Applied Research on English Language

V. 15 N. 3 2026
pp: 179-200
http://are.ui.ac.ir

DOI: 10.22108/are.2026.149554.2777
Document Type: Research Article

Developing Digital Multimodal Technical Report Writing Skills in EFL Classrooms: A Portfolio-Based Perspective

Anna Mirzaiyan, Zahra Amirian *

Department of English Language and Literature, Faculty of Foreign Languages, University of Isfahan, Iran

Received: 2026/07/02 **Accepted: 2026/08/22**

Abstract: The present investigation examined the impact of using digital multimodal instruction on EFL learners' technical writing development within a portfolio-based framework. The study centered on utilizing technological innovations, particularly digital photo-story makers, for multimodal instruction. To this end, an intact group of 34 homogeneous participants underwent a six-session training in digital multimodal composition (DMC). Subsequently, the participants were tasked with producing digital multimodal portfolios instead of traditional unimodal, textual compositions on assigned technical topics. They utilized digital photo-story makers such as InShot, Google, Canva, and Microsoft applications. Three digital multimodal tasks were designated as the targets for statistical analysis. The findings from repeated measures ANOVA indicated a significant improvement in the participants' general writing skill from Task 1 to Task 2; however, Task 3 did not exhibit substantial gains in writing achievement. Additionally, post-hoc analyses indicated that DMC improved writing scores in terms of "language" and "organization", whereas "content" and "communicative achievement" remained unaffected by the instruction. These results may inform stakeholders and material developers to enhance EFL teaching methodologies with more technology-integrated approaches that cater to the contemporary language learners' interests and needs.

Keywords: Portfolio; Technical Report Writing; Digital Multimodal Composition; Textual Unimodal Composition.

* **Corresponding Author.**

Authors' Email Address:
[1] **Anna Mirzaiyan** (a.mirzaiyan@fgn.ui.ac.ir), [2] **Zahra Amirian** (z.amirian@fgn.ui.ac.ir)

Introduction

The incorporation of digital technology in the domain of foreign language pedagogy has exerted a pervasive impact on various dimensions of both teaching and learning processes (Bui, 2022; Hasumi & Chiu, 2024). With the emergence and advancement of technological tools, conventional methodologies for imparting language competencies have been either amalgamated with or, at times, supplanted by progressive strategies that render the instructional experience more appealing.

Recently, the utilization of digital instruments in language education has attracted significant attention from scholars globally within the educational world (Joshi et al., 2025). Empirical evidence suggests that linguistic competencies of English as a Foreign Language (EFL) learners can be markedly improved through the integration of digital tools; the application of technology within language instruction enhances learner engagement and consequently leads to an elevation in overall proficiency (Han et al., 2024). Numerous investigations have been undertaken to elucidate the role of technology in the enhancement of language skills; for example, research conducted by Dousti and Amirian (2023), Lim et al. (2024), and Bao (2017) has demonstrated that the deployment of technology can facilitate the acquisition of language abilities. In the context of writing instruction, an essential competency within EFL contexts, technology-driven devices have gained significance due to their efficacy in assisting learners with writing tasks. Research has indicated that technology-mediated instruction can bolster students 'overall writing experiences and serve to augment learner motivation (Jitpaisarnwattana & Saville, 2025; Little et al., 2018).

The transition from traditional instructional methodologies for writing to contemporary technology-based approaches has yielded markedly distinct linguistic outcomes (Chen, 2026). From a historical point of view, instruction was predominantly unimodal (exclusively textual), whereas the integration of digital resources in language education has catalyzed a transformation from unimodal to digital multimodal instructional formats (Santoso, 2025; Gunuç & Babacan, 2018). Given the increasing prominence of written English as a critical competence in both academic and professional domains, the landscape of writing pedagogy has undergone a significant paradigm shift. As noted by Guo and Li (2024), the transition toward multimodal instructional formats—facilitated by an array of digital applications—has redefined traditional writing practices by offering students enhanced flexibility and efficiency in knowledge construction.

Despite the increasing prevalence of multimodal communication in professional technical environments, traditional EFL curricula often remain tethered to linear, text-centric

paradigms of writing instruction. This misalignment creates a significant gap between academic preparation and the communicative demands of the modern workplace, where technical writers must navigate complex semiotic landscapes. To address this discrepancy, the present study investigates the role of DMC in technical writing within a portfolio-based assessment (PBA) framework. By examining how EFL learners engage with digital portfolios, this research seeks to bridge the divide between linguistic proficiency and the multimodal competencies essential for contemporary technical communication.

Review of Literature

Digital Multimodal Composition

In scholarly discourse, digital multimodal composition (DMC) is characterized as any piece of writing that incorporates both linguistic and non-linguistic modalities (Lim & Kessler, 2024; Lim & Polio, 2020). Non-linguistic modalities encompass the incorporation of visual elements, auditory components, and video segments within a written work (Liu & Aryadoust, 2024). Prior investigations have established that multimodal writing assignments are pivotal in the enhancement of language elements and the cultivation of learners' competencies; for instance, research conducted by Jiang (2018), Cimasko and Shin (2017), and Dzekoe (2017) has elucidated the beneficial impact of multimodality on the authorial voice and identity of learners, alongside the advancement of linguistic proficiency. Recent scholarship has increasingly reframed L2 writing not as a purely linguistic endeavor, but as a process of DMC. Jiang and Hafner (2024) argue that this shift requires learners to move beyond linear text to master the orchestration of diverse semiotic systems—such as visuals, audio, and interactive elements—to meet contemporary rhetorical demands. This multimodal competence has profound implications for learner psychology; for instance, Ndruru et al. (2026) demonstrated that proficiency in digital multimodal composing is a significant predictor of both academic writing self-efficacy and cognitive engagement among EFL students.

