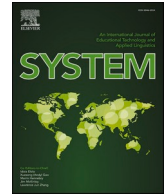




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# Relationships between teacher feedback and English writing proficiency in Chinese students: The mediating effect of writing self-regulated learning strategies

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## ABSTRACT

Teacher feedback and self-regulated learning (SRL) are crucial in English as a foreign language (EFL) writing and instruction. However, little work has explored how these two constructs jointly influence writing. This study aimed to examine the relationships between teacher feedback, students' use of writing SRL strategies, and English writing proficiency. Data were used from 691 EFL learners in five universities in mainland China. The results indicated that all types of teacher feedback did not significantly predict students' English writing proficiency but writing SRL strategies did. Besides, all types of teacher feedback significantly predicted writing SRL strategies. Writing SRL strategies mediated the relationships between four types of teacher feedback (i.e., verification feedback, directive feedback, scaffolding feedback, teacher praise) and English writing proficiency. After adding gender as a covariate, two SEM results yielded significant changes: teacher criticism did not predict writing SRL strategies; writing SRL strategies were not a mediator in the association between scaffolding feedback and English writing proficiency anymore. The findings not only empirically support the social cognitive model of self-regulated writing, but inform us of the importance of using SRL writing strategies in addition to providing varied types of feedback information to enhance students' English writing proficiency.

## 1. Introduction

Writing reflects overall linguistic competence that helps learners achieve academic and vocational goals. Despite the acknowledged importance of writing, challenges of writing are exacerbated when learners have to write in the EFL context (Cheng et al., 2021). Teacher feedback is a ubiquitous incentive to enhance second foreign language (L2) learners' writing output (Bitchener & Storch, 2016; Cheng et al., 2021; Cheng & Liu, 2022; Cheng & Zhang, 2021; Graham et al., 2018; Yang et al., 2022). L2 students speak highly of teacher feedback and believe it is trustworthy, professional, and experienced (Chen et al., 2016; Mahfoodh, 2017; Yang et al., 2006). Teacher feedback is defined as information about one's performance provided by a teacher, peer, or self about learners' performance or understanding (Hattie & Timperley, 2007). Teacher Feedback, if used appropriately, can help L2 student writers develop strategic

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competence to improve their writing proficiency (Gan & Ma, 2023; Hyland & Hyland, 2019; Lee et al., 2021). However, the effectiveness of teacher feedback for writing enhancement varies across its types. Some qualitative studies found that directive feedback was more beneficial for L2 students to revise their grammatical errors in their writing (De Jong & Kuiken, 2012; Shintani et al., 2014), while Kurzer (2018) employed a quasi-experimental study examining direct feedback from students from beginning, intermediate, and advanced writing programs, showing that indirect feedback was more advantageous to improving writing accuracy and developing their writing autonomy.

Owing to the dynamic and multifaceted nature of writing, successful completion of writing tasks requires students to use self-regulated learning (SRL) strategies (Oxford, 2013). For L2 learners, writing is a generative, goal-directed, recursive process that involves cognitive, behavioral, and affective dimensions (Bai & Wang, 2021; Flower & Hayes, 1981; Shen & Bai, 2024; Sun et al., 2023; Teng et al., 2022; Teng & Zhang, 2020; Yang & Zhang, 2023). SRL strategies play a critical role in writing because writing hinges on students' understanding, beliefs, and enactment of writing strategies like planning, monitoring, and evaluating (Hughes et al., 2019). Lack of awareness and limited use of writing strategies is the leading cause for Chinese students encountering barriers when learning to write (Teng & Huang, 2019). Writing SRL strategies mainly involve environmental, behavioral, and personal strategies (e.g., planning, monitoring, and evaluating) that students can apply to enhance their writing proficiency (Bai & Guo, 2021; Bai & Wang, 2021; Teng et al., 2022; Teng & Huang, 2019).

The relationship between teacher feedback, writing SRL strategies, and English writing proficiency is complex. As indicated by social cognitive theory, teacher feedback is the most crucial environmental factor that facilitates students' SRL behaviors (Guo et al., 2021; Pereira et al., 2016; Yang et al., 2023; Zheng et al., 2023). For instance, directive feedback is more effective than indirect feedback for high-proficiency L2 students to use planning strategies in further writing (Cheng & Liu, 2022; Vasu et al., 2022). Teacher praise helps L2 writers confirm the application of SRL strategies in the writing/revising process and motivates them to write (Yang & Zhang, 2023).

