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# Scaffolding Through Google Docs and Writing Achievement: The Mediating Role of Metacognitive Knowledge

Mojgan Amiri[1]
Majid Farahian[2*]

[1]M.A. Student of Applied Linguistics, Department of ELT, Ker.C., Islamic Azad University, Kermanshah, Iran
[*2]Assistant Professor of Applied Linguistics, Department of ELT, Ker.C., Islamic Azad University, Kermanshah, Iran

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**CORRESPONDING AUTHOR**

E-mail: majid.farahian@iau.ac.ir

**ABSTRACT**

Previous studies have explored the significant function of writing in the language development process, the essential role of metacognition in learning, the efficacy of scaffolding in developing students' writing skill, and the application of technology in the learning and training process. However, the relationship between writing metacognitive knowledge and scaffolding via Google Docs and academic writing achievement needs further investigation. Therefore, the present study sought to examine whether writing metacognitive knowledge mediates the relationship between English as a foreign language (EFL) learners' scaffolding via Google Docs and academic writing achievement. The participants were 90 EFL undergraduate students enrolled in a writing course. The proficiency level of the participants was assessed through an online DIALANG test. Then, a quantitative correlational design was used to test the research hypothesis. Two questionnaires were used to gather quantitative data, and students' performance on academic writing achievement was assessed. To evaluate the data, Pearson correlation, multiple linear regression, simple linear regression, and path analysis were run. The findings uncovered the hypothesized model of relationships among the variables of the study. More specifically, the results supported the mediator role of writing metacognitive knowledge.

**KEYWORDS:** EFL writing skill; Peer feedback; Technology-mediated writing; Writing metacognitive knowledge

## 1. Introduction

Writing is a fundamental communication skill for learning a second language and is critical for language learners' achievement (Geng et al., 2021). It is more than a way of communicating in a foreign language because it can help learners acquire the foreign language (Maftoon et al., 2014). Moreover, the act of writing is a creative process through which one creates a text for another person to read (Nosratinia & Adibifar, 2014; Zarinkamar et al., 2021), hence helping them to communicate. In the writing process, there are stages of constructing the text, memory and executive functions (Owens, 2012) and it has been assumed that metacognition as an executive function regulates and controls the process of writing (Ramadhanti & Yanda, 2021). It has been claimed that successful writing as a very complex cognitive process that involves planning, text generation, and revision (Flower et al., 1994) depends on metacognitive knowledge and metacognitive regulation behaviour (McCormick, 2003).

Another variable discussed in the present study is the use of Google Docs in EFL writing courses. A growing body of research supports the incorporation of Web 2.0 applications such as forums, blogs, wikis, and Google Docs in L2 writing courses, as these tools enable educators to establish interactive online environments for collaborative writing, where L2 writers can receive feedback from both instructors and peers, as well as participate in peer feedback and peer editing processes (Dizon, 2016; Strobl, 2013). Nevertheless, the exploration of Google Docs in writing courses has been less extensively researched compared to other Web 2.0 tools (i.e., blogs or wikis) (Ebadi & Rahimi, 2017). Considering that Google Docs presents several useful features for writing courses, such as peer feedback, peer editing, redrafting, and text change tracking (Semeraro & Moore, 2016), gathering more

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empirical evidence regarding the effectiveness of Google Docs could offer a promising and practical technological application for EFL writing instruction.

Metacognitive abilities are essential for EFL learners' academic achievements (Cai & Zhao, 2023; Sun et al., 2024). They empower students to go beyond being mere recipients of information, allowing them to engage critically with the content, establish achievable goals, and modify their learning strategies for greater effectiveness. In the current digital era, marked by an overflow of problems and frequently conflicting information sources, metacognitive skills have become increasingly vital for evaluating credible information and for pursuing self-directed, lifelong learning. Research has also indicated the role of Artificial Intelligence (AI) in improving metacognitive, creative skills and higher order thinking (Ilgun Dibek et al., 2024; Khotimah, et al., 2024). In a meta-analysis, Ilgun Dibek et al. (2024) reported that the use of AIEd had a positive impact on higher order thinking skills. In the same vein, Darwin et al. (2023) fond that Artificial intelligence can be beneficial in fostering critical thinking abilities, but, as they report, there are caveats that need to be managed carefully. Szmyd and Mitera (2024) also hold that learners recognize the significance of critically evaluating their own beliefs as well as those of others. They emphasize that while AI can assist in this evaluation, it cannot substitute for conventional teaching approaches, which are crucial for developing autonomous thinking.

Although a lot of researchers have acknowledged the key role of metacognition in facilitating writing in the EFL context (Farahian & Avarzamani, 2018; Sun & Zhang, 2022; Wang et al., 2024), there is limited information regarding the interface among scaffolding through Google Docs, metacognitive knowledge, and EFL writing achievement. Therefore, the present study, as its main objective, sought to investigate the mediating role of writing metacognitive knowledge in the relationship of scaffolding via Google Docs and academic writing achievement.

The present study is significant since it attempts to bridge the gap between technology-prosperous teaching and metacognitive development in EFL writing. By investigating how scaffolding via Google Docs impacts metacognitive knowledge and writing achievement, this research offers insights into optimizing digital tools for cognitive and metacognitive growth. In the era of increasing AI and digital integration in education, understanding this interplay is important to design effective instructional strategies. This study contributes to both theoretical knowledge and practical applications, which emphasizes the importance of promoting self-regulations and important thinking skills required to learn academic success and lifelong learning in the digital age.