Portfolio-Based Assessment

Unlike traditional assessment methods that may rely solely on standardized tests or single assignments, portfolio-based assessment (PBA) emphasizes the process of learning and encourages students to reflect on their own growth (Naka, 2025). It provides a holistic view of a learner's capabilities, showcasing not only the final products but also the developmental journey that led to those outcomes. Through PBA, educators can foster a more personalized

learning environment, as it allows for the incorporation of diverse learning styles and individual interests. This method also promotes critical thinking and self-assessment, as students are often required to articulate their learning experiences and evaluate their own work. With the widespread application of technology in all areas of education, traditional portfolios have also been replaced by digital ones as a consequence of digitization.

Narayan (2023) defines PBA as a comprehensive evaluation method that involves the systematic collection and analysis of a student's work over a designated period. This approach allows educators to gain a deeper understanding of a student's progress, strengths, and areas for improvement by examining a curated selection of artifacts, such as projects, essays, presentations, and other relevant assignments (Fathi et al., 2020). PBA, as a type of alternative assessment scheme, has been widely employed in writing classes, and most researchers have confirmed the positive contributions of PBA to EFL students' writing performance. For instance, Dieu (2024) reported students' positive attitudes towards keeping portfolios since it resulted in writing improvement in EFL classes. Within the Iranian educational context, several studies (Shahrokhi et al., 2025; Sar et al., 2025; Ghoorchaei et al., 2010; Nezakatgoo, 2011; Tabatabaei & Assefi, 2012; Taki & Heidari, 2011) have demonstrated the efficacy of PBA in enhancing the writing performance of Iranian students.

Due to the significance of assessing EFL learners' portfolios for postulating learning outcomes, studies have explored the impact of keeping portfolios on specific educational aspects such as achievements in skill development. In this regard, Narayan (2023) reported the significant impact of PBA on improving writing components. The study confirmed the positive role of portfolio keeping on word choice, grammar, development, and organization of ideas in students' descriptive writing. Research statistics also supported the positive impact of PBA on improving the components of narration, language, vocabulary, and organization in EFL learners' narrative writing.

By adopting a sequential explanatory mixed-methods approach, Fathi and Rahimi (2022) explored the impact of an electronic writing portfolio on writing performance in an EFL context. The findings showed that both electronic and conventional writing portfolio instruction developed the EFL students' writing performance. In their study, the electronic writing portfolio group outperformed its conventional counterpart in developing writing performance. There was also a qualitative data analysis used to explain the quantitative findings, which revealed the EFL students' microgenetic development of writing content, writing organization, and language use in the electronic writing portfolio group. Students' positive perceptions towards electronic portfolios have also been reported.

Delving into the literature on PBA, EFL learners' improved autonomy has also been reported. For instance, Gebrekidan and Zeru (2023) suggested that portfolio-based assessment influenced EFL students' deep and meaningful conceptions of writing by way of supporting their independent and out-of-class learning endeavors. Moreover, the findings provided implications for using PBA to enhance EFL students' writing self-efficacy beliefs and concern for reflection and revision.

The pedagogical shift from conventional paper-based portfolios to digital formats, catalyzed by the pervasive integration of mobile and personal computing technologies, represents a critical evolution in contemporary EFL instruction. This transformation facilitates the adoption of multimodal compositions, wherein learners integrate diverse semiotic resources to demonstrate communicative competence. Despite this development, the intersection of digital multimodal portfolios and writing ability remains an underexplored domain, warranting further empirical investigation and the implementation of innovative analytical frameworks to fully capture the complexity of learner performance.

Digital Multimodal Portfolios and Technical Writing

Technical writing is widely understood in language pedagogy as a form of communication that employs domain-specific terminology to convey technical information and achieve clearly defined objectives (Allen, 2024; Kuna, 2020). Fundamental attributes of technical writing have been predominantly elucidated through corpus linguistic investigations that illustrate the manner in which proficient authors employ passive constructions, lexical bundles, and syntactic frameworks (such as titles and subtitles), alongside the specialized lexicon endemic to the discipline and the sentence structures inherent within particular fields (Ueasiriphan & Tangkiengsirisin, 2019; Turquois, 2016). The conventional structure of technical report writing is rigorously organized into components including an introduction, methodology section, and conclusion (or variations thereof) (Bazerman & Prior, 2004). Within this structural paradigm, any general assertions must be substantiated; the author is required to transition logically between subtopics, maintain thematic relevance, and establish coherent connections among subtopics (Berkenkotter et al., 2020). Conventional technical writing is characterized by its conciseness and directness; authors typically employ succinct sentences and arrange paragraphs thematically. Technical manuals generally provide minimal contextual background and overview information, focusing instead on direct and task-oriented content.

The corpus of literature pertaining to the pedagogy of technical writing is not particularly rich in studies that scrutinize the influence of the implementation of technology on the enhancement of learners' writing competencies; nonetheless, there exists a limited number of studies that significantly contribute to the advancement of learners in the realm of technical report writing. For example, Suryani et al. (2024) claimed that the amalgamation of technology and conventional writing methods would significantly impact the enhancement of writing skills. In the same line of investigation, Ezza et al. (2019) presented both quantitative and qualitative data demonstrating that the integration of technology into EFL writing courses positively influences learners' writing abilities.