Recently, the learning-centered feedback paradigm underscores the need to value students' strategies in the feedback process aiding from feedback information (Winstone et al., 2022; Yang & Zhang, 2023). In other words, the effect of teacher feedback on learning is influenced by the mediation of behavioral variables (Bandura, 2011; Shute, 2008). However, investigating different types of teacher feedback and its effects on SRL strategies is an under-researched area (Guo et al., 2019; Guo & Wei, 2019; Zheng et al., 2023). Hence, there is a need to value feedback as essential information for improving learning, while also considering students' learning strategies in the feedback process (Carless, 2015; Winstone & Carless, 2019). In the writing context, it's reasonable to anticipate that students' use of writing SRL strategies mediate the effects of teacher feedback on their writing proficiency (Bai & Guo, 2021; Bai, Shen, & Mei, 2020; Guo, 2021). Therefore, this study aims to untangle the relationships between teacher feedback, students' use of SRL strategies, and their writing proficiency in a Chinese EFL context.

## 2. Literature review

### 2.1. Teacher feedback in L2 writing research

Writing can be seen as a product concerning the writer's interaction with the audience, text, context, and language (Hyland & Hyland, 2006), but it is also a generative, goal-directed, recursive process for L2 learners that involves cognitive, behavioral, and affective dimensions (Cheng et al., 2021; Cheng & Zhang, 2021; Flower & Hayes, 1981; Shen & Bai, 2024; Yang et al., 2023). In the past decade, a growing body of research has shown the influential power of teacher feedback in scaffolding L2/EFL writers' writing process and facilitating their written product (Cheng et al., 2021; Cheng & Zhang, 2021; Yang et al., 2023; Zhang, 2022). Teacher feedback refers to information about one's performance provided by a teacher, peer, or self about learners' performance or understanding (Hattie & Timperley, 2007).

Studies indicated that L2 teachers always act upon feedback to inform students of their writing problems and drawbacks in both local (language) and global (content and organization) aspects for writing improvement (Cheng & Zhang, 2021; Zhang, 2016). Cheng and Zhang's (2021) quasi-experimental study that involves text analysis manifested that EFL students with provided teacher feedback outperformed than non-feedback group in aspects of writing accuracy and fluency over time, along with the reduction of rule-based grammatical errors. Furthermore, EFL students speak highly of teacher feedback to help them acquire grammatical structures and improve English writing proficiency and believe it is trustworthy, professional, and experienced (Chen et al., 2016; Hyland & Hyland, 2019; Mahfoodh, 2017). Aside from providing constructive judgments for L2 writers' work, teacher feedback also intrigues students' reflection on the writing process and benefits students to develop their writing process by correcting errors in their work (Hyland and Hyland, 2019).

However, the existing literature also revealed there is unequal efficacy of different types of feedback in teaching and learning L2 writing from its scope (e.g., local feedback and global feedback), focus (selective feedback and comprehensive feedback), explicitness (directive and indirect feedback) (Cheng & Zhang, 2021; Lee, 2020; Shintani et al., 2014; Yang et al., 2023; Yang & Zhang, 2023). Thus, eliciting the power of feedback is related to feedback types, which may promote or worsen L2 writing. To explore how the different types of feedback information provided by teachers enhance EFL students' writing proficiency, this study draws on Guo's (2017) feedback model to investigate its practice in the EFL writing classroom.

Guo (2017) identified five types of teacher feedback in the classroom based on previous research on the functions of teacher feedback in students' learning: *verification feedback*, *directive feedback*, *scaffolding feedback*, *teacher praise*, and *teacher criticism*. *Verification feedback*, also called knowledge of results, refers to the simple dichotomous judgment of whether the initial instructional response/answer is correct or incorrect. *Directive feedback* informs students what needs to be fixed or revised, that is, telling students

the correct answers to their questions or problems. *Scaffolding feedback* refers to a variety of step-by-step cues, hints, models, or prompts, and partial solutions with the ultimate goal of assisting students in independently generating correct answers to the problems (Shute, 2008). *Teacher praise* refers to the teacher's positive responses to students' behaviors or their good work, expressing surprise, delight, and excitement, while *teacher criticism* is negative responses regarding students' behaviors and their performance, like disgust, disapproval, or rejection (Brophy, 1981).

