing skills across all three dimensions, with the teacher scaffolding group demonstrating marginally superior advancements, particularly regarding accuracy and complexity.

Consistent with Vygotsky's (1978) sociocultural theory and ZPD framework, the results underscore the critical role of mediated support in advancing learners' writing skills. The significant gains in writing accuracy for both scaffolding groups concur with earlier research by Baleghizadeh and Oladrostam (2010), who found that mobile-assisted activities could improve grammatical accuracy. Similarly, the present findings align with the work of Khatri (2021) and Golightly (2021), emphasizing the importance of scaffolding—whether from teachers or peers—in facilitating language development through interactive and supportive means.

Regarding writing fluency, the notable improvements observed in the experimental groups corroborate findings by Liu and Chen (2014) and Motallebzadeh et al. (2011), who reported enhanced language production and retention through mobile-assisted learning environments. This study further confirms that technological integration, particularly via mobile devices, can maintain learner motivation and engagement beyond the classroom, thereby promoting sustained language practice and improvement, as suggested by Van and Thanh (2021).

In terms of writing complexity, the significant progress reported for the teacher scaffolding group extends the research tradition that associates guided instruction with deeper

syntactic development. This accords with Barrot and Gabinete (2019) and Zhang et al. (2022), who identified syntactic complexity as an indicator of L2 proficiency responsive to targeted pedagogical interventions. The smaller yet statistically meaningful improvement observed in the peer scaffolding group also supports the potential of socially mediated learning through peer interaction, as emphasized in the sociocultural paradigm. This finding aligns with the results obtained by Taheri and Nazmi (2021).

The relatively greater effect size for teacher scaffolding across accuracy, fluency, and complexity may be attributed to the expert guidance and immediate corrective feedback provided by instructors, which is often essential for internalizing advanced writing conventions. However, the positive impact of peer scaffolding highlights its value as a complementary strategy that fosters collaborative learning and critical evaluation skills.

Overall, these findings add to the growing body of evidence demonstrating that integrating scaffolding strategies within mobile-assisted learning environments can effectively enhance EFL writing performance. They offer pedagogical implications for utilizing mobile technology to deliver both teacher and peer support, thereby maximizing learners' potential to progress through their ZPD and achieve greater autonomy in writing. Future research might explore long-term effects and the interplay between different types of scaffolding in diverse educational contexts.

Conclusion

This study examined the varying effects of teacher scaffolding and peer scaffolding within the framework of MALL on the writing accuracy, fluency, and complexity of Iranian intermediate EFL students. The results demonstrated that both scaffolding approaches significantly enhanced learners' writing performance across all three aspects, with teacher scaffolding producing marginally greater improvements, particularly in terms of accuracy and complexity. These findings are consistent with Vygotsky's (1978) sociocultural theory and the Zone of Proximal Development model, emphasizing the significance of mediated support in the process of language acquisition (McLeod, 2020). Furthermore, the research confirms the effectiveness of mobile technology as a tool for delivering such scaffolding, in line with earlier studies that underscore the contribution of MALL to the development of language skills (Baleghizadeh & Oladrostam, 2010; Liu & Chen, 2014).

The pedagogical implications of this research are significant. Language educators are encouraged to integrate mobile-assisted scaffolding strategies into writing instruction to foster learners' development in accuracy, fluency, and complexity. Teacher scaffolding, with its targeted feedback and expert guidance, appears particularly beneficial for promoting higher-level writing skills. However, peer scaffolding also offers valuable opportunities for collaborative learning, critical thinking, and learner autonomy. Incorporating both methods may create a balanced instructional environment that addresses diverse learner needs. Furthermore, the use of accessible mobile platforms facilitates flexible, interactive, and learner-centered instruction that can extend beyond traditional classroom settings.

For future investigations, it is advisable to conduct longitudinal studies to examine the long-term impacts of mobile-assisted scaffolding on the progression of writing skills over prolonged durations. Investigations could also examine the differential impacts of scaffolding on other language skills or proficiency levels, including beginner and advanced learners. Additionally, qualitative studies focusing on learners' perceptions and experiences with mobile-assisted scaffolding may provide deeper insights into its motivational and affective dimensions. Research might further investigate the optimal balance and integration of teacher and peer scaffolding in varied cultural and educational contexts to refine mobile-assisted language pedagogy.

References

Ahmad, H., & Halim, H. (2017). Determining Sample Size for Research Activities: The Case of Organizational Research. *Selangor Business Review, 2*(1), 20–34. Retrieved from https://sbr.journals.unisel.edu.my/index.php/sbr/article/view/12

Amerian, M., Ahmadian, M., & Mehri, E. (2014). Sociocultural theory in practice: The effect of teacher, class, and peer scaffolding on the writing development of EFL learners. *International Journal of Applied Linguistics and English Literature, 3*(5), 1-12. http://dx.doi.org/10.7575/aiac.ijalel.v.3n.5p.1

Andujar, A. (2016). Benefits of mobile instant messaging for developing ESL writing. *System*, *62*, 63–76. https://doi.org/10.1016/j.system.2016.07.004

Arvanitis, P., & Krystalli, P. (2021). Mobile-assisted language learning (MALL): Trends from 2010 to 2020 using text analysis techniques. *European Journal of Education*, *4*(1), 13-22. https://doi.org/10.26417/ejls-2019.v5i1-191

Bachore, M. M. (2015). Language Learning through Mobile Technologies: An Opportunity for Language Learners and Teachers. *Journal of Education and Practice*, *6*(31), 50–53. http://files.eric.ed.gov/fulltext/EJ1083417.pdf

Baleghizadeh, S., & Oladrostam, E. (2010). The Effect of Mobile-Assisted Language Learning (MALL) on Grammatical Accuracy of EFL Students. *Mextesol Journal*, *34*(2), 1-10.