Biju and Vijayakumar (2023) and Assaggaf and Bamahara (2016) indicated that learners expressed positive perceptions regarding the application of portfolios in the instruction of technical writing. The principal outcomes of their investigation were predominantly related to an increase in corrective feedback and enhancements in various components of technical writing.

The integration of technological tools and conventional EFL tasks appears to facilitate the transfer of academic skills to specialized technical domains. In the context of English for Specific Academic Purposes (ESAP), Goudarzi et al. (2026) found that multimodal technology-based collaborative tasks can significantly enhance the ability of engineering graduates to transfer theoretical learning to authentic technical writing activities. The transition from conventional physical portfolios to digital systems aligns with the increasing digitization of modern pedagogical landscapes; however, the scholarly understanding of this shift remains incomplete. Although the integration of digital tools in writing instruction is well-documented, a significant lacuna exists in the literature concerning how multimodality specifically influences the development of diverse writing genres.

In particular, there is a dearth of empirical evidence regarding the intersection of multimodal digital portfolios and the mastery of technical writing—a competency of paramount importance for EFL learners transitioning into professional employment. Although the existing literature establishes a strong link between multimodal instruction and increased student engagement (Ndruru et al., 2026) and communicative competence (Korosidou & Griva, 2024), several critical gaps remain. First, much of the current research relies on self-reported data regarding student attitudes and self-efficacy rather than objective measures of technical writing quality. Second, while the theoretical framework for digital multimodal composing is well-defined (Jiang & Hafner, 2024), there is a paucity of research investigating how these skills transfer to highly structured technical genres, such as design

reports or technical proposals. Finally, there is limited evidence on how assessment frameworks, such as PBA, can systematically capture the nuances of multimodal technical growth. To fill these gaps, this study seeks to address the following two research questions:

RQ1: Does digital multimodal instruction of technical writing improve EFL learners' overall writing skills within a portfolio-based framework?

RQ2: Does digital multimodal instruction of technical writing affect writing sub-skills (content, communicative achievement, organization, and language) in EFL learners' compositions within a portfolio-based framework?

Methods

Design of the Study

This research adopted a quantitative methodology within a PBA framework to examine the improvement of technical writing proficiency among EFL learners over a defined temporal span. The investigation employed document analysis as a methodological approach to scrutinize the advancement of technical report writing competencies for intermediate EFL learners. Due to the nature of this study, which observed variables at multiple points, a one-group repeated measures (quasi-experimental) design was employed. This study investigated the writing progression of a single group of EFL learners over a two-month period (6 sessions). The participants completed three technical report writing tasks. The writing prompts were adapted from IELTS Task 2 academic topics but modified to align with a technical report structure. This ensured that the tasks were of a standardized difficulty level while remaining relevant to the technical focus of the study.

Participants

Thirty-four undergraduate university students at an intermediate level of proficiency took part in the present study. The participants were all Persian native speakers taking a "Writing" course in the Faculty of Foreign Languages, University of Isfahan, in the first semester of the educational year 2024. The "Writing" course is a compulsory course administered in the second year of the four-year undergraduate program in which EFL learners learn how to write different types of compositions. The participants, both males and females, came from similar majors, including English literature and translation studies, ranging from 20 to 28 years old. In order to guarantee homogeneity of the participants, the Oxford Quick Placement Test was conducted and showed that all the participants were at the intermediate level of proficiency.

Instruments

This study employed a number of instruments to collect data as described in the following sections.

OQPT

This test was used as a homogenizer and originally consisted of 60 multiple-choice test items, which were presented in two sections: grammar and vocabulary. For the purpose of this study, the researchers decided to choose only 30 multiple-choice items comprising 15 vocabulary and 15 grammar test items; the reading comprehension sections were excluded due to practical limitations. The original test was adapted from Afshinfar and Shokouhifar's (2016) study and had previously been reported on validity and reliability by Allan (2004).

Digital Multimodal Instruction

At the beginning of the course, the participants were introduced to different types of digital photo-story maker applications, including CANVA, InShot, Google, and Microsoft. The participants were allowed to use the apps on their phones or laptops during instruction. Following the six sessions of introducing multimodal writing as an innovative approach to technical report writing, each individual was asked to deliver three multimodal technical assignments using any of the apps introduced in the class. The writing prompts (adapted IELTS Task 2 academic topics) were chosen by the instructor (one of the researchers) and two other professional ELT teachers after sharing ideas. Moreover, the topics have been selected on the concept of *workplace challenges* for two major reasons: first, the frequency of such concepts for writing in EFL classes has been proven by previous documents based on learners' future needs for writing; second, these topics lend themselves well enough to be presented in a multimodal format. The topics assigned to the participants are as follows: Employee Burnout, Employee Training and Professional Development, and Monitoring Employees at Work.

Cambridge Writing Assessment Scale

The participants' multimodal compositions were scored by reference to the Cambridge Writing Assessment Scale, which is aligned to the Common European Framework of Reference for Languages (CEFR) levels. This scale is divided into four subscales: Content, communicative achievement, organization, and language (Cambridge English Language Assessment, 2016). A brief definition of each subscale is as follows:

Content refers to how well the learners have accomplished the task; *Communicative achievement* is defined as how appropriate the writing is for the task;

Organization means how the learner puts the elements of the writing together in a logical order;

Language refers to the appropriate use of vocabulary and grammar.

The scores at each subscale ranged from 0 (the lowest) to 5 (the highest). Therefore, the sum of the four subscales ranged from 0 to 20.