## 2. Literature review

### 2.1. Metacognition

According to Flavell (1987), metacognitive knowledge is "the part of one's acquired word knowledge that has to do with cognitive matters" (p. 21). Generally speaking, metacognition is considered as one's thinking about his/her thinking (Dennis & Somerville, 2022) and is defined as the knowledge about and regulation of cognitive processes (Yu-Ling et al., 2001). When learners get involved in planning, monitoring, evaluating, and making changes to their own learning behaviours, metacognition comes into play (Vakilifard & Abedini, 2021). As Flavell (1979) suggests, metacognition is knowing about knowing or cognition about cognition.

Metacognition and its function in the development of writing have been investigated by various researchers (e.g., Colognesi et al., 2020; Ramadhanti & Yanda, 2021). Furthermore, they have scrutinized the correlation between metacognitive skills and writing achievement (e.g., Eriyani, 2020; Teng, 2019). Therefore, metacognition-affected training is distinguished as an efficient teaching procedure (Al-Jarrah et al., 2018).

Even though students benefit from developing this knowledge, particularly in writing courses, they are not taught how to cultivate metacognitive skills, especially in FL contexts like Iran (Nourazar et al., 2022) where product-oriented oriented approaches to learning and teaching are valued (Cheraghi et al., 2022). In this context many teachers assume that the instruction of grammar and vocabulary would be sufficient for writing and therefore the significant role of writing processes has been disregarded in EFL classes (Avarzamani & Farahian, 2019).

### 2.2. Technology in education

Nowadays, technology has advanced tremendously, enabling the concept of scaffolding—originally limited to human interactions—to expand beyond human agents since the early 1990s. This evolution now incorporates web-based tools as non-human scaffolding supports in learning environments (Kadkhodaei et. al, 2025). Although the notion of collaborative writing has been around for some time, its devices have undergone significant modifications. Research shows that online cooperative activities (e.g., blogs & wiki, an essential component of Web 2.0) is contingent upon the improvement of three aptitudes among college students: (1) social skills (Apple et al., 2011), (2) teamwork (Blair, 2006), (3) and basic computing skills (Bottge et al., 2009). Collaborative tasks enable students to learn beyond what they might have learned alone, to share perspectives, and to complete tasks successfully, which can maximize learning both inside and outside of the classroom (Jones, 2007) In this regard, Google Docs is a platform for online collaborative writing. It enables numerous authors to edit in real-time and facilitates collaborative writing with the ease of accessing it from anywhere. In this context, Hemati and Farahian (2024) notes that Google Docs as an online digital media helps instructors in collaborative writing by preparing effective features that aid students in developing collaborative writing skills. Google Docs enables people to collaborate on the same task without limitations often created by usual face-to-face interactions (Perron & Sellers, 2011).

Research on the use of digital tools for scaffolding has shown promising results to improve both writing achievement and metacognition. For example, the study on collaborative writing platforms such as Google Docs has demonstrated that these tools can enhance the writing achievement by providing real-time feedback, enabling peer collaboration, and offering structured support (Fathi et al., 2021; Graham & Perin, 2007; Nabhan & Sa'diyah, 2021; Nhung & Hue, 2022; Mahmood, 2018). Similarly, scaffolding through digital tools have been found to promote metacognition by encouraging learners to reflect on their writing processes, set goals, and monitor their progress (Cho & McArther, 2010; Zheng et al., 2015). While specific studies on 'scaffolding through Google Docs' are limited, comprehensive literature on technology-mediated scaffolding shows that such tools can support both writing achievement and metacognitive development by creating environment for interactive and adaptive learning. Despite the growing body of research in this area, only some studies have concentrated on the connections between students' metacognitive awareness and their writing performance (e.g. Teng, 2019) and this has been particularly the case in EFL contexts. Furthermore, no significant research has reported the interface among scaffolding through Google Docs, metacognitive knowledge, and EFL writing achievement. In an effort to address this research lacuna, the present study aimed at exploring the mediating effect of writing metacognitive knowledge in the relationship of scaffolding via Google Docs and academic writing achievement. Accordingly, the hypothesized model was presented (see Figure 1) and subsequent research questions were proposed:

1. Is there a significant relationship between EFL learners' scaffolding via Google Docs and their writing achievement?

2. Is there a significant relationship between EFL learners' scaffolding via Google Docs and their writing metacognitive knowledge?

3. Is there a significant relationship between EFL learners' writing metacognitive knowledge and their writing achievement?

4. Does EFL learners' writing metacognitive knowledge mediate the relationship between scaffolding via Google Docs and their writing achievement?

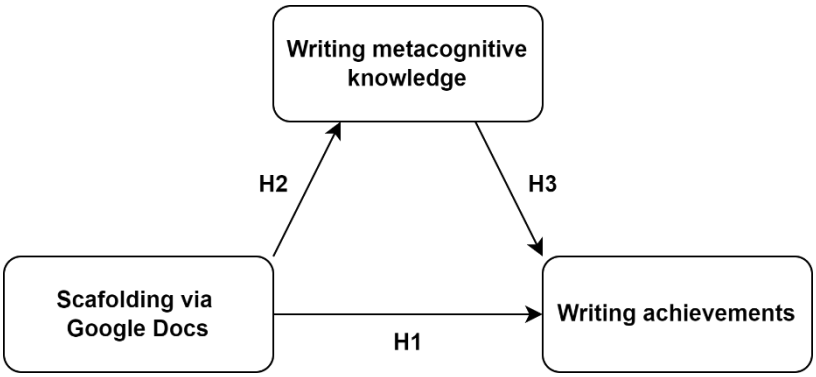


**Figure 1.** The hypothesized model

## 3. Methodology

### 3.1. Design

The current study explored the mediating role of writing metacognitive knowledge in the relationship of scaffolding via Google Docs and academic writing achievement. Therefore, this study utilized a quantitative and correlational design to test research hypotheses.