Barrot, J. & Gabinete, M. (2021). Complexity, accuracy, and fluency in the argumentative writing of ESL and EFL learners. *International Review of Applied Linguistics in Language Teaching*, *59*(2), 209-232. https://doi.org/10.1515/iral-2017-0012

Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and Conducting Mixed Methods Research* (3rd ed.). Sage Publications.

Gharehblagh, N. M., & Nasri, N. (2020). Developing EFL Elementary Learners' Writing Skills Through Mobile-Assisted Language Learning (MALL). *Teaching English with Technology*, *20*(1), 104-121. https://files.eric.ed.gov/fulltext/EJ1242657.pdf

Golightly, A. (2021). Building bridges: the impact of scaffolds in PBL on the learning of South African pre-service geography teachers. *Journal of Geography in Higher Education*, *47*(1), 37–55. https://doi.org/10.1080/03098265.2021.1990227

Gonzalez, V. (2019, April 10). *8 Ways to Scaffold Writing for English Learners*. Seidlitz Education. https://seidlitzblog.org/2019/04/10/8-ways-to-scaffold-writing-for-english-learners/

Guo, F., Zhang, Y., & Wu, Z. (2022). Mobile-assisted vocabulary learning through the Shanbay App outside the classroom: Effects of self-regulation and peer scaffolding. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.993224

Khatri, P. (2021). Importance of scaffolding. *Writing Across the University of Alberta*, *2*(1), 33–36. https://doi.org/10.29173/writingacrossuofa2

Khodabande, I., & Boroughani, T. (2023). Mobile-assisted focus on forms in English for academic purposes instruction: Investigating the impacts on learning academic words. *Frontiers in Psychology*, *14*. https://doi.org/10.3389/fpsyg.2023.1071555

Kloper, E., Squire, K. & Jenkins, H. (2002). Environmental Detectives: PDAs as a Window into a Virtual Simulated World. In *Proceedings of the IEEE International Workshop on Wireless and Mobile Technologies in Education* (pp. 95-98). http://dx.doi.org/10.1109/WMTE.2002.1039227

Kozulin, A., Gindis, B., Vladimir S. Ageyev, V. S. & Miller, S. M. (2003). *Vygotsky's Educational Theory in Cultural Context*. Cambridge University Press.

Larsen-Freeman, D. (2006). The emergence of complexity, fluency, and accuracy in the oral and written production of five Chinese learners of English. *Applied Linguistics, 27*(4), 590–619. https://doi.org/10.1093/applin/aml029

Liu, P. L., & Chen, C. J. (2014). Learning English phrases through actions: A study of mobile-assisted language learning. *Interactive Learning Environments, 23*(2), 158-171.http://dx.doi.org/10.1080/10494820.2014.959976

McLeod, S. (2020). Vygotsky's Sociocultural Theory of Cognitive Development. Simply Psychology. Retrieved from https://www.simplypsychology.org/vygotsky.html

Motallebzadeh, K., Beh-Afarin, R., & Daliry Rad, S. (2011). The effect of short message service on the retention of collocations among Iranian lower intermediate EFL learners. *Theory and Practice in Language Studies, 1*(11),1514 - 1520. http://dx.doi.org/10.4304/tpls.1.11.1514-1520

Parsa, N., & Anjomshoa, L. (2022). Impact of Mobile-Assisted Language Learning (MALL) on EFL Learners' Grammar Achievement and Self-efficacy. *International Journal of Language and Translation Research*, *1*(4), 71-94.

Pollitt, A. (2017). *Oxford Placement Test Scores: Grade reporting table*. Oxford University Press.

Rambe, P., & Bere, A. (2013). Using mobile instant messaging to leverage learner participation and transform pedagogy at a South African University of Technology. *British Journal of Educational Technology, 44(4)*, 544-549. http://dx.doi.org/10.1111/bjet.12057

Taheri, P., & Nazmi, R. (2021). Improving EFL Learners' Argumentative Writing Ability: Teacher vs. Peer Scaffolding. *DOAJ (DOAJ: Directory of Open Access Journals)*. https://doi.org/10.22132/tel.2021.143348

Titova, C., & Danilina, E. (2018). Experimental implementation of an organization's mobile technology model for formative and summative assessment of students' writing skills in a non-linguistic university. *Vestnik Tambovskogo Universiteta. Seriâ: Gumanitarnye Nauki*, *23*(172), 35–42. https://doi.org/10.20310/1810-0201-2018-23-172-35-42

Van, T. N., & Thanh, H. N. T. (2021, December). The impacts of mobile-assisted language learning (MALL) on freshmen's vocabulary acquisition and their perspectives. In *18th International Conference of the Asia Association of Computer-Assisted Language Learning (AsiaCALL–2-2021)* (pp. 278-290). Atlantis Press.

Vygotsky, L. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Cambridge, MA: Harvard University Press.

Watson, S. L. & Reigeluth, C. M. (2016). The learner-centered paradigm of education. In *R. West (Ed.). Foundations of Learning and Instructional Design Technology*. Retrieved from https://lidtfoundations.pressbooks.com/chapter/systemic-change/.

Zhang, L. J., & Cheng, X. (2021). Examining the effects of comprehensive written corrective feedback on L2 EAP students' linguistic performance: A mixed-methods study. *Journal of English for Academic Purposes*, *54*, 101043. https://doi.org/10.1016/j.jeap.2021.101043

Zhang, S., Zhang, H., & Zhang, C. (2022). A dynamic systems study on complexity, accuracy, and fluency in English writing development by Chinese university students. *Frontiers in Psychology*, *13*. https://doi.org/10.3389/fpsyg.2022.787710