Procedure

The present study used digital multimodal portfolio keeping for the purpose of data collection and document analysis. Forty undergraduate EFL learners enrolled in the Writing course were conveniently selected. All 40 students took the OQPT, and the homogeneity of the group was ensured by excluding 6 students from statistical analysis.

In the next step, technical report writing, which is the focus of the present study, was selected as the dominant theme for teaching writing in the class. Teaching technical writing took 6 sessions of 90 minutes as part of the semester-long writing instruction course. The participants were instructed by one of the researchers. This helped her meticulously control the process of treatment and data collection. The participants received instruction on how to make digital multimodal compositions using digital apps during the six sessions of instruction. Subsequently, the participants were tasked with three writing assignments adapted from IELTS Task 2 academic topics to be delivered every three weeks as part of the students' class activity. The students were informed that they should keep their assignments as digital multimodal portfolios to be evaluated at the end of the course. In other words, each participant had a portfolio consisting of three multimodal writing tasks. The participants were free to use any of the apps introduced in the class, including Microsoft Photo Story 3, IN-Shot, or Canva, to make their multimodal clips.

Scoring Procedure

At the end of the writing course, each participant produced three digital multimodal technical report compositions. To estimate inter-rater reliability of writing scores, three trained raters scored all compositions separately. Inter-rater reliability was assessed using the intra-class correlation coefficient (ICC, two-way random, absolute agreement, average measures). The ICCs were 0.87 for Task 1, 0.91 for Task 2, and 0.89 for Task 3, indicating good to excellent agreement among raters.

In order to answer the first research question, which explored the influence of multimodal instruction on participants' general writing improvement over time, the total scores obtained in Tasks 1, 2, and 3 were compared.

For the purpose of investigating the effect of multimodal instruction on writing sub-skills (research question 2), the sub-skills of Tasks 1, 2, and 3 were compared.

Data Analysis

The elicited data were analyzed using the Statistical Package for Social Sciences (SPSS) software (version 24). As for the normality of scores, the Shapiro-Wilk normality test was conducted and confirmed that the distribution of scores is normal ($p > 0.05$).

Results

The first Research Question

Table 1 below illustrates the descriptive statistics (mean and standard deviation) of the group from Task 1 to Task 3, considering the 4 sub-skills of the Cambridge English Language Assessment (2016). The participants were scored in 4 the writing sub-skills mentioned earlier: content, communicative achievement, organization, and language. Moreover, there is a final score (total=20) for each participant, which is the sum of sub-skill fractions.

Table 1. Descriptive Statistics

	Task 1	**Task 2**	**Task 3**
Experimental (n=34)			
Content	4.35(.64)	4.04(.98)	4.24(.61)
Communicative achievement	4.24(.66)	4.34(.67)	3.97(1.05)
Organization	3.68(.64)	4.22(.61)	4.02(.73)
Language	3.30(.79)	3.95(.71)	3.97(1.01)
Total	15.57(1.32)	16.55(1.59)	16.2(1.72)

Table 1 shows the descriptive statistics of the mean and standard deviation of scores in Tasks 1, 2, and 3 over time. The initial analysis of the results shows an increase in the general writing scores from Task 1 to Task 2.

In order to seek the answer to the first research question, repeated measures ANOVA was conducted to investigate the influence of DMC on participants' writing achievement.

Table 2. Mauchly's Test of Sphericity[a]

Within Subjects Effect	Mauchly's W	Approx. Chi-Square	Df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Total score	.969	1.024	2	.599	.970	1.00	.500

Table 2 shows that Mauchly's Test of Sphericity for writing is not significant at .05 (P = .599 > .05). Therefore, the error covariance matrix's homogeneity assumption is validated.

Table 3. Repeated Measures ANOVA

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	η^2	Observed Power
Time	20.93	2	10.46	6.03	.004	.151	.87
Error(time)	117.90	68	1.73	-	-	-	-

Table 4. Estimated Marginal Means

Time	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Task 1	15.55	.223	15.103	16.011
Task 2	16.64	.270	16.094	17.192
Task 3	16.21	.292	15.622	16.807

Table 4 presents estimated marginal means of writing proficiency scores at three assessment stages: Tasks 1, 2, and 3. The data indicate an increase in writing skills from Task 1 (15.55) to Task 2 (16.64) and Task 3 (16.21).

Table 5. Bonferroni Test. Comparison of Mean Scores over Time

(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference[b]	
					Lower Bound	Upper Bound
1	2	-1.086*	.315	.005	-1.880	-.292
	3	-.657	.290	.089	-1.387	.072
2	3	.429	.338	.638	-.421	1.279

A pairwise comparison in Table 5 indicates a significant improvement in students' writing scores from Task 1 to Task 2 (P < .05). Conversely, no significant differences were observed between Task 1 and Task 3 scores, nor between Task 2 and Task 3 scores (P > .05).

The Second Research Question

The following statistical analysis has been conducted in order to seek an answer to the second research question regarding the influence of multimodal instruction on writing sub-skills: content, communicative achievement, organization, and language.

