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Effects of cooperative–metacognitive instruction on EFL learners' writing and metacognitive awareness

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ABSTRACT

This study aims to explore the effects of incorporating metacognitive prompts into cooperative learning on students' academic writing and metacognitive awareness. In total, 150 tertiary-level learners were randomly and equally divided into three groups: a cooperative learning group with metacognitive instruction (EG), a metacognitive instruction group (CG1), and a cooperative learning group (CG2). Participants completed a semester-long intervention. Results revealed that the EG students performed best on academic writing and metacognitive regulation; no significant differences were detected between CG1 and CG2. These findings suggest that significant improvement in metacognitive knowledge was not detected in any group. Relevant implications for teaching writing and understanding EFL learners' metacognitive awareness are discussed.

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Cooperative learning; metacognition; metacognitive regulation; writing

1. Introduction

Given an increase in student enrolment and the number of courses offered at higher education institutions, there is a need for an effective method to help learners improve their English academic writing. Writing is particularly challenging for students learning English as a foreign language (EFL). Writing reflects an interaction between writers and readers, and EFL students may find it difficult to engage readers through composition. Writing is also a complex activity that requires cognitive resources; however, traditional writing instruction does not appear to prepare students to surmount these challenges and cultivate critical thinking skills around writing (Torrance & Jeffery, 1999). Teaching EFL students to be effective writers also does not appear rewarding for instructors (Hyland, 2004). Even with writing training, academic writing may still be difficult for students (Lillis & Scott, 2007; Swales, 2004).

Research in EFL education has revealed encouraging findings regarding metacognitive instruction in writing courses (e.g., Nguyen & Gu, 2013; Teng, 2016). However, students need to engage in writing-related group interactions to maximize the potential of metacognitive instruction (Teng, 2016). It is thus essential to adopt cooperative learning to facilitate writing instruction (Rosa-Velardo, Martos-Salgado, & Frutos-Escrig, 1997). Storch (2013) argued it is challenging to maximize group performance and meaningful learning when students are simply assigned into small groups, particularly when tasks are complex. As suggested in previous studies (Slavin & Karweit, 2015; Zion, Michalsky, & Mevarech, 2005), learners' capacity to monitor and evaluate their learning processes determines the success or failure of collaborative group work. Students' participation in collaborative work settings depends on students' awareness of their own thinking (Hew & Cheung, 2010). As argued by Gentil (2011), writing is a multi-componential skill that calls for convergence of distinct

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disciplinary foci. Put simply, academic writing entails the development of multiple metacognitive and cooperative learning skills as part of writing instruction (Ortega, 2012). This matter warrants additional research, particularly on the role of embedding metacognitive instruction in collaborative writing to potentially promote students' group information processing and elaboration abilities when learning to write. Students' academic writing performance may improve as a result.

Metacognition and cooperative learning are often treated separately despite ongoing discussions around the benefits of embedding metacognitive instruction into cooperative writing (Teng, 2016). Studies on this combined approach are therefore scarce. To address this gap, the main objective of the present study is to explore the potential effects of cooperative–metacognitive instruction on improvements in academic writing and metacognitive awareness. Findings are relevant to English education, which requires the acquisition of language skills and knowledge along with student engagement in scientific inquiry. These characteristics can promote sustainable English learning and peer interactions as students think, reason, and negotiate better ways to solve problems in self-directed learning.

2. Literature review

2.1 Metacognition

Metacognition has been defined as the ability to think about learning and plan, monitor, and regulate the process of acquiring knowledge (Flavell, 1979). Metacognition determines one's learning process and is key to successful learning. The term generally refers to two simultaneous processes: controlling one's own learning progress and adopting strategies to improve this process. Metacognition can also be classified into two parts: knowledge of metacognition and regulation of metacognition. According to Schraw (2009), knowledge of metacognition refers to knowledge about one's cognitive processes. These processes include understanding personal strengths and weakness that influence one's performance (declarative knowledge); knowledge needed for completing a task (procedural knowledge); and knowledge about how to employ strategies for information acquisition (conditional knowledge). The regulation of metacognition involves how learners can control their learning; it includes selecting appropriate strategies and allocating resources for learning (planning), self-assessing one's ability to comprehend task performance targets (monitoring), and appraising task performance and learning efficiency (evaluating). Schraw and Dennison (1994) added information management (i.e., skills and strategy sequences for organizing, elaborating, and summarizing information) and debugging (i.e., strategies for correcting comprehension and performance errors) as important components of metacognitive regulation.

Metacognition has increasingly been considered a facilitator of self-regulated learning because it benefits learners in transferring skills, knowledge, and strategies across situations (Teng, 2020; Veenman, Van Hout-Wolters, & Afferbach, 2006). Expert learners often understand the level of commitment, perseverance, and interaction required to complete tasks (Metcalfe & Shimamura, 1994). In terms of writing, such learners also tend to be attuned to planning, generating, and revising and editing their texts (Chien, 2012). These qualities are associated with metacognition; indeed, expert learners utilize various metacognitive strategies to regulate their learning, commitment, disposition, and attention, which elicits more effective learning (Teng & Reynolds, 2019).

Students have exhibited different levels of metacognitive awareness following metacognitive instruction. For example, an integration of distributed metacognitive exercises into class content enabled university students to acquire metacognitive knowledge but not monitoring accuracy (Nietfeld, Li, & Osborne, 2006). Likewise, metacognitive instruction led high school students to achieve better levels of metacognitive regulation but not metacognitive knowledge (Mevarech & Amrany, 2008). Metacognitive instruction helped pre-college students improve domain-specific metacognitive knowledge (a systematic structure of knowledge codified within a specific domain of metacognition) but not general metacognitive knowledge (a systematic structure of knowledge for explaining and

predicting various cognitive and metacognitive phenomena) (Mevarech & Fridkin, 2006). Although these studies were conducted in diverse contexts, they exemplify the need to delve deeper into how intervention through metacognitive instruction can enhance metacognitive awareness.