### 3.2. Participants

The study involved 90 undergraduate students (56 females and 34 males) who were taking a writing course at a university in Kermanshah (a city in the west of Iran). The ages of the participants varied between 20 and 24 years. To evaluate the participants' proficiency, the online DIALANG test was utilized. The students were categorized into six proficiency levels: A1, A2, B1, B2, C1, and C2, based on their test results. Those students who scored at A1 and A2 levels were excluded from the study since they were unable to handle the tasks involved. Additionally, some participants at the C1 and C2 levels were also removed due to concerns that they may have already developed their metacognitive skills. This exclusion ensured that the study focused on participants who would benefit most from scaffolding via Google Docs and whose metacognitive knowledge was still developing. Finally, from an initial group of 148, 90 students with B1 and B2 English proficiency were selected for the study.

They were in 3 classes with class1 (18 females and 12 males), class2 (17 females and 13 males), and class3 (21 females and 9 males) students, respectively. These classes were chosen because the instructor utilized Google Docs for collaborative writing throughout the term, aligning with the study's focus on scaffolding and metacognitive development. In general terms, the

course aimed to develop students' ability to write 5 paragraph essays. This university was chosen because, following the COVID-19 pandemic, all courses were conducted online, providing a natural setting for examining the impact of scaffolding via Google Docs on writing achievement and metacognitive knowledge.

Before the study, the Scaffolding via Google Docs Questionnaire was administered to inquire whether the students had any writing experience in Google Docs before the study and if they had received any instruction on it. The response we received from all participants was negative. This lack of prior exposure was crucial for isolating the effects of scaffolding via Google Docs on writing achievement and metacognitive knowledge. The participants were also assured that the results would be kept in absolute confidence and would only be applied to the intended research. The first researcher was the instructor and had at least seventeen years of experience instructing EFL in various language schools.

## 3.3. Instruments

### *3.3.1. DIALANG Proficiency Test*

DIALANG is a diagnostic test. Its main purpose is to inform language learners about their proficiency level. According to the Common European Framework of Reference for Languages, the outcomes of the DIALANG test, which assesses general language proficiency, are classified into levels ranging from A1 to C2.

### *3.3.2. Writing achievement test*

Since it has been suggested that writing is generally simpler when the subject matter is well-known rather than when it is not (McCutchen, 2000) in the final session of the course, students were requested to compose a brief essay ranging from 80 to 120 words on the topic, "Do you believe that social media can have adverse effects on your life?". The scoring rubric developed by Jacobes et al. (1981) was utilized to assess the students' essays. To evaluate students' writing, the rubric emphasizes five areas: organization, content, language use, vocabulary, and mechanics. Four levels are employed to grade each category. Each classification is evaluated using a scale that ranges from very poor to fair, good to average, and excellent to very good. A maximum score of 100 is given to perfect writing.

### *3.3.3. Metacognitive awareness writing questionnaire*

The MAWQ, developed by Farahian (2017), is based on the concept that writing metacognitive knowledge can be divided into two main categories: Knowledge of cognition and regulation of cognition. This tool consists of 36 items and utilizes a 5-point Likert scale, where responses range from strongly agree (1) to strongly disagree (5). The author stated that the scale exhibited a satisfactory level of reliability, with reliability indices ranging from 67 to 91. Regarding the scale's validity, Farahian provides details on the procedure for validating the scale.

### *3.3.4. Scaffolding via Google Docs questionnaire (SGDQ)*

The instrument was designed and validated by Farahian and Ebadi (2022). The framework underlying the development of the questionnaire was informed by the work of Wood et al. (1976), Vygotsky (1986), Hogan and Pressly (1997), Van de Pole et al. (2010), Mortazavi et al. (2016), Ikawati (2020), and Suwastini et al (2021). The SGDQ contains 15 items. It consists of four categories including instructional, interactional, reflective, and affective.

The questionnaire is based on a 5-point Likert scale varying from strongly agree= 5 to strongly disagree= 1. As reported, the questionnaire was examined to estimate the construct validity using the exploratory factor analysis (EFA), and average variance extracted (AVE). In addition, the reliability of the questionnaire was evaluated using Cronbach's alpha coefficient. It was computed to be 0.91.

## 3.4. Procedure

At the beginning of the study, the DIALANG proficiency test was used to determine the homogeneity of all the students. After the students took the proficiency test, they participated in a writing course. The analysis of the data excluded information regarding students whose proficiency levels fell outside the study's objectives. The first researcher was the teacher of three online classes. During a fourteen-session course, the students were instructed on writing 5 paragraph essays and each session they were given some model paragraphs to analyse during the online courses. They were also given some take-home assignments. The students were instructed to create their own Google Docs and share them with their teammates and the teacher. As part of their assignment, each student was required to choose a partner, read his/her partner's writing task, and provide the necessary feedback. Following Slavin (1996), cooperative learning activities were based on individual accountability, equal participation, simultaneous interaction, and positive interdependence. For example, as he suggests, three conditions in the chosen activities accounted for individual accountability: 1) the student performed individually; 2) group members observed her/his performance, and 3) again the student performed individually. As already explained to the students in two training sessions, when the students performed at the second stage, each pair was monitored performing one or some of the nine language functions for scaffolding

(see, Mohammadzadeh et al., 2022) including agreeing, explaining, giving ideas, instructing, restating, suggesting, comprehension checking, eliciting opinion, and questioning. For example, agreeing, involves expressing agreement with other learners' ideas or explaining the meaning of a term or idea that is not clear to the partner.