Verification feedback draws students' attention to realize there are input-output gaps in their writing and align with teachers' intention on what needs to improve compared with the initial work, but it is less powerful than answer feedback (Ene & Estela, 2016; Marsh et al., 2012). Some studies held that directive feedback is more favorable for L2 students to revise their grammatical errors as self-editors and improve writing accuracy (Hyland & Hyland, 2019; Lee, 2017; Shintani et al., 2014). However, others argued indirect and direct feedback is equally effective in the short term with indirect feedback increasing students' cognitive engagement in guided learning and problem-solving and their writing autonomy by reflecting prior and partial internalized knowledge (Bitchener & Ferris, 2012; De Jong, & Kuiken, 2012; Kurzer, 2018). Noticeably, although EFL students always welcome and expect directive feedback, most of them simply copy the overt provided directive feedback without thinking and might repeat the same mistakes in their subsequent revisions (Hyland & Hyland, 2019; Lee, 2017).

Scaffolding is a prominent feature of L2 writing classrooms, assisting students in taking advantage of their writing process. As Lee (2017) claims, in the pre-writing stage, teachers' scaffolding helps students understand the writing goals and assessment criteria of the writing task. In this regard, Students can know whether their works are in accordance with successful criteria and what counts as "good" (Wilson & Czik, 2016; Wisniewski et al., 2020; Wu & Schunn, 2020; Yang & Weir, 1998; Zarrinabadi & Rahimi, 2022; Zhou et al., 2022). In the writing/revision stage, ongoing scaffolding in prior stages of writing encourages them to engage in the writing process and write multiple drafts, exhibiting more confidence and strong ability.

Writing quality refers to linguistic, syntactic, semantic, or rhetorical features related to the essay (writing product), the extent to which students incorporate revisions, and its overall holistic assessments of the quality of the written product (Biber et al., 2011, pp. i-99). A plethora of research acknowledges the important role of praise in facilitating L2 writing quality, writing development, and writing confidence, but in reality, most EFL teachers hardly use it and underestimate its value due to the Chinese culture effect and the disparity of individual beliefs (Choi, 2021; Selcuk et al., 2021; Zarrinabadi & Rahimi, 2022; Zhou et al., 2024). The review from Zhou et al. (2024) analyzed both providers' and receivers' perceptions and experiences of teacher praise in the L2 writing context. They suggest that teachers should increase the quality and quantity of praise, especially for low achievers, they need to give more motivational and sincere praise to promote their writing engagement (Özsoy-Güneş, Güneş, & Kırbaşlar, 2014). Regarding criticism, students frequently interpret it as an indication of failure and a personal attack, affecting students' use of teacher feedback and may cause defensiveness; consequently, it's recommended that L2 teachers balance quantity between criticisms and praise or provide criticism supplemented with suggestions to mitigate its fully negative force (Mahfoodh, 2017; Zhou et al., 2024).

Importantly, the conceptualization of feedback has shifted from a teacher-centered view to a learning-centered view over the past few years (Winstone & Carless, 2019). This perspective entails feedback as a process where students' agency and volition are emphasized (Winstone et al., 2022). Building on this line of thinking, there is a need to value feedback as information promoting L2 writing, while also considering students' motivation, behavior, and learning strategies in improving students' writing proficiency and regulating their writing process.

## 2.2. Writing SRL strategies

SRL of writing is defined as self-initiated thoughts, feelings, and actions that writers use to attain various literary goals and improve writing skills and the quality of the texts they create (Zimmerman & Risemberg, 1997). Writing is not simply producing a written product but also a recursive process that writers should be "self-planned, self-initiated, and self-sustained" (Zimmerman & Risemberg, 1997). On the other hand, three crucial processes of planning, translating and reviewing operate through a monitoring function that enables students' access to writing activities. Therefore, students must learn to employ varied strategies like planning, evaluating, and revising in learning how to write and regulate this process and arrange cognitive behaviors hierarchically (Flower & Hayes, 1981).

Drawing on this line of thinking, this study uses the social cognitive model of writing including environmental, behavioral, and personal (covert) processes (Zimmerman & Risemberg, 1997; Harris, 2023) as a SRL framework to explore the interconnection between SRL strategies and L2 writing. Specifically, Harris (2023) stated that environmental process refers to writers' self-regulation of the physical or social setting they write (i.e., closing windows or seeking social assistance). Behavioral processes involve the adaptive use of a motoric performance strategy (e.g., such as self-monitoring). Personal processes refer to writers' self-regulation of cognitive beliefs and affective status (e.g., planning). This model corresponds well with the currently widely-acknowledged understanding of the multifaceted nature of self-regulated learning, and it reflects that for L2 writers' writing is a sociocognitive activity impacted by cognitive, emotional, and behavioral factors (Bazerman, 2016).