2.2 Metacognition and writing

Metacognitive instruction facilitates learners' writing performance. For example, metacognitive instruction may help Chinese EFL students realize that the ultimate goal is not simply to complete a task but rather to develop competence by monitoring, regulating, and evaluating their own performance (Teng, 2016). This finding highlights the importance of metacognition when approaching concrete writing tasks and underscores the value of analysing information, identifying problems, exploring strategies, monitoring the learning process, and reflecting on one's writing performance. Along with acquiring declarative knowledge through instruction, individuals are expected to enhance their writing competence by acquiring procedural and conditional knowledge to maximize and optimize accessible resources. This process aligns with Flavell's (1979) cognitive model, which includes four categories of variables and their interconnections: metacognitive knowledge, metacognitive experiences, tasks (or goals), and strategies (or activities). Expert learners combine these variables to oversee their learning process and plan, monitor, and evaluate ongoing cognitive activities and outcomes. Additionally, metacognitive instruction helps learners cultivate strategic reasoning for better engagement when formulating and answering questions related to information-processing load (i.e., the effort associated with handling information about a topic) (Teng, 2019b). According to Penningroth and Rosenberg (1995), information-processing loads significantly influence learners' writing.

Despite differences in research designs when using metacognitive instruction (Dinsmore, Alexander, & Loughlin, 2008), scholars in educational psychology have agreed that metacognition contributes to improving learners' abilities to use knowledge, self-regulate learning, and enhance English learning performance (e.g., Cross, 2015; Teng & Reynolds, 2019; Vandergrift & Goh, 2012). Findings have also indicated a link between metacognition and text quality (e.g., Ofte, 2014; Ong & Zhang, 2013; Teng, 2019a). For example, Ong and Zhang (2013) found that metacognitive awareness affects modulation of the writing process. Larkin (2009) collected data from 25 hours of video-based observation, teaching reflections, and teaching notes; her findings implied the effectiveness of metacognitive skills for writing. Teng (2019a) focused on university EFL students' metacognitive awareness and writing performance, identifying metacognitive regulation as a significant predictor of EFL writing. Teng (2019b) also showed that incorporating group feedback guidance in a metacognitive instruction setting facilitated Chinese EFL students' writing performance compared with incorporating self-explanation guidance in a metacognitive training setting. In a recent study, Bui and Kong (2019) argued that metacognitive instruction can enhance young learners' peer review experience, thereby assisting them in becoming self-regulated learners.

These studies suggest that metacognitive instruction enhances learners' writing performance in various settings; however, results have failed to uncover the extent of metacognitive skills transferred from metacognitive instruction to new and more demanding writing tasks. In other words, it is necessary to explore how learners receiving metacognitive instruction might apply acquired metacognitive skills to new forms of writing. Although studies have noted that metacognitive instruction can help learners transfer previously learned metacognitive skills to new learning situations (e.g., Mevarech & Amrany, 2008; Mevarech & Kramarski, 2003), more research on how metacognitive skills can benefit learners in more demanding and time-consuming writing tasks is warranted.

2.3 Cooperative learning

Cooperative learning is a common topic in educational research (Johnson & Johnson, 1994). Cooperative learning refers to an instructional approach in which learners work in groups to

complete an activity, task, problem, project, or other instructional goal, with their teacher serving as a guide or facilitator (Slavin, 1980). Research on cooperative learning has appeared in social and cognitive psychology. Psychologists have tended to adopt a motivational perspective towards cooperative learning. Researchers suggested that relevant mental information processes or feedback are key to effective learning (Slavin, 1996).

Studies have presented the effects of cooperative learning on student development. For example, Slavin (2014) suggested that cooperative learning can enhance individuals' commitment to group work and benefit individual achievement. Students' interaction and engagement in group discussions can help learners develop arguments about complex problems and reflect on their own performance. Similarly, Holt, Chips, and Wallace (1991) pointed out the potential of cooperative learning in helping learners acquire new content and English skills in linguistically and culturally diverse classrooms.

2.4 Cooperative learning and writing

Cooperative learning is an important element in educational research and practice. Peer interactions can elicit deeper information processing and profound knowledge construction. Research has suggested that student interaction can promote complex problem solving, valid arguments, deep processing, and insightful feedback (Gillies, 2004; Kirschner, Paas, & Kirschner, 2009). Thus, cooperative learning may improve students' thinking skills and help them cultivate knowledge and strategies to enhance writing (Lan, Sung, Cheng, & Chang, 2015).

Studies have also delineated the effects of cooperative learning on students' writing achievements. For instance, Rosa-Velardo et al. (1997) applied several cooperative learning structures (e.g., roundtables and think-pair-share) in writing exercises. Cooperative learning was found to be beneficial for improving writing skills. Elola and Oskoz (2010) found similar results, wherein participation in collaborative synchronous interactions seemed to help learners concentrate on writing while engaging in complementary writing tasks. However, regarding the disadvantages of cooperative learning, Kagan and High (2002) argued that students who lack social skills may not be able to work in groups, which could result in task conflicts. In addition, cooperative group learners lacking metacognitive skills may not be capable of monitoring or reflecting upon their learning processes. Group learners' metacognitive skills have been found to contribute to successful cooperative learning (Mevarech & Kramarski, 1997). The absence of such skills leaves space for additional embedded metacognitive instruction to examine the potential of cooperative learning (Zion et al., 2005).