The students were expected to synchronously pass comments and edit each other's writing tasks in online classes using Google Docs. To familiarize the students with the process, the first researcher/instructor used some sample films to address the students' possible questions and elaborate on the technical aspects of Google Docs. During the process, each student was asked to revise the writing assignments of another student each time (see Figure 2). The students were required to revise their classmates' work by using a different font colour, focusing on key features like an overview of the content, the accuracy of the information, and the word count (i.e., task achievement); the organization of ideas, paragraph structure, and linking techniques (i.e., coherence and cohesion); and the use of appropriate vocabulary, idiomatic phrases, metaphors, collocations, verbal phrases, prepositions, and other linguistic features. The instructor provided instructional, interactive, reflective, and emotional support to guide students through this process. Each session, the students of three classes received the same number of writing assignments. They were asked to compose a short essay (80–120 words) about a well-known subject that sounded attractive and relevant to the preferences of the students. The students' agreements with the chosen topics were also taken into account. There were 10 consecutive weeks of instruction, each lasting 90 minutes. All of the students took the online exams in the final week of the term. Two instructors who had more experience and were more skilled at teaching composition writing than the researcher/instructor were asked to rate the writing tasks using a scale adapted from Jacobs et al. (1981). This assignment was given to the students in the last session. The findings revealed that the two raters had an inter-rater reliability of .89. Then, students completed two short questionnaires about their views toward Scaffolding via Google Docs and MAWQ at the end of the writing course. Because of the COVID-19 lockdown, the students were not directly accessible to the researchers. Thus, the first researcher delivered the questionnaires via Google Forms.

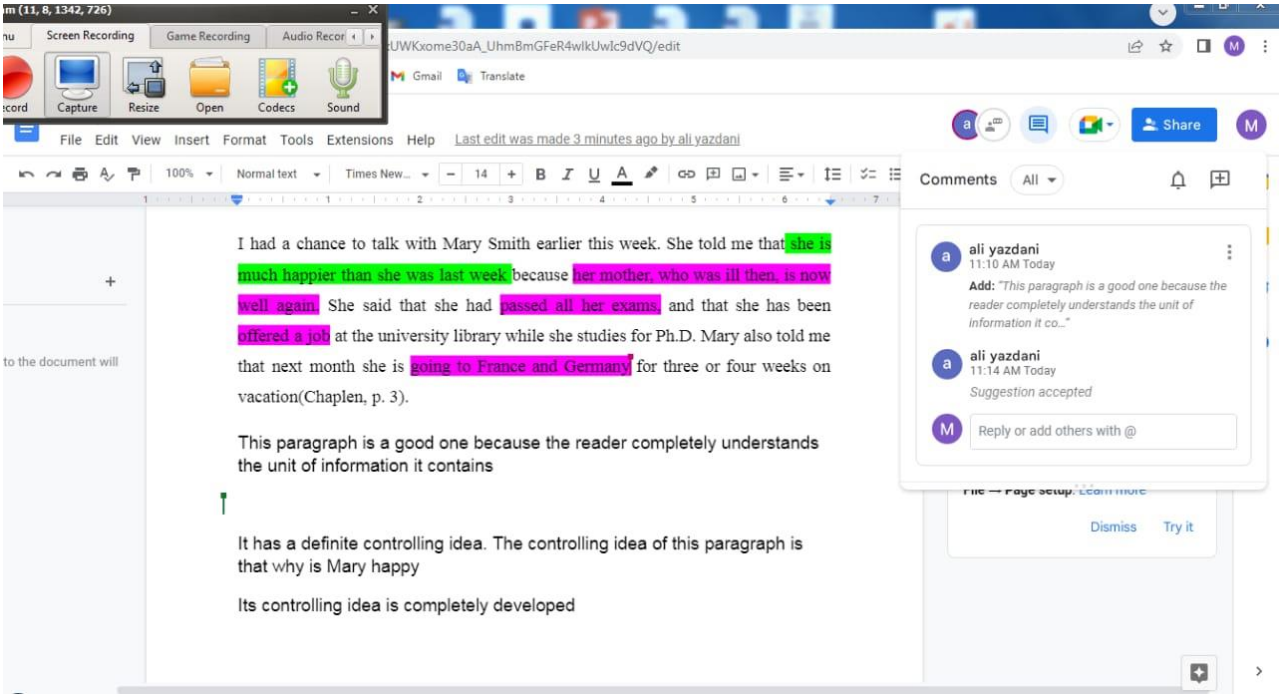


**Figure 2.** A snapshot of scaffolding via Google Docs

### 3.5. Data analysis

When scores were allocated to the students' performance on academic writing achievement, and the participants' answers to the items of the questionnaires were analysed quantitatively, using SPSS 23, the researchers ran descriptive statistics to present the statistics related to the variables under the study. In order to further explore the connections between the three variables, three Pearson product-moment correlations were computed. Likewise, to explore the mediating influence of writing metacognitive knowledge on the connections between scaffolding through Google Docs and academic writing achievement, Pearson correlation, multiple linear regression, simple linear regression, and path analysis using Amos version 23 were conducted.

## 4. Results

Before performing the stages of data analysis, it was necessary to assess the normality of the collected data using One-Sample Kolmogorov-Smirnov Test. The purpose of this test was to demonstrate the normality of data distribution and determine whether

parametric or nonparametric tests should be used to evaluate the data. According to the obtained results, the distribution of data is normal, because for all of the variables sig>0.05. Then, it is possible to use parametric tests to analyse data.

The first research question sought if there is a significant relationship between EFL learners' scaffolding via Google Docs and writing achievement. The result is shown in Table 1 using Pearson's correlation coefficient.