Graham and Harris (2000) identified that 16 SRL strategies can be used for students to control environmental, behavioral, and personal influences (e.g., goal setting, planning, seeking information, revising, etc) for eventually controlling the writing process through analyzing empirical data of previous studies and anecdotal reports of experts. Planning strategies enable writers to know how a paper is structured and what needs to be highlighted; monitoring strategies assist writers in deciding when a paper is completed by monitoring the text's quality and quantity; the application of review records strategies contributes to helping writers control the development of ideas in the writing process (Graham & Harris, 1997). Bai and Wang (2021) found that self-regulated writers tend to use different strategies before/while/after writing. For instance, they plan and set goals before writing, monitor the progress and quality of the text while writing, and use revising strategies to edit their work

Some recent research generally approves that planning, monitoring, and evaluating are crucial aspects of improving Chinese EFL students' writing proficiency, enabling them to be more willing to self-reflect their writing and become independent writers ultimately (Bai & Wang, 2021; Teng & Zhang, 2022; Zhang & Qin, 2018). However, Teng and Huang's (2019) research considered goal-oriented monitoring and evaluation as the most influential strategies for positively predicting EFL students' English writing proficiency.

EFL students show a great intention towards seeking assistance strategy and always employ it for the completion of a challenging thesis (Mbato & Cendra, 2019). Adult writers invariably experience challenges in writing, so it's essential to foster their use of persistence strategies. Failing to do so might undermine students' success and retention in writing courses (Ruecker et al., 2017). Given that personal, behavioral, and environmental self-regulatory processes interact reciprocally during writing via an enactive feedback loop, this study will also explore the effect of teacher feedback on both writing SRL strategies and writing.

### 2.3. Relationships between teacher feedback, writing SRL strategies, and L2 writing

As indicated by social cognitive theory, SRL is seen as a reciprocal interaction influenced by personal, behavioral, and environmental factors within the learning environment, whereby feedback is an inherent catalyst for all SRL activities (Zimmerman, 2000, 2008). The interactions with teachers within a social context are an important environmental factor affecting students' use of SRL (Butler & Winne, 1995; Zimmerman, 2000, 2008). Students' use of environmental, behavioral, and personal strategies interacts reciprocally with an enactive feedback loop, where students monitor and respond to feedback about the successful use of SRL strategies (Graham & Harris, 1997).

Numerous studies suggested that teacher feedback is the most crucial environmental factor that facilitates students' SRL behaviors (Guo et al., 2021; Pereira et al., 2016; Yang et al., 2023; Zheng et al., 2023). It's noted that feedback types shape students' adoption and use of SRL strategies in the L2/EFL writing context. Verification feedback informs students whether or not their tasks are correct, on which L2 writers are likely to use self-evaluation or seek-assistance strategies to evaluate how well they have done in the writing tasks (Teng et al., 2022). Proponents hold that elaborated directive feedback demonstrates greater effectiveness than corrective feedback, as it explains why answers are correct and indicates how students improve their learning through suggestions in the first Language (L1) context (Hattie & Timperley, 2007; Wisniewski et al., 2020). Thus, directive feedback is more effective for L1 writers who generally have higher writing proficiency (Biber et al., 2011, pp. i-99).

Opponents argue that directive feedback practices in the L2 context are form-focused in that teachers provide corrective answers with a negative tone, undermining learners' motivation and students' use of organization strategies for L2 learners (Guo and Wei, 2019; Lipnevich & Smith, 2008). Cheng and Liu (2022) investigated how L2 high-proficiency students and low-proficiency students differ in engaging with teacher feedback by conducting interviews and collecting their teacher's written feedback, and students' multiple drafts. They found that directive feedback may lead to L2 high-achievers limited engagement for behavioral SRL strategies in their work tasks. Conversely, they benefit from indirect feedback, which increases their willingness to use planning strategies in subsequent writing tasks (Panadero et al., 2019).

Scaffolding is found to be the most powerful type of teacher feedback to make students learn effectively, which also facilitates EFL students are more likely to adopt SRL strategies, such as strategies for time management, goal setting, and self-evaluation (Guo et al., 2019; Zheng et al., 2023; Zhu, 2023). This is because scaffolding feedback is beneficial for students to engage in more advanced activities and more advanced thinking and problem-solving by requiring students to decode hints, cues, and prompts (Shute, 2008). Positive or negative emotions conveyed by praise and criticism can affect students' SRL (Shen et al., 2023). Teacher praise has a positive effect on EFL students' application of SRL strategies in the writing/revising process (e.g., organization strategies, meta-cognitive monitoring, and management) and motivates them to write in further writing (Guo & Wei, 2019; Yang & Zhang, 2023). Regarding teacher criticism, it did not exert an effect on SRL strategies in face-to-face classrooms, but it is seen as promoting students to manage time and tasks well and self-evaluate their learning in online classrooms (Guo & Wei, 2019; Zheng et al., 2023).