2.5 Rationale for the present study

Cooperative learning and metacognitive instruction are complementary. First, each approach is related to writing, a complex social-cognitive process in which writers must adapt goals to accomplish a task. Second, learners consciously and unconsciously use metacognitive skills or strategies to achieve writing-related objectives in cooperative learning settings. Slavin and Karweit (2015) posited that metacognitive instruction improves cooperative learning; learners' abilities to monitor and reflect on their learning processes can contribute to successful cooperative learning. Third, certain writing activities in social and cultural contexts represent communicative actions. In these cases, learners must develop an awareness of culturally specific systems of signs (e.g., language or writing) through experiences and information from their surroundings, preferably via cooperative learning. Within this context, combining cooperative learning with metacognitive instruction may help learners develop the skills needed to transform thoughts into text. Finally, learning to write in an EFL context should be carefully structured, as students may become easily distracted during collaborative writing (Storch, 2013). Embedding metacognitive instruction may be useful in structuring students' collaborative writing. Consequently, cooperative learning and metacognitive instruction can potentially be integrated to maximize writing achievement.

This study mainly focused on the possible effects of cooperative–metacognitive instruction on academic writing and metacognitive awareness. Three groups were involved in the study: the first group was exposed to a cooperative learning condition with embedded metacognitive instruction (EG), the second group received metacognitive instruction exclusively (CG1), and the third group engaged in cooperative learning (CG2). This study aimed to address the following research questions:

(1) To what extent do the different types of instruction enhance EFL learners' academic writing?
(2) To what extent do the different types of instruction impact EFL learners' metacognitive awareness?
(3) Is metacognitive awareness correlated with learners' writing performance? If yes, to what extent does it affect learners' writing performance?

3. Method

3.1 Participants

A total of 150 tertiary-level students majoring in interior design were selected from a medium-sized university in China, which hosted approximately 15,000 students. This university was selected out of convenience. An essential prerequisite for gaining admission into this university was a score of at least 90 (out of 150 points) on the National Matriculation English Test, which equalled to approximately 5 points on the International English Language Testing System. Students at this level are expected to have a partial command of the English language and be able to handle basic communication in most situations (Cheng & Qi, 2006). Participants were taking a college English writing course during the study period, which required 36 hours of class time in one semester. The original number of participants was 220; however, 70 students were excluded due to either insufficient writing proficiency or hesitation about the intervention. The final sample consisted of 150 students (52 men and 98 women) from 18 to 20 years old. All participants were first-year students and had learned EFL for at least 6 years.

Writing was the prime focus of this study, and participants' most recent writing examination was a selection criterion. The writing exam was based on the International English Language Testing System. The EG achieved a mean score of 5.9 out of 9 points, whereas each control group attained a mean score of 5.8. Students' writing proficiency was therefore deemed intermediate. Students at this level can present main ideas, but these ideas are often insufficiently developed. Participants can also attempt to construct complex sentences, but the sentences lack accuracy. No significant differences in proficiency level were identified among the three groups ($p = .681$, n.s.).

3.2 Instruction methods

Participants were randomly and equally divided across three conditions, including two control groups (CG1 and CG2) and one experimental group (EG). The groups were identical in the following aspects: lesson structure, time, context, tasks, topics, writing techniques (e.g., planning and content organization), and textbook. The only difference was that learners in the EG condition received cooperative–metacognitive instruction, whereas those in the CG1 condition received metacognitive instruction and those in the CG2 condition received cooperative learning instruction. The same set of cooperative learning sessions, such as the think-pair-share (write-pair-share) process, circle chat, fishbowl debate, and group problem solving, were presented to EG and CG2.

In terms of cooperative learning, the students were divided into 10 sub-groups, with five students in a sub-group. The students chose their group members on a voluntary basis. Interventions involving cooperative learning activities aligned with cooperative learning principles: individual accountability, positive interdependence, equal participation, and simultaneous interaction (Slavin,

1996). For example, individual accountability was documented on the basis of three conditions in the chosen activities: 1) a student performed on his/her own; 2) the performance (or the product of the performance) was observed by group members; and 3) individual performance was required. Positive interdependence applied because three conditions were present in activities: 1) resource interdependence (e.g., assigning each sub-group student a set of arguments for writing to share with their partners); 2) task interdependence (e.g., giving students a multifaceted task to complete and assigning students a group presentation); and 3) reward interdependence (e.g., teams encouraged and helped each other because the teacher compared, summarized, and encouraged each team's performance).

Metacognitive instruction included knowledge of metacognition and regulation of metacognition (see Appendix I). Knowledge of metacognition included declarative knowledge, procedural knowledge, and conditional knowledge; regulation of metacognition involved planning, monitoring, evaluating English writing, and incorporating essential strategies for setting goals. Flavell (1979) suggested person, task, and strategy knowledge are three components of metacognitive knowledge. The present study followed Paris, Cross, and Lipson (1984) proposal that metacognitive knowledge includes declarative, procedural, and conditional knowledge. One reason was that the three types of metacognitive knowledge can better reflect learners' cognitive awareness of writing (Raphael, Englert, & Kirschner, 1989). The instructional approach was based on principles from Veenman et al. (2006). The same set of metacognitive instruction sessions were provided for EG and CG1.

Out of 36 one-hour sessions, EG students received 12 cooperative–metacognitive instruction sessions as part of their English writing course. Six sessions using metacognitive instruction were incorporated into CG1's course, and 6 sessions using cooperative training were incorporated into CG2's course. The remaining 24 sessions in EG's course and the remaining 30 sessions in CG1's and CG2's courses consisted of practical writing instruction. Such instruction was consistent across all groups and included three dimensions. First, teaching contents were mainly based on the textbook. The teacher also prepared online materials for writing instruction. Second, classroom writing activities included reading and creating new texts, reflecting on and evaluating texts, and discussing ideas for writing. Finally, students were required to complete writing tasks. Writing tasks included note taking; describing people, places, things, and events; explanation and argumentation; and personal narratives. EG students were assigned collaborative tasks and were required to complete them using metacognitive prompts. Students in CG1 were required to complete individual writing tasks using metacognitive prompts, and students in CG2 were required to complete collaborative writing tasks without metacognitive prompts.