Table 6. Mauchly's Test of Sphericity[a]

Within-Subjects Effect	Mauchly's W	Approx. Chi-Square	Df	Sig.	Epsilon[b]		
					Greenhouse-Geisser	Huynh-Feldt	Lower-bound
Content	.784	8.013	2	.018	.823	.859	.500
communicative achievement	.900	3.473	2	.176	.909	.958	.500
Organization	.993	.216	2	.898	.994	1.00	.500
Language	.976	.814	2	.666	.976	1.00	.500

Table 6 shows that Mauchly's test of Sphericity is not significant for the elements of communicative achievement, organization, and language at the .05 error level (P > .05); therefore, the assumption of homogeneity of the error covariance matrix is confirmed. However, the content component is significant at the .05 error level; therefore, the assumption of homogeneity of the error covariance matrix is rejected, and for this reason the results of the Greenhouse-Geisser test are reported.

The findings of the repeated measures ANOVA in Table 7 reveal that the influence of digital multimodal instruction on “organization” is meaningful over time and there is a meaningful difference between the participants’ scores across the three assessments ($F(2,68) = 7.78$; $P < .05$; $\eta^2 = .18$). The square of eta (18.6) shows that 18.6% of in-group variance related to “organization” is justified by the independent variable, i.e. multimodal instruction. The results also reveal that multimodal instruction has meaningfully influenced the component of “language” over the three assessments ($F(2,68) = 8.89$; $P < .05$; $\eta^2 = .20$). Eta squared equals .207, indicating that 20.7% of in-group variance in “language” is because of

multimodal instruction. However, the findings do not show any significant influence on "content" and "communicative achievement" (P > .05).

Table 7. Repeated Measures ANOVA for Writing Sub-skills

Source	Variable	Type III Sum of Squares	Df	Mean Square	F	Sig.	η^2	Observed Power
Time	Content	1.771	1.64	1.07	1.60	.213	.045	.29
	Communicative achievement	2.586	2	1.29	2.60	.081	.071	.50
	Organization	5.276	2	2.63	7.78	.001	.186	.94
	Language	10.300	2	5.150	8.89	.000	.207	.96
Error(time)	Content	37.562	55.94	.67	-	-	-	-
	Communicative achievement	33.748	68	.46	-	-	-	-
	Organization	23.057	68	.33	-	-	-	-
	Language	39.367	68	.57	-	-	-	-

Table 8. Bonferroni Test. Comparison of Mean Scores over the Three Tasks

	(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference[b]	
						Lower Bound	Upper Bound
Content	1	2	.314	.208	.421	-.210	.838
		3	.114	.135	1.00	-.225	.453
	2	3	-.200	.182	.842	-.659	.259
Communicative achievement	1	2	-.100	.146	1.00	-.468	.268
		3	.271	.164	.324	-.143	.685
	2	3	.371	.192	.183	-.111	.854
Organization	1	2	-.543*	.140	.001	-.894	-.191
		3	-.343*	.134	.046	-.680	-.005
	2	3	.200	.144	.520	-.162	.562
Language	1	2	-.657*	.170	.001	-1.085	-.229
		3	-.671*	.194	.004	-1.161	-.182
	2	3	-.014	.180	1.00	-.469	.440

Comparative results in Tables 8 and 1 above show that there is a significant difference in participants' adjusted mean scores in the sub-skill of "organization" in Task 1 (3.68) and Task 2 (4.22), and from Task 1 (3.68) to Task 3 (4.02) (P < 0.05). Moreover, there is a meaningful difference between mean scores in "language" from Task 1 (3.30) to Task 2 (3.95), and from Task 1 (3.30) to Task 3 (3.97) (P < 0.05). The findings indicate that the

mean scores of "organization" and "language" have meaningfully increased after multimodal instruction, and the increase in scores has been constant in Task 3.

Discussion

The integration of digital multimodal instruction into EFL writing curricula represents a transformative shift in the pedagogical approach to second language acquisition, fundamentally altering the traditional conceptualization of composing processes. By leveraging diverse semiotic resources—including visual, auditory, and kinetic inputs—this instructional paradigm facilitates a more nuanced understanding of literacy, extending beyond the constraints of unimodal text production to encompass the complex orchestration of meaning-making in digital environments (Lim & Kessler, 2024). The role of technology in writing has expanded far beyond its conventional function as a mere medium for word processing, becoming an essential component of contemporary multimodal composition instead. In digital writing environments, technology enables writers to combine linguistic, visual, and interactive resources in ways that reshape the processes of meaning-making and textual construction (Jiang & Hafner, 2024). From this perspective, writing is no longer limited to the production of linear verbal text but involves the strategic orchestration of multiple semiotic modes to achieve rhetorical purpose and audience engagement. Such a view is particularly relevant to L2 and EFL contexts, where digital multimodal composing can support learners' development of rhetorical flexibility, self-efficacy, and cognitive engagement (Ndruru et al., 2026).

This study was an endeavor to investigate the influence of digital multimodal composition on EFL learners' technical writing within a PBA framework,

As discussed earlier in the results section, a statistically validated enhancement in scores for both "language" and "organization" was observed between Task 1 and Task 2. However, the gains realized during this initial phase did not appear to be sustained over time, as evidenced by the lack of a significant difference between Tasks 2 and 3 mean scores. This outcome implies that the introduction of digital multimodal instruction may be particularly effective in prompting initial learning and skill acquisition, but the retention and further development of these skills may depend on factors not fully captured by this study's timeframe.

The findings of the study concerning the first research question showed that digital multimodal instruction of technical writing had a positive influence on the improvement of technical writing among Iranian EFL learners from Task 1 to Task 2, but the effect was not

sustained in Task 3. This is in line with Guo and Li (2024), Suryani et al. (2024), and Ezza et al. (2019), who reported positive impacts of the implementation of technology on EFL writing skills. As can be observed, the repeated-measurement variance analysis (Table 3) indicated that multimodal instruction significantly enhanced learners' writing skills (from Task 1 to Task 2), with a significant difference in average scores at various intervals; therefore, the positive influence of digital multimodal instruction on writing improvement is confirmed.