In addition, the effect of feedback on learning is influenced by the mediation of behavioral variables (e.g., SRL strategies) (Bandura, 2011; Shute, 2008). Feedback has been increasingly conceptualized as a learning-centered process which underscores the necessity to explore the role of students and how they use strategies to promote learning in the feedback process (Winstone & Carless, 2019). Yang et al. (2023) found that teacher feedback is favorable to developing EFL students' SRL writing strategies in metacognitive, cognitive, socio-behavioral, and motivational regulation aspects. Thus, it's expected that writing SRL strategies mediate the effect of teacher feedback on L2 writing proficiency since a repertoire of feedback information creates opportunities for EFL writers to proactively engage with SRL strategies to regulate the quality of their work.

### 2.4. Gender differences in writing and developing writing SRL strategies

Gender influences students' thinking, arguing, and reflecting (Tsemach & Zohar, 2021). Teachers tend to provide positive comments for females but negative comments for their male classmates regarding their achievement (Schwab et al., 2022). Females make more efforts to seek feedback and are more willing to uptake and use feedback in their revised writing (Wu & Schunn, 2020). There is no consensus reached as some scientific evidence has shown that gender influences students' writing performance usually favoring females (Cheong et al., 2022; Noroozi et al., 2022). Cheong et al. (2022) confirmed that females scored significantly higher regarding their writing performance due to their high superiority in vocabulary knowledge. Noroozi et al. (2022)'s experimental study found that females were significantly different from males in how they took a position on the topic, leading to females' outperformed achievement in writing augmentative essays. Furthermore, females' essays exhibit better-writing quality and higher fluency with fewer lexicon errors (Al-Saadi, 2020).

Gender differences are also permanent in students' self-regulated learning process (Stanikzai, 2019). Females tend to use more SRL strategies, specifically in planning, monitoring, and evaluating, which plays a crucial effect in predicting their writing proficiency (Teng & Huang, 2019; Teng et al., 2022). This result is in line with Bai, Shen, & Mei (2020) study, which reported that females have a far stronger tendency to plan, act on feedback, and use self-initiation strategies. Özsoy-Güneş, Güneş, & Kırbaşlar (2014) reported that female students were significantly more willing to plan and determine their learning goals, while male students were more skillful in self-direction strategies in the learning process. Tu's (2021) study showed that self-directed strategies involve fostering students' multiple competencies (e.g., academic competency, literacy competency, and self-directed strategies competency) that can benefit students' more advanced and complex writing, called creative writing (Santangelo & Graham, 2016). This refers to creating different types of genres for students with self-expressive ideas to perform their multiple competencies on the writing assignments. Thus, it's possible that females who prefer self-directed strategies are more likely to develop more holistic competency in the writing process and improve their writing proficiency. However, Sun and Wang's (2020) study found that gender differences failed to be supported regarding Chinese EFL university students' writing SRL strategies. Owing to the mixed findings of gender effect, there is a need to investigate the gender difference in the relationships between teacher feedback, writing SRL strategies, and English writing proficiency.

### 2.5. The current study

Based on the literature above, we addressed the following questions and tested the hypotheses.

**Research Question 1.** To what extent do different types of teacher feedback predict English writing proficiency?

**Hypotheses 1.** Verification feedback (H1.1), directive feedback (H1.2), scaffolding feedback (H1.3), teacher praise (H1.4), and teacher criticism (H1.5) predict English writing proficiency

**Research Question 2.** To what extent do writing SRL strategies predict English writing proficiency?

**Hypotheses 2.** Writing SRL strategies predict English writing proficiency.

**Research Question 3.** To what extent do writing SRL strategies mediate the relationships between different types of teacher feedback and English writing proficiency?

**Hypotheses 3.** Verification feedback (H3.1), directive feedback (H3.2), scaffolding feedback (H3.3), teacher praise (H3.4), and teacher criticism (H3.5) predict writing SRL strategies.

**Hypotheses 4.** Writing SRL strategies mediate the effects of verification feedback (H4.1), directive feedback (H4.2), scaffolding feedback (H4.3), teacher praise (H4.4), and teacher criticism (H4.5) on English writing proficiency.