The 36-session academic writing course the 3 groups attended was taught by a female teacher familiar with metacognitive instruction and cooperative learning instruction. She attended a daylong training administered by the author. The teacher was also a member of a research project focusing on metacognitive training and cooperative learning. Hence, the all-day training was sufficient for her to grasp the essence of the teaching approach. The teacher possessed a master's degree in English education and 10 years of experience teaching English writing at the university level. Appendix II presents the intervention for the three groups. All students were encouraged to continue their classroom learning after class if necessary.

3.3 Measures

3.3.1 Pre- and post-writing tests

Participants were required to write a comparison and contrast essay. This test served as a pre- and post-intervention measure. The test aimed to evaluate students' academic writing proficiency. The marking scheme for the test included five components: content, organization, punctuation, word choice, and grammatical accuracy. Following the Chinese tradition, the maximum possible score for each test was 15 points, with 3 points for each component. Two experienced raters, who were not members of the course-teaching faculty, marked the tests independently. They arrived at

a consensus on the scoring system prior to marking tests individually. In addition, the raters did not know whether the essays were collected from pre- or post-tests. A third rater independently rated the test again if differences emerged in scoring between the two raters. Scores on controversial items were based on majority opinion. For example, for one essay, the first rater gave 1.5 points each for content and organization and 2 points for punctuation, word choice, and grammatical accuracy; the second rater gave 2 points for each component. The third rater gave 1.5 points each for content, organization, and punctuation and 2 points each for the other two components. Thus, the final scores on content and organization were 1.5 points each; the scores for punctuation, word choice, and grammatical accuracy were 2 points each.

In pre-test marking, 30 discrepancies were observed out of 750 (4%). In post-test marking, 35 discrepancies were observed out of 750 (4.6%). The marking scheme was thus considered reliable due to high interrater reliability.

3.3.2 Delayed writing test

The delayed writing test was the end-of-term examination for all students at the chosen university. It was administered one month after the intervention. This test was co-designed by the teaching faculty and supervised and administered by the college English teaching department. The test asked students to write an argumentative essay. This type of essay differed from the comparison and contrast essays in the pre- and post-tests. The purpose of the comparison and contrast writing test was to compare two or more things, problems, events, or ideas and evaluate their similarities and differences. Conversely, the purpose of the argumentative writing task was to explain, clarify, and illustrate viewpoints on a particular issue and convince readers of the validity and accuracy of the writer's argument. Per informal interviews with students in the same department, they found argumentative essays more challenging and time-consuming to write than comparison and contrast essays. This discrepancy is likely attributable to the nature of argumentative essays, for which students are required to provide substantial information to support an argument along with presenting the argument's strengths and weaknesses. The author obtained official permission from the department to conduct this study, which enabled the author to apply the same marking criteria for this test as in the pre- and post-tests.

3.3.3 Metacognition scale

This study adapted Schraw and Dennison (1994) self-report Metacognitive Awareness Inventory (MAI) to measure metacognitive awareness development. In their study, the survey focused on general studies; items were modified in the present study to suit writing-related scenarios. For example, the item "I ask myself if I have considered all options when solving a problem" was revised to "I ask myself if I have considered all options when writing". The instrument included eight components: declarative knowledge, procedural knowledge, conditional knowledge, planning, monitoring, evaluating, information management, and debugging strategies. The first three dimensions comprised knowledge of metacognition, and the last five dimensions comprised regulation of metacognition.

This instrument contained 52 items that were evaluated based on a 5-point Likert-type scale (1 = never; 5 = always). This instrument was administered at the beginning of the study, immediately after the intervention, and one month after the intervention. Potential changes in scores reflected changes in participants' metacognitive awareness. Cronbach's alpha was 0.76 for the pre-test, 0.79 for the post-test, and 0.77 for the delayed test.

3.4 Procedure

Consent to participate was sought from students and teachers concerned, and ethical approval was obtained from the university. Participants completed a 36-hour academic writing course, and the experiment was conducted for the duration of the class. The entire experiment lasted 18 weeks (one

semester), with students spending 2 hours per week on the course. Learners were also required to spend 60 minutes writing a comparison and contrast essay consisting of 200 words; this served as a pre- and post-test. The learners then completed the MAI the following day. A delayed test on writing (lasting one hour) was conducted one month after the intervention. The learners again completed the MAI the day after the delayed test. The author observed three writing lessons for each of the three groups. An observation, and a conversation with the teacher after the observation, ensured that each instructional approach was consistent with the research design.

3.5 Data analysis

Data collected from writing tests and metacognition survey were analysed using SPSS statistical software. Two-way mixed-model repeated-measures ANOVAs were performed to identify any between-subjects group effects or within-subject time effects. Pearson correlation analysis was performed to assess the relationship between metacognition and writing. A subsequent multiple regression analysis was conducted to measure the predictive effects of metacognitive regulation and metacognitive knowledge on writing. The significance level was set to 0.05.

4. Results

4.1 Effects of metacognitive instruction and/or cooperative learning on academic writing

Table 1 presents descriptive statistics for the pre-, post-, and delayed writing tests for the three groups (EG: cooperative learning + metacognitive instruction; CG1: metacognitive instruction group; CG2: cooperative learning group).

As shown in Table 1, the mean scores of the three conditions varied slightly prior to the intervention. The cooperative learning + metacognitive instruction group seemed to outperform the two control groups on the post- and delayed post-tests. Scores from learners in the metacognitive instruction group were slightly higher than those in the cooperative learning group on the post-test and delayed test.

Two-way mixed-model repeated-measures ANOVAs were performed to examine between-subjects group effects (EG, CG1, and CG2), within-subject time effects (pre-test, post-test, and delayed post-test), or time × group interaction effects on learners' writing performance. Results are presented in Table 2.

Findings revealed a significant effect of testing time, F (2, 147) = 61.472, $p < .001$, $\eta^2_p = .485$, revealing that scores of members of each group increased over time. Results also showed a significant effect of group (treatment), F (2, 147) = 6.392, $p < .001$, $\eta^2_p = .316$, indicating that the groups' writing performance was statistically different. Results indicated a significant time × treatment interaction effect, F (2, 147) = 77.069, $p < .001$, $\eta^2_p = .512$. Details about the interaction effect are presented in Figure 1, indicating that the interaction effect of time × treatment pertained to all three groups.