**Table 1.** Relationship between EFL learners' scaffolding via Google Docs and writing achievement

| | | Writing achievement | Instructional | Interactional | Reflective | Affective | Total |
|---|---|---|---|---|---|---|---|
| Writing achievement | Pearson Correlation | 1 | | | | | |
| | Sig. | | | | | | |
| Instructional | Pearson Correlation | .065 | 1 | | | | |
| | Sig. (2-tailed) | .544 | | | | | |
| Interactional | Pearson Correlation | .159 | .568** | 1 | | | |
| | Sig. (2-tailed) | .135 | .000 | | | | |
| Reflective | Pearson Correlation | .093 | .473** | .533** | 1 | | |
| | Sig. (2-tailed) | .385 | .000 | .000 | | | |
| Affective | Pearson Correlation | .305** | .380** | .359** | .397** | 1 | |
| | Sig. (2-tailed) | .003 | .000 | .001 | .000 | | |
| Total | Pearson Correlation | .203 | .812** | .729** | .803** | .600** | 1 |
| | Sig. (2-tailed) | .055 | .000 | .000 | .000 | .000 | |

**. Correlation is significant at the 0.01 level (2-tailed).

As it can be seen in Table 1, all subscales of EFL learners' scaffolding via Google Docs and its overall score were not significantly related to writing achievement. Therefore, the hypothesis of the research was rejected, and the opposite hypothesis was confirmed.

The second research question sought whether there is a significant relationship between EFL learners' scaffolding via Google Docs and EFL learners' writing metacognitive knowledge. The result can be found in Table 2 using Pearson's correlation coefficient.

**Table 2.** EFL learners' scaffolding via Google Docs and EFL learners' writing metacognitive knowledge

| | | Writing metacognitive awareness | Instructional | Interactional | Reflective | Affective | Total |
|---|---|---|---|---|---|---|---|
| Writing metacognitive awareness | Pearson Correlation | 1 | | | | | |
| | Sig. (2-tailed) | | | | | | |
| Instructional | Pearson Correlation | .652** | 1 | | | | |
| | Sig. (2-tailed) | .000 | | | | | |
| Interactional | Pearson Correlation | .714** | .568** | 1 | | | |
| | Sig. (2-tailed) | .000 | .000 | | | | |
| Reflective | Pearson Correlation | .593** | .473** | .533** | 1 | | |
| | Sig. (2-tailed) | .000 | .000 | .000 | | | |
| Affective | Pearson Correlation | .550** | .380** | .359** | .397** | 1 | |
| | Sig. (2-tailed) | .000 | .000 | .001 | .000 | | |
| Total | Pearson Correlation | .826** | .812** | .729** | .803** | .600** | 1 |
| | Sig. (2-tailed) | .000 | .000 | .000 | .000 | .000 | |

**. Correlation is significant at the 0.01 level (2-tailed).

As can be seen in Table 2, all subscales of EFL learners' scaffolding via Google Docs including instructional, interactional, reflective, affective, and also its overall score were significantly related to writing metacognitive knowledge. Therefore, the research hypothesis was confirmed, and the counter hypothesis was rejected. Multiple regression was used for further analysis. The results of this test are shown in Tables 4-5.

**Table 3.** Model Summary of EFL learners' scaffolding and their writing metacognitive knowledge

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .825[a] | .681 | .666 | .31923 |

As seen in Table 3, there are a variety of indicators that evaluate the success of the model in predicting the dependent variable. Here, the R value obtained is equal to 0.825. That is the Pearson correlation between the values of instructional, interactional, reflective, and affective and the actual values of the writing metacognitive knowledge. The $R^2$ coefficient shows the amount of variance explained by the writing metacognitive knowledge by the combination of the instructional, interactional, reflective, and affective which is 0.681. In other words, these four variables together explain 68% of the variance of the writing metacognitive knowledge variable. Other indicators such as Adjusted R Square (0.666) and Std. Error of the Estimate (0.31923) can be found in the Table.

**Table 4.** ANOVA for EFL learners' scaffolding and their writing metacognitive knowledge

| | Model | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 18.475 | 4 | 4.619 | 45.324 | .000 |
| | Residual | 8.662 | 85 | .102 | | |
| | Total | 27.137 | 89 | | | |

Based on Table 4, the F value observed in the 4 degrees of freedom is equal to 45.324 and P=<0.05 shows that this F value is significant at the 0.05 level. Therefore, the variance of variable writing metacognitive knowledge can be explained by variables instructional, interactional, reflective, and affective. Table 5 shows the prediction coefficients of writing metacognitive knowledge using these predictor variables.

**Table 5.** Coefficients (predictor variables of EFL learners' writing metacognitive knowledge model)

| | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | .519 | .178 | | 2.906 | .005 |
| | Instructional | .179 | .054 | .258 | 3.302 | .001 |
| | Interactional | .311 | .064 | .392 | 4.874 | .000 |
| | Reflective | .130 | .060 | .165 | 2.156 | .034 |
| | Affective | .156 | .044 | .246 | 3.561 | .001 |

As illustrated in Table 5, four independent predictor variables namely instructional, interactional, reflective, and affective are related to writing metacognitive knowledge P < 0.005. Therefore, based on the alpha level of 0.05, they can statistically explain the variance of writing metacognitive knowledge in a meaningful way. The standardized beta (β) coefficient shows the influence coefficient of the instructional (β=0.258) and according to the t-statistic (3.302) it can be inferred that this variable can reflect the changes regarding writing metacognitive knowledge. This coefficient of influence is positive, and it shows that if one unit is added to the amount of instructional, the score of writing metacognitive knowledge increases by 25.8%. The standardized beta (β) coefficients show the influence coefficient of the interactional (β=0.392) and according to the t-statistic (4.874) it can be inferred that this variable can reflect the changes related to writing metacognitive knowledge. This coefficient is positive, and it shows that if one unit is added to the amount of instructional, the score of writing metacognitive knowledge increases by 39.28%. The standardized beta (β) coefficients show the influence coefficient of the reflective (β=0.165) and according to the t-statistic (2.156) it can be inferred that this variable can reflect the changes related to writing metacognitive knowledge. This coefficient of influence is positive, and it shows that if one unit is added to the amount of Instructional, the score of writing metacognitive knowledge increases by 16.5 %. The standardized beta (β) coefficients show the influence coefficient of the affective (β=0.246) and according to the t-statistic (3.561) it can be inferred that this variable can reflect the changes related to writing metacognitive knowledge. This coefficient of influence is positive, and it shows that if one unit is added to the amount of instructional, the score of writing metacognitive knowledge increases by 24.6%.