## 3. Method

In addressing the research questions and test hypotheses, the cross-sectional questionnaires were used to explore the relationships between teacher feedback, writing SRL strategies, and English writing proficiency. With the rapid development of web communication, the online questionnaire is an increasingly attractive method in behavioral and social sciences, particularly in L2 research. This is because online questionnaire is easy to and control content and variables are cost-effective, versatile, and have good external validity, areand versatile, but it's less biased in interviewer effects (Couper & Miller, 2008). The purpose of our study is to generalize from sampled Chinese students to the Chinese population so that inferences can be obtained regarding their perceived teacher feedback, behaviors of using writing SRL strategies, and English writing proficiency.

### 3.1. Participants

Convenience sampling was used to recruit participants from five universities in Mainland China. Participants (N = 766) were all sophomores and seniors with non-English majors enrolled in the College English Course, which was only provided during the first two years in Mainland China. They were selected since undergraduates in years two and three were more likely to report their College English Test Band (CET4) scores. In most universities, students are allowed to participate in the CET4 only if they have finished either half or a full year of a College English Course. Furthermore, sophomore and senior students have had more recent and sufficient experience for perceiving teacher feedback and SRL in writing in the College English Course. Participants with outliers for any measure were removed (See 4.3 for details), resulting in a final sample including 691 participants.

The participants ranged in age from 18 to 23 years old ( $M = 19.58$ ,  $SD = 0.91$  years), of whom 294 (42.5%) were males and 397 (57.5%) were females. We try to collect data in a sample with even gender distribution because it is a well-rooted concern in statistical theory. However, collecting equally sized samples may cause practical challenges for researchers who use undergraduate students' samples since they are always provided with opportunities to self-select into particular research (Miller, 1981). Hence, it is not surprising that pools of undergraduate students' research are frequently overrepresented by women, freshmen, and psychology majors (Barlow & Cromer, 2006). Besides, gender, prior experience, and attitudes are also relevant to the types of studies in which females or males may frequently volunteer to participate. There are 480 (69.5%) sophomore students and 211 (30.5%) senior students, respectively.

### 3.2. Measures

#### 3.2.1. Teacher feedback questionnaire (TFQ)

To measure students' perceived teacher feedback of different types in the English writing classroom, we adapted the Chinese version of the TFQ (Guo, 2017) by embedding "English writing" in original items to frame the English writing-specific context. We used the TFQ by asking students about their teachers' feedback practices in the writing classroom because one focus of this study is to investigate the effect of teacher feedback information provided by teachers on L2 students' writing. The second reason is that The TFQ is the only available measure of teacher feedback that has been validated and widely used in China with good psychometric properties (Guo et al., 2019; Guo et al., 2021; Guo & Bai, 2019, 2022; Zheng et al., 2023).

Two items of the TFQ, i.e., "My teacher points out where I am right and wrong in my homework" and "My teacher directly tells us the correct answers to the test questions", were removed because they were inappropriate in our context that focuses on students' perceived teacher feedback in the English classroom rather than text or homework. Twenty-two Likert items were in the modified TFQ assessing verification feedback (4 items), directive feedback (4 items), scaffolding feedback (4 items), teacher praise (5 items), and teacher criticism (5 items). Response options range from 1 (never) to 6 (always), with higher values indicating a higher frequency of receiving feedback. The Cronbach's alpha of the TFQ subscales in this study ranged from 0.80 to 0.91 (see Table 2).

#### 3.2.2. Questionnaire of English writing SRL strategies (QEWSRLS)

The QEWSRLS was used to assess students' use of SRL strategies in English writing, which has previously been validated among undergraduates in mainland China ( $\alpha = 0.65$  to  $0.88$ ) (Wang & Sun, 2020). The QEWSRLS is a 26-item self-report measure, including three subscales of environmental SRL strategies (8 items), behavioral SRL strategies (8 items), and personal SRL strategies (10 items). Behavioral SRL strategies comprised seeking opportunities strategies, self-monitoring strategies, and self-consequences strategies; environmental SRL strategies included seeking assistance strategies, persistence strategies, and review of records strategies. Personal SRL strategies are composed of self-evaluation strategies, organization and transformation strategies, and goal-setting and planning strategies. Students rated each item ranging from 1 (never) to 6 (Always). The Cronbach's alpha values were 0.69 for environmental SRL strategies, 0.80 for behavioral SRL strategies, and 0.83 for personal SRL strategies (See Table 2).