Post hoc Bonferroni group comparisons on the post-test revealed that EG outperformed CG1 ($p = .001$; $d = .611$) and CG2 ($p = .001$; $d = .629$); however, no significant differences were detected

Table 1. Descriptive statistics of learners' scores in the three writing tests.

		Pre-test		Post-test		Delayed post-test	
Group	*n*	*M*	*SD*	*M*	*SD*	*M*	*SD*
EG	50	5.961	1.432	10.812	1.322	10.811	1.383
CG1	50	6.012	1.342	8.762	1.331	8.692	1.333
CG2	50	6.023	1.301	8.662	1.334	8.612	1.292

EG = Experimental group; CG = control group.

Table 2. Two-way repeated-measures ANOVA results of learners' writing development.

Source	*df*	*F*	*p*	Partial η^2
Between-subjects				
Group	2	6.392	.000**	.316
Error	147			
Within-subjects				
Time	2	61.472	.000**	.485
Time × Group	2	77.069	.000**	.512
Error	147			

**$p < .001$

between CG1 and CG2 ($p = .498$; $d = .037$). That is, EG outperformed CG1 and CG2 in the post-test in terms of mean scores, but CG1 did not have an advantage over CG2.

Post hoc Bonferroni comparisons of the groups' performance on the delayed post-test showed that EG again outperformed CG1, with a large effect size ($p = .001$; $d = .615$). EG also outperformed CG2 with a similarly large effect size ($p = .001$; $d = .634$). No significant difference appeared between CG1 and CG2 ($p = .061$; $d = .030$). Overall, these comparisons provide an answer to the first research question, indicating that cooperative learning combined with metacognitive instruction provides an advantage over cooperative learning only or metacognitive instruction only. However, the difference in writing yielded through cooperative learning and metacognitive instruction was not statistically different.

4.2 Metacognitive awareness

Table 3 presents mean scores and standard deviations for knowledge of metacognition by time and treatment.

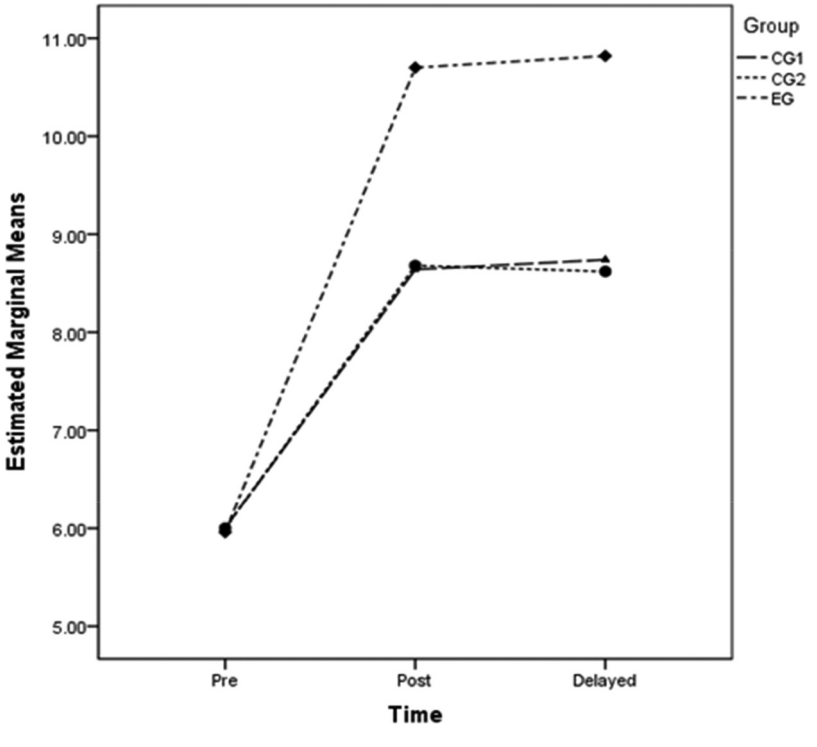

Figure 1. Time × treatment interaction effect.

As exhibited in Table 3, mean scores in the three conditions varied slightly prior to the intervention. There were also minor variations on the post-test and delayed test. Table 3 suggests that even groups receiving metacognitive training demonstrated a declining tendency in terms of declarative, procedural, and conditional knowledge on their post- and delayed tests.

In terms of knowledge of metacognition, two-way mixed-model repeated-measures ANOVAs were performed to assess for any between-subjects treatment effects (EG, CG1, and CG2), within-subject time effects (pre-test, post-test, and delayed post-test), or time × treatment interaction effects on learners' metacognitive knowledge. In terms of the pre-test, results revealed no significant differences among the groups prior to the intervention, F (2, 147) = 1.021, $p > .05$, n.s. Further analyses did not show a significant effect on time, F (2, 147) = 1.253, $p > .05$, n.s., or treatment, F (2, 147) = 1.162, $p > .05$, n.s. A significant interaction effect between treatment and time was not found, F (2, 147) = 1.253, $p > .05$, n.s.

Table 4 presents the mean scores and standard deviations, by time and treatment, for the regulation component of metacognition.

The mean scores across the three conditions varied slightly for the pre-test. However, the mean scores for EG appeared higher than for CG1 and CG2 for the post-test and delayed test. Although CG1 demonstrated higher scores than CG2 on the post-test and delayed test, the differences seemed slight.

Two-way mixed-model repeated-measures ANOVAs indicated a significant effect for time, F (2, 147) = 8.662, $p < .05$, $\eta^2_p = .423$, along with a significant effect for treatment, $F(2, 147) = 9.463$, $p < .05$, $\eta^2_p = .383$. The interaction effect between treatment and time was not significant, F (2, 147) = 1.162, $p > .05$.