Research question three explored if there is a significant relationship between EFL learners' writing metacognitive knowledge and their writing achievement. The result of Pearson's correlation coefficient is presented in Table 6.

**Table 6.** Relationship between EFL learners' writing metacognitive knowledge and writing achievement

| | | writing achievement | writing metacognitive knowledge |
|---|---|---|---|
| writing achievement | Pearson Correlation | 1 | .275** |
| | Sig. (2-tailed) | | .009 |
| writing metacognitive knowledge | Pearson Correlation | .275** | 1 |
| | Sig. (2-tailed) | .009 | |

**. Correlation is significant at the 0.01 level (2-tailed).

As can be seen in Table 6, writing achievement was significantly related to writing achievement. Therefore, the research hypothesis was confirmed, and the counter hypothesis was rejected. Multiple regression was used for further analysis. The results of this test are illustrated in Tables 7-9.

**Table 7.** Model Summary of EFL learners' writing metacognitive knowledge and writing achievement

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .275[a] | .076 | .065 | .59319 |

As displayed in Table 7, there are a variety of indicators that evaluate the success of the model in predicting the dependent variable. Here, the R value obtained is equal to 0.275. That is the Pearson correlation between the values of writing metacognitive knowledge and the actual values of the writing achievement. The $R^2$ coefficient shows the amount of variance explained by the writing achievement by the writing metacognitive knowledge which is 0.076 here. In other words, these four variables together explain 7.6% of the variance of the writing achievement variable. Other indicators such as Adjusted R Square (0.065) and Std. Error of the Estimate (0.59319) can be seen in the Table.

**Table 8.** ANOVA for EFL learners' writing metacognitive knowledge and their writing achievement

| | Model | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 2.543 | 1 | 2.543 | 7.227 | .009 |
| | Residual | 30.965 | 88 | .352 | | |
| | Total | 33.508 | 89 | | | |

According to Table 8, the F value observed in the 1 degree of freedom is equal to 7.227 and P=0.000<0.05 indicates that this F value is significant at the 0.05 level. Therefore, the variance of variable writing achievement can be explained by the writing metacognitive knowledge variable. Table 10 shows the prediction coefficients of writing metacognitive knowledge using these predictor variables.

**Table 9.** Coefficients (predictors of variables of EFL learners' writing achievement

| | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 2.226 | .331 | | 6.719 | .000 |
| | writing metacognitive knowledge | .306 | .114 | .275 | 2.688 | .009 |

As illustrated in Table 9, one independent predictor variable namely writing metacognitive knowledge is related to writing achievement P<0.005. Therefore, based on the alpha level of 0.05, they can statistically explain the variance of writing achievement in a meaningful way. The standardized beta (β) coefficient shows the influence coefficient of the writing metacognitive knowledge (β=0.275) and according to the t-statistic (2.688) it can be inferred that this variable can reflect the changes in writing achievement. This coefficient of influence is positive, and it shows that if one unit is added to the amount of writing metacognitive knowledge, writing achievement increases by 27.5%.

Since it is not possible to investigate the role of the mediator dependent variable using regression, it was decided to investigate the primary model and the mediator role of writing metacognitive knowledge using path analysis.

Research question four investigated if EFL learners' writing metacognitive knowledge mediates the relationship between scaffolding via Google Docs and their writing achievement. To answer the question, path analysis was employed.

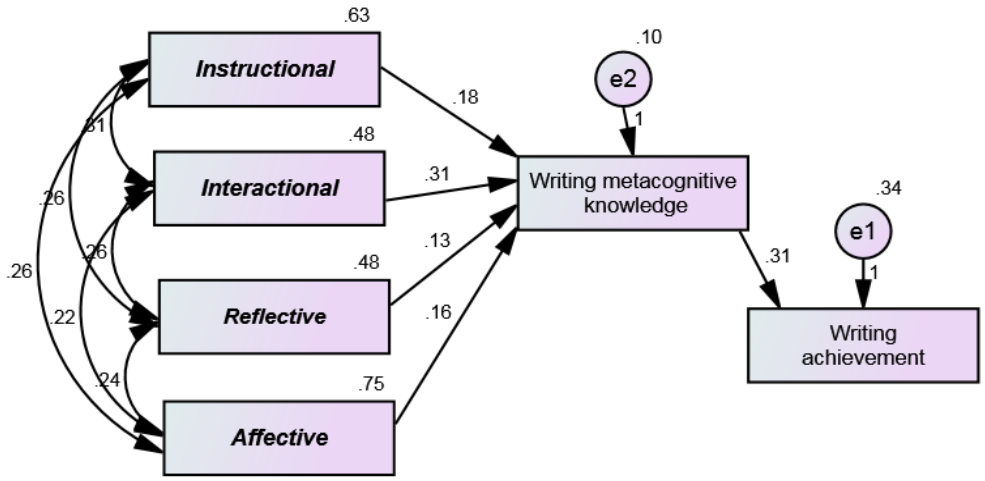


**Figure 3.** The final model

For this purpose, three categories of Absolute Fit Indices, Comparative Fit Indices and Parsimonious Fit Indices were employed in examining the relationship model between these variables, using Amos software. The results related to some of the most important indicators of absolute, comparative, and parsimonious fit are presented in Table 10.