Further analysis in this research addressed the influence of digital multimodal instruction on specific writing components. The findings indicate that the integration of this instruction significantly enhanced 'organization' and 'language' in EFL learners' compositions. This aligns with previous research (e.g., Narayan, 2023), which also reported improvements in these specific writing elements. However, the study did not find a significant impact on 'content' or 'communicative achievement.'

The positive influence of DMC on 'organization' and 'language' was statistically validated not only from Task 1 to Task 2, but also when comparing Task 1 to Task 3, suggesting a degree of sustained impact on these particular components.

As an interpretation of the results observed, the following assumptions can be made: while 'organization' and 'language' demonstrated statistically significant improvements from Task 1 to both Tasks 2 and 3 (Tasks 1 & 2, and Tasks 1 & 3, respectively), 'content' and 'communicative achievement' remained unaffected. This differential effect, wherein organizational and linguistic aspects benefited while content and overall communicative success did not, could be attributed to the nature of the digital portfolio intervention. Digital tools may more readily support the structuring of ideas and the application of specific linguistic features, which are often more amenable to direct instruction and practice. Conversely, the development of 'content' (depth of ideas, critical thinking) and broader 'communicative achievement' might require different pedagogical strategies or a longer developmental period. Our findings resonate with existing literature highlighting gains in specific linguistic and structural areas (Narayan, 2023).

The insightful findings of the present investigation also confirm Fathi and Rahimi (2022) in proving that writing components of "organization" and "language" would be significantly enhanced by using electronic portfolios; however, the current findings do not show improvements in "content" as opposed to the findings of Fathi and Rahimi (2022). The discrepancy in "content" enhancement between the present study and their study might have

been due to the different genres of writing under investigation in the present study and their investigation.

Considering the findings of the study from a digital multimodal perspective, the results evidenced the positive contribution of this innovative technology-based intervention on EFL students' writing performance in general. These results were consistent with the findings of Nezakatgoo (2011), Roohani and Taheri (2015), Tabatabaei and Assefi (2012), and Taki and Heidari (2011). However, there is a slight discrepancy with the findings of Roohani and Taheri (2015) regarding the components under investigation. This discrepancy might have been due to the different context in which the studies were conducted, or the limited number of participants in the present study. Therefore, caution should be taken in the interpretation of results and in overgeneralizing them to larger samples.

Our investigation into the impact of digital multimodal instruction on technical writing skills revealed a clear positive effect on learners' 'language' and 'organization' scores, as confirmed by assessing digital portfolios over multiple points. The absence of further significant improvement between Tasks 2 and 3, however, raises interesting questions about the long-term efficacy and optimal implementation of digital portfolios. It is possible that the initial period of portfolio use provides a crucial boost in understanding and application, but that without continued reinforcement or integration into a broader learning strategy, these gains may plateau. This finding warrants further exploration into the types of digital portfolio use that promote sustained development.

Evidence from the present investigation corroborates previous studies in that multimodal, technology-mediated tasks can facilitate learning and improve learners' ability to apply writing knowledge in discipline-specific contexts (Goudarzi et al., 2026). Accordingly, technology should be understood not simply as a supportive tool, but as a pedagogical force that configures how learners plan, compose, revise, and negotiate meaning within increasingly complex writing environments.

As a result, the digital portfolio functions as both an assessment mechanism and a pedagogical catalyst, enabling learners to bridge the gap between abstract academic requirements and the authentic, multimodal demands of their technical fields.

Limitations and Future Scope of the Study

In order to improve the quality of research for future investigations, several limitations might be acknowledged. First of all, in this study, an intact group was selected due to the availability of participants; therefore, some factors such as learners' aptitude might have been overlooked. It is suggested that future studies investigate more than one group of participants

and control intervening variables such as students' aptitude towards using digital tools. Also, the results of the study should be interpreted with caution because of the limited number of writing assignments.

Future research should also take into account that writing is a complex process and multiple factors might contribute to the development of this skill; therefore, factors such as teachers' role in the instruction of digital composition, which was not investigated in this study, can be taken into consideration for more robust findings.

It is also recommended that future research shed light on the role of keeping digital portfolios on other language skills as well as other genres of writing; genre mismatch should be taken into consideration for future investigation.

Further investigation might provide more insightful implications for ELT teachers and practitioners regarding the implementation of technology into language classes.

Acknowledgement

The authors sincerely thank all the participants for their valuable cooperation throughout the data collection process and for their contributions to developing multimodal texts during the instructional phase of this study.

Declaration of Conflicting Interests

There were no conflicting interests at work prior to or during this study.

Funding

No funding was available for this study.

References

Afshinfar, J., & Shokouhifar, A. (2016). The effect of explicit and implicit corrective feedback on the narrative writing of advanced Iranian EFL learners. *Journal of Applied Linguistics and Applied Literature: Dynamics and Advances, 4*(2), 15–41.

Allan, D. (2004). *Oxford placement test*. Oxford University Press.

Allen, M. E. (2024). *An in-depth exploration of student experiences and perspectives of learning technical writing in undergraduate computer science education* [Doctoral dissertation, University of British Columbia].