Post hoc Bonferroni comparisons of groups on the post-test showed that EG participants outperformed CG1 learners in terms of planning ($p < .05$, $d = .326$), information management ($p < .05$, $d = .469$), monitoring ($p < .05$, $d = .335$), debugging ($p < .05$, $d = .459$), and evaluation ($p < .05$, $d = .510$). In addition, EG participants CG2 outperformed learners in the in terms of planning ($p < .05$, $d = .355$), information management ($p < .05$, $d = .542$), monitoring ($p < .05$, $d = .500$), debugging ($p < .05$, $d = .537$), and evaluation ($p < .05$, $d = .520$). Although CG1 seemed to outperform CG2, significant differences between CG1 and CG2 were not observed for each facet of metacognitive regulation.

Table 3. Mean scores and standard deviations on metacognitive knowledge by time and treatment.

Metacognitive knowledge			EG	CG1	CG2
Declarative knowledge	Pre-test	*M*	2.025	2.044	2.034
		SD	.693	.615	.624
	Post-test	*M*	2.044	2.044	2.034
		SD	.643	.674	.625
	Delayed test	*M*	2.033	2.023	2.014
		SD	.614	.623	.634
Procedural knowledge	Pre-test	*M*	2.04	2.06	1.944
		SD	.713	.683	.593
	Post-test	*M*	2.017	2.045	2.036
		SD	.683	.692	.725
	Delayed test	*M*	1.983	2.027	2.018
		SD	.612	.627	.638
Conditional knowledge	Pre-test	*M*	1.925	1.974	2.014
		SD	.733	.753	.764
	Post-test	*M*	2.014	2.043	2.034
		SD	.673	.614	.695
	Delayed test	*M*	1.983	2.034	2.025
		SD	.623	.643	.674
Total	Pre-test	*M*	1.996	2.026	1.997
		SD	.713	.683	.66
	Post-test	*M*	2.025	2.044	2.034
		SD	.666	.661	.681
	Delayed test	*M*	1.999	2.028	2.019
		SD	.616	.634	.648

Table 4. Mean scores and standard deviations on regulation of metacognition by time and treatment.

Metacognitive regulation			EG	CG1	CG2
Planning	Pre-test	*M*	2.043	1.973	1.984
		SD	.641	.561	.623
	Post-test	*M*	3.984	3.593	3.524
		SD	.561	.571	.645
	Delayed test	*M*	3.783	3.515	3.512
		SD	.667	.561	.652
Information management	Pre-test	*M*	2.024	2.084	2.055
		SD	.661	.672	.561
	Post-test	*M*	4.326	3.755	3.625
		SD	.512	.561	.572
	Delayed test	*M*	4.315	3.744	3.615
		SD	.632	.561	.572
Monitoring	Pre-test	*M*	2.046	1.914	2.013
		SD	.652	.671	.512
	Post-test	*M*	4.283	3.736	3.686
		SD	.561	.662	.667
	Delayed test	*M*	4.184	3.713	3.615
		SD	.671	.651	.561
Debugging	Pre-test	*M*	1.985	2.043	1.983
		SD	.656	.546	.543
	Post-test	*M*	4.287	3.754	3.687
		SD	.663	.562	.678
	Delayed test	*M*	4.281	3.742	3.681
		SD	.667	.572	.561
Evaluation	Pre-test	*M*	2.025	1.993	2.094
		SD	.656	.667	.681
	Post-test	*M*	4.263	3.695	3.644
		SD	.689	.667	.678
	Delayed test	*M*	4.261	3.684	3.641
		SD	.678	.668	.677
Total	Pre-test	*M*	2.024	2.001	2.025
		SD	.653	.623	.584
	Post-test	*M*	4.219	3.706	3.633
		SD	.597	.604	.648
	Delayed test	*M*	4.164	3.679	3.612
		SD	.641	.602	.604

Post hoc Bonferroni comparisons of groups on the delayed post-test revealed that EG outperformed CG1 in terms of planning ($p < .05$, $d = .253$), information management ($p < .05$, $d = .431$), monitoring ($p < .05$, $d = .469$), debugging ($p < .05$, $d = .458$), and evaluation ($p < .05$, $d = .510$). Additionally, EG participants outperformed CG2 learners in terms of planning ($p < .05$, $d = .279$), information management ($p < .05$, $d = .502$), monitoring ($p < .05$, $d = .417$), debugging ($p < .05$, $d = .502$), and evaluation ($p < .05$, $d = .544$). Although CG1 appeared to outperform CG2, significant differences between CG1 and CG2 were not detected for each facet of metacognitive regulation.

These inferences provided an answer to the second research question, intended to identify the group demonstrating the greatest improvements in metacognitive awareness. Results indicated that students in the EG outperformed learners in the other two groups in terms of metacognitive regulation but not metacognitive knowledge.

4.3 Correlations between metacognition and writing scores

Table 5 presents the results of the Pearson correlation analysis.

Results revealed a minor negative correlation between students' writing scores and metacognitive knowledge scores, but this association was not significant. These findings remained consistent for the three tests in each group. In the present study, this pattern may have manifested because students did not exhibit significantly improved metacognitive knowledge after the intervention (see

Table 5. Correlation between writing scores and metacognition in writing tests.