**Table 10.** Model fit indices

| Index name | Acceptable fit | Model evaluation result |
|---|---|---|
| *CMIN* ($\chi^{r}$) | - | 6.616 |
| CMIN/DF | <3 | 1.654 (P=.158) |
| Goodness of Fit Index (GFI) | >.90 | . 977 |
| Adjusted Goodness of Fit Index (AGFI) | >.90 | .878 |
| Normed Fit Index (NFI) | >.90 | .968 |
| Comparative Fit Index (CFI) | >.90 | .986 |
| Incremental Fit Index (IFI) | >.90 | .987 |
| Root Mean square Residual (RMR) | <.05 | .023 |
| Root Mean Square Error of approximation (RMSEA) | <.05 | .086 |

Based on Table 10, the relative chi-square is equal to 1.654, which means that the model does not have a good fit. The goodness of fit index (GFI) jointly evaluates the relative value of variances and covariance through the model. Here, the GFI value is equal to 0.977 and indicates the good fit of the model. In addition, in the present study, the Root Mean Square Residual (RMR) is equal to 0.023, which indicates a good fit, and as a result, the model is very desirable. Normalized fit index (NFI) is acceptable for values above 0.90. This index in the current model is equal to 0.968, which shows the optimal fit of the model. The value of Comparative Fit Index (CFI) is equal to 0.986, which indicates the fit of the model. The Incremental Fit Index (IFI) was developed to address parsimony and sample size issues related to NFI. This index here is equal to 0.987. The Root Mean Square Error of approximation (RMSEA) represents the average of the differences between the actual correlation/variance of the sample and the expected model estimated from the population. Considering that the current model, RMSEA=0.086>0.08, does not have a good fit, In general, the result of the indicators reveals that all the indicators have been reported in the RMSEA component at the optimal level, and the model has a good fit with the data, and this indicates that there is a linear relationship between the variables and the structure.

Although the presented model has almost a good fit, the question arises as to what is the significant effect of the variables instructional, interactional, reflective, and affective on the variable writing achievement through variable writing metacognitive knowledge as the dependent variable of the criterion. The results are presented in Table 11.

**Table 11.** The direct and indirect effect of independent variables with the dependent medium and criterion

| Predictor | Criterion | Direct effects | Indirect Effect | Total Effect |
|---|---|---|---|---|
| Instructional | writing metacognitive knowledge | 0.179 | 0.000 | 0.179 |
| Interactional | writing metacognitive knowledge | 0.311 | 0.000 | 0.311 |
| Reflective | writing metacognitive knowledge | 0.130 | 0.000 | 0.130 |
| Affective | writing metacognitive knowledge | 0.156 | 0.000 | 0.156 |
| Writing metacognitive knowledge | writing metacognitive | 0.306 | 0.000 | 0.306 |

As it can be seen in Table 12, the results indicate that writing metacognitive knowledge has a mediating effect on the relationship between instructional, interactional, reflective, and affective with writing metacognitive.

## 5. Discussion

The aim of the current investigation was to test the hypothesis that writing metacognitive knowledge mediates the relationship between scaffolding via Google Docs and academic writing achievement. As a result, the first research question explored if there was a significant relationship between EFL learners' scaffolding via Google Docs and EFL learners' writing achievement. The results demonstrated that EFL learners' scaffolding via Google Docs as well as any of its subscales did not significantly correlate with writing achievement. Based on the results, the researchers concluded that there was no significant relationship between the scaffolding of EFL learners via Google Docs and their writing achievement. The results of the first research question were compatible with those of Nhung and Hue (2022), who concluded that use of Google Docs had a significant effect on EFL students' writing performance. In the same line, Nguyen and Nguyen (2022) reported that applying Google Docs in online teaching and learning English had positive results in students' writing performance. Seyyedrezaie et al. (2016) also investigated the impact of the Google Docs on EFL learners' writing achievement and found that Google Docs improved learners' writing performance statistically. In the same vein, Fathi et al. (2021) who investigated the impact of collaborative writing using Google Docs on EFL learners' writing performance and writing self-regulation found that collaborative writing both via using Google Docs and in the face-to-face classroom significantly promoted the writing performance and writing self-regulation of the participants. This finding of the first research question is not unexpected because scaffolding via Google Docs may provide a dynamic and interactive platform that supports real-time feedback, peer collaboration, and structured guidance which play a key role in improving writing achievement. The collaborative nature of Google Docs allows learners to engage in meaningful interactions, share ideas, and refine their writing through continuous revision. This supports Vygotsky's (1978) sociocultural theory of learning. According to this theory, learning is a socially mediated process, and tools like Google Docs facilitate scaffolding by enabling more knowledgeable peers to support learners within their zone of proximal development (ZPD). In addition, the accessibility and flexibility of Google Docs may encourage active participation and self-regulation.