Assaggaf, H. T., & Bamahra, Y. S. (2016). The effects of portfolio use in teaching report writing: EFL students' perspective. *International Journal of Applied Linguistics and English Literature, 5*(3), 26–34. https://doi.org/10.7575/aiac.ijalel.v.5n.3p.26

Bao, X. (2017). Application of multimodality to teaching reading. *English Language and Literature Studies, 7*(3), 78–84. https://doi.org/10.5539/ells.v7n3p78

Bazerman, C., & Prior, P. (Eds.). (2004). *What writing does and how it does it: An introduction to analyzing texts and textual practices*. Routledge. https://doi.org/10.4324/9781410609526

Berkenkotter, C., Huckin, T. N., & Ackerman, J. (2020). Social context and socially constructed texts: The initiation of a graduate student into a writing research community. In *Landmark essays on writing across the curriculum* (pp. 211–232). Routledge.

Biju, L. G., & Vijayakumar, S. (2023). Systematic review on the impact of technology-supported writing environment for developing writing skills. *Computer-Assisted Language Learning Electronic Journal, 24*(3), 290–313.

Bui, T. H. (2022). English teachers' integration of digital technologies in the classroom. *International Journal of Educational Research Open, 3*, 100204. https://doi.org/10.1016/j.ijedro.2022.100204

Cambridge English Language Assessment. (2016). *The Cambridge English Scale*.

Chen, S. Y. R. (2026). Two voices, one draft: A diachronic comparison of human and AI feedback in EFL essay writing. *Australian Journal of Applied Linguistics, 9*, 103200. https://doi.org/10.29140/ajal.2026.103200

Cimasko, T., & Shin, D. S. (2017). Multimodal resemiotization and authorial agency in an L2 writing classroom. *Written Communication, 34*(4), 387–413. https://doi.org/10.1177/0741088317727246

Dieu, H. N. T. (2024). The effects of portfolios on developing students' writing ability. *European Journal of English Language Teaching, 9*(1), 84–104. https://doi.org/10.46827/ejel.v9i1.5258

Dousti, M., & Amirian, Z. (2023). The effect of web-mediated, blended, and purely online learning on EFL learners' writing achievement in the Iranian context: A comparative study. *Education and Information Technologies, 28*(2), 1675–1696. https://doi.org/10.1007/s10639-022-11215-0

Dzekoe, R. (2017). Computer-based multimodal composing activities, self-revision, and L2 acquisition through writing. *Language Learning & Technology, 21*(2), 73–95. https://doi.org/10.64152/10125/44612

Ezza, E. S., Alhuqail, E., & Elhussain, S. (2019). Technology-based instructional intervention into an EFL writing classroom. *Cypriot Journal of Educational Sciences, 14*(4), 507–519. https://doi.org/10.18844/cjes.v11i4.3904

Fathi, J., Derakhshan, A., & Safdari, M. (2020). The impact of portfolio-based writing instruction on writing performance and anxiety of EFL students. *Polish Psychological Bulletin, 51*(3), 226–235. https://doi.org/10.24425/ppb.2020.134729

Fathi, J., & Rahimi, M. (2022). Electronic writing portfolio in a collaborative writing environment: Its impact on EFL students' writing performance. *Computer Assisted Language Learning, 37*(7), 1659–1697. https://doi.org/10.1080/09588221.2022.2097697

Gebrekidan, H., & Zeru, A. (2023). Effects of portfolio-based assessment on EFL students' conceptions and approaches to writing. *Cogent Education, 10*(1), 1–32. https://doi.org/10.1080/2331186X.2023.2195749

Ghoorchaei, B., Tavakoli, M., & Ansari, D. N. (2010). The impact of portfolio assessment on Iranian students' essay writing: A process-oriented approach. *Journal of Language Studies, 10*(3), 35–51.

Goudarzi, E., Gooniband Shooshtari, Z., & Jalilifar, A. (2026). Transfer of learning in a multimodal, collaborative ESAP writing program: Assessing engineering graduates' perceptions via the LTSI. *Language Related Research, 17*(1), 77–111. https://doi.org/10.48311/LRR/lrr.2026.7131

Gunuç, S., & Babacan, N. (2018). Technology integration in English language teaching and learning. In *Positioning English for specific purposes in an English language teaching context* (Vol. 1, pp. 1–192). https://doi.org/10.22190/JTESAP1702349G

Guo, H., & Li, D. (2024). The effect of electronic portfolio-based writing instruction on the second language writing performance and writing self-efficacy of EFL learners: A mixed methods study. *SAGE Open, 14*(2), 21582440241257697. https://doi.org/10.1177/21582440241257697

Han, S., Wang, M., Zhang, J., Li, D., & Duan, J. (2024). A review of large language models: Fundamental architectures, key technological evolutions, interdisciplinary technologies integration, optimization and compression techniques, applications, and challenges. *Electronics, 13*(24), 5040. https://doi.org/10.3390/electronics13245040

Hasumi, T., & Chiu, M. S. (2024). Technology-enhanced language learning in English language education: Performance analysis, core publications, and emerging trends. *Cogent Education, 11*(1), 2346044. https://doi.org/10.1080/2331186X.2024.2346044

Jiang, L. (2018). Digital multimodal composing and investment change in learners' writing in English as a foreign language. *Journal of Second Language Writing, 40*, 60–72. https://doi.org/10.1016/j.jslw.2018.03.002

Jiang, L. G., & Hafner, C. A. (2024). Digital multimodal composing in L2 classrooms: A research agenda. *Language Teaching, 58*(4), 528–546. https://doi.org/10.1017/S0261444824000107