Group	Test	Correlation (WS and MK)	Correlation (WS and MR)	Correlation (MK and MR)
EG	Pre-test	$r = -.072$ ($p = .354$)	$r = .056$ ($p = .702$)	$r = .631$ ($p = .032$)
	Post-test	$r = -.071$ ($p = .355$)	$r = .423$ ($p = .021$)	$r = .722$ ($p = .001$)
	Delayed test	$r = -.068$ ($p = .356$)	$r = .422$ ($p = .025$)	$r = .713$ ($p = .001$)
CG1	Pre-test	$r = -.073$ ($p = .353$)	$r = .078$ ($p = .399$)	$r = .652$($p = .043$)
	Post-test	$r = -.074$ ($p = .352$)	$r = .421$ ($p = .026$)	$r = .661$ ($p = .034$)
	Delayed test	$r = -.057$ ($p = .365$)	$r = .424$ ($p = .023$)	$r = .731$ ($p = .023$)
CG2	Pre-test	$r = -.071$ ($p = .353$)	$r = .072$ ($p = .542$)	$r = .674$($p = .012$)
	Post-test	$r = -.076$ ($p = .343$)	$r = .425$ ($p = .022$)	$r = .723$ ($p = .001$)
	Delayed test	$r = -.056$ ($p = .367$)	$r = .432$ ($p = .015$)	$r = .692$ ($p = .001$)

WS = writing scores; MK = metacognitive knowledge; MR = metacognitive regulation

Table 3). However, large improvements in metacognitive regulation (see Table 4) may explain the minor positive but insignificant correlations between students' writing scores and metacognitive regulation for the pre-test followed by strong and significant correlations between writing scores and metacognitive regulation for the post-test and delayed test in each group. Therefore, a higher level of metacognitive regulation seems to lead to higher writing scores. Finally, a positive and significant correlation was found between metacognitive knowledge and metacognitive regulation ($p < .05$). A subsequent multiple regression analysis indicated that regulation of metacognition added 15% to the variance explained by knowledge of metacognition (F change = 29.231, $p < .05$). Accordingly, although the results revealed a positive and significant association between metacognitive knowledge and metacognitive regulation, the dimension of metacognitive regulation played a pivotal role in explaining writing improvement; the variance explained by metacognitive regulation was larger than that accounted for by metacognitive knowledge.

5. Discussion

The main purpose of this study was to conduct a comparative investigation of academic writing performance, transfer ability, and metacognitive awareness among students exposed to one of three training groups (cooperative–metacognitive instruction, metacognitive instruction, and cooperative learning instruction). Overall, increases in writing scores across the three groups was remarkable; students' writing proficiency prior to the intervention was not high, and only 36 hours were spent on treatment. The semester-long cooperative–metacognitive instruction thus appears a feasible and efficacious teaching approach. This finding suggests a beneficial effect of structured cooperative-metacognitive learning settings on students' academic writing performance. In addition, there was significant effect of testing time, suggesting that scores of each group increased over time. There was also a significant effect of group treatment, revealing that the groups' writing performance was statistically different. There was a significant interaction effect between time and treatment. It means that there were significant differences between the types of group learning instruction and over time. For example, the significant changes in scores (academic writing and metacognitive skills) over time were detected in the condition of cooperative–metacognitive instruction. With regard to the separate instruction of cooperative learning or metacognitive instruction, the changes in scores were not significant over time.

Contributing to what has been known related to cooperative learning (Johnson & Johnson, 1994; Kirschner et al., 2009; Slavin, 1996), the current findings imply the benefits of incorporating metacognition instruction into cooperative writing among EFL students (Teng, 2016). The improvements in academic writing aligned with studies involving metacognitive instruction (Chien, 2012; Conner, 2007; Larkin, 2009; Nelsi & Susana, 2008; Teng, 2019b). As shown in previous studies (Nguyen & Gu, 2013; Ong & Zhang, 2013; Teng, 2016), metacognitive instruction can contribute to improved English writing performance for learners from different backgrounds. An additional piece of evidence from this study suggested that students who received the cooperative–metacognitive instruction were

more skilled in transferring their learning to different writing tasks that required higher-order skills. Students in the cooperative–metacognitive instruction condition may be able to extend their metacognitive skills to a delayed and more demanding writing task situation. Learners in the cooperative writing group and metacognitive instruction group also improved their writing scores. Cooperative learning, as well as metacognitive instruction, appeared to enhance learners' writing performance to some extent, although this improvement was not as significant as in the group for whom metacognitive instruction was incorporated into cooperative writing.

Regarding students' outcomes on metacognitive awareness, the post- and delayed test revealed that all groups improved on the regulation facet of metacognition. EG demonstrated the highest mean score, followed by CG1 and CG2. Therefore, one could argue that the students who received cooperative–metacognitive instruction developed higher levels of metacognitive awareness than learners in the CGs. This finding is in line with Mevarech and Amrany (2008), who found that students receiving cooperative–metacognitive instruction likely improved in metacognitive regulation. One unexpected finding was that learners in the cooperative learning group also improved their regulation of metacognition. Although learners in the metacognitive instruction group showed higher scores than those in the cooperative learning group, this discrepancy was not statistically different. One explanation is that cooperative learning also leads to the development of metacognitive skills. As argued by Salonen, Vauras, and Efklides (2005), regulation processes during cooperative learning may cause a learner to play multiple roles: a leading instructional role, a co-regulatory role, and a contributing role when receiving feedback from group members. Shifting roles may enhance self-regulated learning. Improved metacognitive regulation may thus explain (a) why writing scores could improve on the post- and delayed test and (b) the positive and significant correlations between metacognitive regulation and writing scores on the post- and delayed test.

Metacognitive instruction might have caused students to develop an awareness of metacognitive regulation. However, results did not indicate enhanced knowledge of metacognition. This finding raises questions regarding the effectiveness of cooperative-metacognitive instruction in positively influencing knowledge of metacognition. The lack of improvement in metacognitive knowledge may partially explain the negative and non-significant correlation between knowledge and metacognition and writing scores across the three groups. The absence of a positive impact on learners' knowledge of metacognition could be attributed to the inherent difficulty in addressing students' diverse thinking strategies within classroom instruction. EFL students may not have paid deliberate attention to general thinking skills related to metacognitive knowledge. Such instruction might not have affected their knowledge of metacognition because teaching about thinking is challenging (Veenman et al., 2006). In particular, metacognitive instruction may have demonstrated a declining tendency in terms of declarative, procedural, and conditional knowledge due to challenges in building students' awareness to discern which strategies and conditions work best for them while learning (Brown, 1987). In previous studies (e.g., Schraw, 2001), learners demonstrated certain cognitive awareness of metacognitive knowledge after metacognitive instruction. This may not be the case of EFL students. EFL learners may find it difficult to understand specific knowledge about themselves (e.g., strengths, weaknesses, and interests in and feelings about learning participation) or refrain from eliciting reactions and responses from peers, as argued by Teng (2019a). Such challenges may be more intensified in the Chinese EFL context, where passive learning and a test-oriented culture prevail.