### 3.3. English writing proficiency

Students' English writing proficiency was indicated by writing and translation scores with the full score of 213 (30% of the total) in College English Test Band 4 (CET4). The CET4 aimed to assess if non-English major students had achieved the English proficiency levels outlined in the national College English teaching syllabus (Higher Education Department of the Ministry of Education, 2007). CET-4 scores are summative, but students' use of teacher feedback and SRL strategies are formative in nature. We used CET-4 scores as an outcome variable indicating students' English writing proficiency for two reasons. Firstly, according to assessment theory, students' performance in summative assessments is influenced by their formative learning behaviors, including students' utilization of teacher feedback and SRL strategies. Secondly, CET-4, in nature, is a criterion-relevant and norm-referenced proficiency test without stipulated teaching contents or textbooks (Cai, 2007; National College English Testing Committee, 2016). CET4, on the one hand, assesses whether students have achieved the requirements of College English teaching guidelines (CMoE, 2020). On the other hand, it uses normed-referenced assessment so that candidates' scores are represented by their relative position compared to other candidates within the normative group. Thus, CET4 is the only available performance indicator of writing proficiency that is comparable across universities in China. Prior research confirmed its reliability and validity and recent research has shown its application to measure students' writing proficiency and achievement (Yang & Weir, 1998; Song & Chen, 2006; Sun & Wang, 2020; Sun et al., 2023).

CET-4, in its present form, comprises four sections: listening, reading, translating, and writing (National College English Testing Committee, 2016) but reports three sub-scores of listening, reading, translation, and writing, respectively. In the writing section, students are required to write a short essay of no less than 120 words within half an hour. In our sample, the average score of translation and writing was found to be  $M = 155.10$  ( $SD = 22.40$ ) out of a maximum possible score of 213, indicating that there is Chinese students' writing proficiency is moderate and still needs to improve.

### 3.4. Procedures

All consent forms were obtained prior to the administration of the questionnaire to the students, and they were informed that their

**Table 1**  
Confirmatory factor analyses of the TFQ and QWSRLS.

Model	$\chi^2$	df	CFI	TLI	RMSEA	SRMR
TFQ Model	803.176***	199	0.944	0.935	0.066	0.049
SRL Model 1	1948.642***	293	0.794	0.771	0.090	0.073
SRL Model 2	998.308***	167	0.845	0.824	0.085	0.052
SRL Model 3	664.433***	164	0.907	0.892	0.066	0.043

Note.  $N = 691$ ; CFI = comparative fit index; TLI = Tucker–Lewis index; RMSEA = root mean squared error of approximation; SRMR = standardized root mean squared residual. \* $p < 0.05$ . \*\* $p < 0.01$ . \*\*\* $p < 0.001$ .

**Table 2**  
Descriptive statistics and bivariate correlations of variables.

Variable	N	1	2	3	4	5	6	7	8	9	10
1. VF	4	(0.80)									
2. DF	4	0.73**	(0.86)								
3. SF	4	0.70**	0.72**	(0.90)							
4. TP	5	0.59**	0.59**	0.62**	(0.91)						
5. TC	5	0.09*	0.14**	0.10*	0.38**	(0.91)					
6. ES	5	0.39**	0.35**	0.38**	0.40**	0.09*	(0.69)				
7. BS	7	0.38**	0.30**	0.40**	0.42**	0.09*	0.73**	(0.80)			
8. PS	8	0.41**	0.32**	0.44**	0.39**	0.002	0.72**	0.77**	(0.83)		
9.WSRLS	-	0.43**	0.35**	0.45**	0.44**	0.06	0.87**	0.92**	0.93**	(0.91)	
10. EWP	-	0.08**	0.03	0.09*	0.08*	-0.02	0.10**	0.15**	0.20**	0.18**	
Mean	-	4.09	3.92	4.30	3.82	2.48	4.14	4.17	4.28	4.21	155.10
SD	-	1.04	1.14	1.05	1.14	1.10	0.72	0.73	0.75	0.67	22.40
Skewness	-	-0.37	-0.21	-0.54	-0.37	0.59	-0.14	-0.04	-0.22	-0.15	-0.44
Kurtosis	-	-0.34	-0.52	0.14	-0.37	-0.17	0.03	0.31	0.01	0.28	0.73

Note. VF = verification feedback; DF = directive feedback; SF = scaffolding feedback; TP = teacher praise; TC = teacher criticism; ES = environmental SRL strategies; BS = behavioral SRL strategies; PS = personal SRL strategies; WSRLS = writing SRL strategies; EWP = English writing proficiency \*p < 0.05. \*\*p < 0.01. Values shown in parentheses on the diagonal are internal consistency reliabilities of the scales (Cronbach’s alpha).