The second research question explored if there was a significant relationship between scaffolding via Google Docs and EFL learners' writing metacognitive knowledge. The results uncovered a strong positive relationship between scaffolding via Google Docs and EFL learners' writing metacognitive knowledge, indicating that EFL learners' scaffolding via Google Docs is connected with their level of writing metacognitive knowledge. This can display how EFL learners' scaffolding via Google Docs is crucial to foster their learning autonomy and self-regulation and to be an autonomous learner who is able to regulate his/her own thinking, to be more aware of the significance of writing metacognitive knowledge which develops his/her thinking skills, and to promote students' achievement in online learning. The result lend support to the study conducted by Mortazavi et al. (2016) who reported that scaffolding strategies develop the student's self-efficacy and monitoring skills during writing. They also declared that notable developments in self-regulatory and writing skills are the results of applying scaffolding mechanisms. In a partially similar result, Ikwati (2020) also investigated scaffolding in teaching writing and revealed that through scaffolding not only do students learn how to do the assignment but also it enables them to become independent and successful writers. That finding is not unexpected since the aim of scaffolding via Google Docs is to transfer learning responsibility, encourage learners' autonomy, foster students' success in learning, gain self-regulation, and regulate their own thinking. Moreover, metacognition, an essential segment of self-regulation (Teng, 2019), is of great significance in online learning contexts (Ersani et al., 2021).

The third research question aimed to find if there was a significant relationship between writing metacognitive knowledge and academic writing achievement. This is compatible with the finding that found that there is a positive relationship between writing metacognitive knowledge and ESL learners' writing performance (Kasper, 1997). This is also in tandem with the outcomes revealed by Victori (1999) who studied the relationship between L2 learners' metacognitive abilities and writing performance and perceived a meaningful relationship between the two variables. The findings of the present study also support the study by Teng (2019) who studied the relationship between metacognitive awareness and writing achievement. He found that metacognitive awareness is an essential segment in exhibiting an EFL learner's writing achievement and that metacognitive regulation can process a learner's metacognitive awareness and promote independence in developing desired written outcomes. Furthermore, the result is consistent with Colognesi et al. (2020) who reported those FL/SL students with higher metacognitive knowledge made more significant progress in their writing skill.

The fourth research question explored the mediating role of writing metacognitive knowledge. The results revealed that the relationship between EFL learners' scaffolding via Google Docs and their academic writing achievement through writing metacognitive knowledge was certainly noteworthy. In other words, writing metacognitive knowledge gained a mediating role in the relationship between scaffolding via Google Docs and academic writing achievement. This means that EFL learners who employ scaffolding via Google Docs tend to have significant writing metacognitive knowledge and ultimately may have special academic writing achievement. This is considered reasonable because if learners do not employ scaffolding via Google Docs, sources of enhancing purposeful communication, reciprocal teaching, autonomous class participation, self-regulation, dynamic classroom interaction, mutual collaboration, as well as the transfer of learning responsibility could diminish and in turn learners' academic writing may be influenced. Despite the fact that to the researchers' knowledge, no studies have specifically explored the precise relationship between learners' scaffolding via Google Docs and their academic writing achievement through writing metacognitive knowledge, some studies have demonstrated a relationship between learners' scaffolding via Google Docs and their writing metacognitive knowledge (Ersani et al., 2021; Ikawati, 2020; Mortazavi et al., 2016) and writing metacognitive

knowledge and their academic writing achievement (Al-Jarrah et al., 2018; Colognesi et al., 2020; Ramadhanti & Yanda, 2021; Teng, 2019; Wijaya, 2022).

One acceptable interpretation for the mediating effect of writing metacognitive knowledge could be that "metacognitive awareness includes what learners know about their own thinking and what they know about strategies for learning" (Stanton, et al., 2021, P. 2). Writing metacognitive awareness helps learners identify their own strengths (Ramadhanti & Yanda, 2021) and strategies (Jaleel & Premachandran, 2016), requires learners to reflect on what they write (Colognesi, et al., 2020), and helps learners develop an awareness of writing process (Hayes & Flower, 1980). Thus create adept writers who are able to regulate their own thinking (Jaleel & Premachandran, 2016) and learning (Yanyan, 2010).

## 6. Conclusion

The results illuminated the considerable effect of the mediation of writing metacognitive knowledge in the relationship of scaffolding via Google Docs and academic writing achievement among EFL learners. Thereupon, raising the level of one of these variables has an impact on the development of other variables. It follows that to improve EFL learners' academic writing achievement, it is essential, first, to reinforce their writing metacognitive knowledge which is subsequently impacted by their scaffolding via Google Docs. The results of this study have substantial implications for EFL instructors and curriculum developers, because it reinforces the role of metacognitive knowledge in the domain of foreign language writing. The findings of this study have also implicated that raising metacognitive knowledge requires serious attention in teacher training courses. Finally, the present study adds to the body of studies in the field of metacognition and contributes to the understanding of writing metacognitive knowledge.

Scaffolding via Google Docs can be effectively integrated into metacognitive teaching methods in EFL writing programs, where appropriate training and activities can be offered in the classroom setting. Educators should focus on enhancing students' metacognitive understanding and strategies while also leveraging technology to broaden EFL learners' range of metacognitive experiences, thereby enhancing their writing skills. In this regard, EFL teachers could improve EFL students' metacognitive experiences and writing skill by encouraging them to use Google Docs inside and outside classrooms.

It is worth noting that the present study has some limitations. recruiting EFL learners from a province in the West of Iran is the study's first drawback. As a result, they are not representative of all English language learners from all provinces of the country. Future investigations may utilize the questionnaires among EFL learners selected from a wide range of institutions throughout the country. By the same token, as the participants lacked any prior experience of using Google Docs for writing development, learners' writing performance and their self-regulation might have been affected by a kind of Hawthorne effect experienced during the course. Additionally, the variables were only evaluated via self-reporting. Future research could employ techniques such as integrating concurrent think-aloud protocols, eye tracking, recordings of learner-system interactions on screen, log files, and other similar methods. (Azevedo, 2020). In further research, the researcher might require thinking about performing in-depth studies with a variety of data collection techniques (e.g. think loud, interviews, journals) and drawing on additional facets (e.g. teachers' attitudes) in order to provide more reliable results.

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