Overall, the findings of the current study revealed several patterns rarely discussed in the literature. First, metacognitive instruction has been suggested to lead students to link new and existing knowledge (Nguyen & Gu, 2013). Students with exposure to metacognitive instruction may more easily transfer metacognitive strategies to a new and more demanding writing task (Teng, 2016). The present study documents that students who received cooperative–metacognition instruction could better transfer their metacognitive skills to a delayed writing situation. However, one issue that deserves attention was the declining tendency on writing performance in the three conditions. As demonstrated by Nguyen and Gu (2013), despite the metacognitive instruction, learners' writing

scores dropped over time. The experimental group managed to keep the highest score. This could show the support for the potential of cooperative-metacognitive instruction on writing.

In addition, the findings hint at a complex interaction between metacognition and writing. This interaction was demonstrated by strong correlations between writing scores and metacognitive regulation on the post-test and delayed test in each group. Students who did not demonstrate improvement in metacognitive regulation might not exhibit significantly enhanced writing skills. This conclusion coincides with other studies (Teng, 2019a; Teng & Huang, 2019; Teng & Zhang, 2016); thus, despite the association between metacognitive knowledge and regulation, metacognitive regulation may be a more significant predictor of EFL students' writing outcomes. Finally, students who had been exposed to cooperative–metacognitive instruction were in a better position to enhance their writing performance than those who studied in cooperative settings without metacognitive interventions or received metacognitive instruction without cooperative learning. This difference implies that metacognitive instruction can cultivate cooperative learning settings. Even so, future research is needed to explore which types of metacognitive instruction are best suited to cooperative learning conditions.

6. Implications and limitations

This study's results offer theoretical and practical implications. First, learners were found to transfer their metacognitive regulatory skills to other writing situations. Transfer ability is an important skill to be taught in educational settings; learners need such skills when applying acquired knowledge to new learning settings. As proposed by the Gestalt theory of learning (Ikehara, 1999), learning should not simply be a mechanistic response to a stimulus; rather, learners need to grasp inherent learning systems and structures to be applied to new situations. In the context of teaching writing, students should strive to identify the underlying nature and structure of writing and use and transfer such skills to other writing tasks.

Second, learners may lack metacognitive knowledge; achievements in metacognitive knowledge were indeed a difficult dimension for EFL students in this study. Learners may need systematic metacognitive instruction to help them acquire such knowledge. For example, teachers should help learners identify declarative, procedural, and conditional knowledge involved in specific strategies as well as the strengths and weaknesses of certain strategies. In addition, students should adopt these skills to understand their personal learning characteristics (e.g., how they perform learning tasks and monitor and evaluate their learning).

Third, results revealed a positive effect of the cooperative–metacognition condition on participants' writing achievement and regulation of metacognition. During this type of instruction, the teacher may have gradually granted students autonomy to guide their own learning. The students may have also learned to assume responsibility in self-directing their learning (Fisher & Frey, 2008). In line with earlier studies (Nguyen & Gu, 2013), the gradual transfer of responsibility from teachers to learners is essential when teaching and learning EFL writing.

Finally, cooperative work and metacognitive instruction appeared complementary, leading to enhanced writing and metacognitive regulation. In this case, metacognitive prompts helped learners receive and synthesize peer feedback in cooperative learning settings. During a teaching session, instructors should guide learners to evaluate others and themselves by receiving and providing feedback.

Several limitations remained when interpreting the results. First, participants in this study were exclusively Chinese. Similar results may or may not emerge for learners in other contexts. Second, although metacognitive awareness and writing are correlated, metacognition is a complex process. Although more scholars are beginning to report on metacognitive instruction, the relationship between writing and metacognition requires ongoing research (Zinchuk, 2015). In addition, whether text structure knowledge can enhance metacognitive instruction remains underexplored (Teng, 2019c). Subsequent studies on applying text structure knowledge in metacognitive instruction

would therefore be worthwhile. Third, studies using other metacognition frameworks applied in EFL writing (e.g., Flavell's model) could be compared with the metacognitive instruction included in this study. Fourth, it is challenging to adapt a cooperative learning structure (e.g., circle chats) to large classes in the Chinese EFL context. Further studies on designing and evaluating appropriate activities for collaborative writing settings are needed. Fifth, the topic for the pre-and post-test was the same. The pre-test might have affected the writing in post-test. The delayed writing test was a different type of genre. The students might have experience writing an argumentative essay, which could contaminate the findings. Finally, research similar to this study should be conducted using a larger sample and extended to investigate the effects of different metacognitive instructional approaches. For example, a strategy evaluation matrix can be used and compared to measure the development of metacognitive knowledge (Schraw, 2009). In addition, tasks should be incorporated to assess participants' writing competence when assigning learners to groups. This method would help identify each learner's writing proficiency prior to the intervention and evaluate students' writing skills thereafter. Despite these limitations, this study provides insightful guidance for providing cooperative–metacognitive instruction to potentially enhance EFL students' writing and metacognitive awareness.

Disclosure statement

No potential conflict of interest was reported by the author.

Notes on contributor

Mark Feng Teng is a language teacher educator with extensive teaching experience in China. His research interests include metacognition and L2 writing, L2 vocabulary acquisition. His publications have appeared in *TESOL Quarterly, Language Teaching Research, CALL*, and *Applied Linguistics Review*, and other international flagship journals. His recent monographs were published by Springer, Bloomsbury, and Routledge.

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