Jitpaisarnwattana, N., & Saville, N. (2025). Autonomous learning and students' perceptions of automated writing evaluation as a tool to improve writing skills. *Technology in Language Teaching and Learning, 7*(3), 102826. https://doi.org/ 10.29140/tltl.v7n3.102826

Joshi, D. R., Khanal, J., Chapai, K. P. S., & Adhikari, K. P. (2025). The impact of digital resource utilization on student learning outcomes and self-efficacy across different economic contexts: A comparative analysis of PISA, 2022. *International Journal of Educational Research Open, 8*, 100443. https://doi.org/10.1016/j.ijedro.2025.100443

Korosidou, E., & Griva, E. (2024). Fostering students' L2 writing skills and intercultural awareness through digital storytelling in elementary education. *International Electronic Journal of Elementary Education, 16*(5), 585–597. https://doi.org/10.26822/iejee.2024.355

Kuna, D. (2020). Teaching English for specific academic purposes in a multidisciplinary setting: Challenges and opportunities. In V. Cigan, A.-M. Krakić, & D. Omrčen (Eds.), *Od teorije do prakse u jeziku struke* (pp. 128–143). Udruga nastavnika jezika struke na visokoškolskim ustanovama.

Lim, J., & Kessler, M. (2024). Multimodal composing and second language acquisition. *Language Teaching, 57*(2), 183–202. https://doi.org/10.1017/S0261444823000125

Lim, J., & Polio, C. (2020). Multimodal assignments in higher education: Implications for multimodal writing tasks for L2 writers. *Journal of Second Language Writing, 47*, 100713. https://doi.org/10.1016/j.jslw.2020.100713

Lim, F. V., Toh, W., & Ong, M. (2024). Assessing multiliteracies: A systematic review and a perspective from Singapore. *Asia Pacific Journal of Education, 44*(3), 597–610. https://doi.org/10.1080/02188791.2024.2390658

Little, C. W., Clark, J. C., Tani, N. E., & Connor, C. M. (2018). Improving writing skills through technology-based instruction: A meta-analysis. *Review of Education, 6*(2), 183–201. https://doi.org/10.1002/rev3.3114

Liu, T., & Aryadoust, V. (2024). Does modality matter? A meta-analysis of the effect of video input in L2 listening assessment. *System, 120*, 103191. https://doi.org/10.1016/j.system.2023.103191

Naka, L. (2025). Portfolio as an assessment tool: Impact on student participation and improvement in EFL learning. *International Journal of Language Testing, 15*(2), 134–152. https://doi.org/10.22034/ijlt.2025.506151.1419

Narayan, R. (2023). A critical review of portfolio assessment as an alternative tool in English language teaching classrooms. *English Language and Literature Studies, 13*(1), 1–8.

Ndruru, F., Widiati, U., Basthomi, Y., Zagoto, I., Rovikasari, M., & Wahyuningsih, S. (2026). Digital multimodal composing competence and writing enjoyment: Modeling self-efficacy and cognitive engagement among EFL students. *TESL-EJ, 29*(4), 1–22. https://doi.org/10.55593/ej.29116a4

Nezakatgoo, B. (2011). The effects of portfolio assessment on writing of EFL students. *English Language Teaching, 4*(2), 231–241. https://doi.org/10.5539/elt.v4n2p231

Roohani, A., & Taheri, F. (2015). The effect of portfolio assessment on EFL learners' expository writing ability. *Iranian Journal of Language Testing, 5*(1), 46–59.

Santoso, K. H. (2025). Integrating educational technology in ELT: A decade of systematic review and future directions. *Journal of Education and Research, 1*(1), 87–102.

Sar, H. R. S. K., Sabet, M. K., Zafarghandi, A. M., & Hassaskhah, J. (2025). The effects of e-portfolio, paper-based and essay-writing assessments on Iranian EFL learners' motivation and autonomy. *Iranian Journal of Language Teaching Research, 13*(2), 63–90. https://doi.org/10.30466/ijltr.2025.55609.2829

Shahrokhi, M., Mohebati, Z., & Talebi, M. (2025). A critical review of the effect of portfolio assessment on writing anxiety, performance and autonomy. In *2025 12th International and the 18th National Conference on E-Learning and E-Teaching (ICeLeT)* (pp. 1–6). IEEE. https://doi.org/10.1109/ICeLeT66022.2025.11025138

Suryani, N. Y., Rizal, S., Rohani, T., & Ratnaningsih, H. (2024). Improving learners' English writing skills through digital technologies and project-based learning. *Jurnal Ilmiah Ilmu Terapan Universitas Jambi, 8*(1), 21–34. https://doi.org/10.22437/jiituj.v8i1.32506

Tabatabaei, O., & Assefi, F. (2012). The effect of portfolio assessment technique on writing performance of EFL learner. *English Language Teaching, 5*(5), 138–147. https://doi.org/10.5539/elt.v5n5p138

Taki, S., & Heidari, M. (2011). The effect of using portfolio-based writing assessment on language learning: The case of young Iranian EFL learners. *English Language Teaching, 4*(3), 192–199. https://doi.org/10.5539/elt.v4n3p192

Turquois, E. (2016). Technical writing, genre and aesthetic in Procopius. In *Shifting genres in late antiquity* (pp. 219–231). Routledge.

Ueasiriphan, T., & Tangkiengsirisin, S. (2019). The effects of genre-based teaching on enhancement of Thai engineers' technical writing ability. *International Journal of Instruction, 12*(2), 723–738. https://doi.org/10.29333/iji.2019.12246a