participation was voluntary and that they could withdraw anytime. They were informed that finishing the questionnaire by a Chinese survey website (<https://www.wjx.cn/>) may take around 8–10 min. They finish it in an English class under their English teachers’ supervision and can submit it online anytime. In the first section of the questionnaire, students provided their demographic information, including age, gender, grade, university, and translation and writing scores. In the second section, they reported their perceived teacher feedback in the English writing classroom and the use of English writing SRL strategies. All measures were administered in the student’s primary language of Mandarin. They can finish it using more time or less according to their realistic situation.

### 3.5. Data analysis

Data was screened for missing data and outliers with an R statistical computing environment (R Core Team, 2019; Rosseel, 2012). None of the participants’ responses were discarded since their item-level missing data remained below 5% (Tabachnick & Fidell, 2007). 75 outliers were identified using the Mahalanobis distance rule and excluded from the final analysis, resulting in a final sample (N = 691) for further computation. This dataset then was checked for normality following Kline’s (2015) guidelines. The skewness values varied from -0.54 to 0.59, and the range of kurtosis values was from -0.52 to 0.73 (see Table 2). Both skewness (between -3 and +3) and kurtosis (between -10 and +10) fell within acceptable ranges for SEM (Kline, 2015).

Firstly, we conducted confirmatory factor analysis (CFA) using the lavaan package (Rosseel, 2012) with maximum likelihood estimation to examine the factor structure of the TFQ and the QEWSRLS. If the CFA model fit is not satisfactory, modification indices (MI) were examined Vasu et al., 2022. Then, Descriptive statistics and correlations of the key variables were computed using SPSS 26.0 before analyzing mediation effects.

Third, we tested the hypothesized structural equation modeling (SEM). The model-data fit was evaluated by the following indices: Tucker-Lewis index (TLI) > 0.86, comparative fit index (CFI) > 0.90, root mean square error of approximation (RMSEA) < 0.06 to 0.08, and standardized root mean square residual (SRMR) < 0.08 (Hu & Bentler, 1999; Schreiber et al., 2006). The significance of the mediation effect of writing self-regulated learning was examined using a 95% Confidence Interval (CI) calculated from 5000 bootstrap samples. If the 95% CI of the indirect effect did not encompass 0, it suggests the mediation effect was statistically significant. We continued to test hypothesized structural equation modeling (SEM) using gender as a covariate to examine whether the effects hold after controlling this alternative explanatory variable.

## 4. Results

### 4.1. Confirmatory factor analysis (CFA)

Prior to testing mediating effects, we conducted two separate CFAs for the TFQ and QEWSRLS. Regarding teacher feedback, a five-factor model based on Guo’s (2017) model is posited. The results showed a satisfactory fit to the data:  $\chi^2(199) = 803.18$ , CFI = 0.944, TLI = 0.935, RMSEA = 0.066, SRMR = 0.049 (See Table 1). All the standardized factor loadings for the indicators on the latent variables were statistically significant ( $p \leq .001$ ). As for writing SRL strategies, initially, a three-factor model with three groups covaries (Model 1) based on Wang and Sun’s (2020) model specification was tested, in which all 26 items loaded across three types of SRL strategies (i.e., environmental SRL strategies, behavioral SRL strategies, and personal SRL strategies). The model fit indices of this three-factor CFA were poor:  $\chi^2(293) = 1948.642$ , CFI = 0.794, TLI = 0.711, RMSEA = 0.090, SRMR = 0.073 (see Table 1).

The poor model fit of Model 1 was possible because it failed to capture the multidimensional nature of writing SRL strategies simply by the traditional application of CFA, which was dependent on highly restrictive, independent cluster models in which all cross-

loadings are fixed at zero without considering the existence of higher-order factors or hierarchical structures. Recent advancements in measurement models advocated using hierarchical CFA (HCFA) to examine the complex multidimensional/hierarchical nature of a construct (Morin et al., 2016).

Due to the high covariance between environmental SRL strategies, behavioral SRL strategies, and personal SRL strategies ( $> 0.97$ ), consistent with Wang and Sun's (2020) results of CFA analysis, we proposed a higher-order factor structure of the QEWSRLS (Model 2). The analytical premise of Model 2 is that a single higher-order factor, writing SRL strategies, was empirically adequate to explain the associations of the three lower-order strategy types. Besides, previous studies also supported the validity of a higher model of SRL strategies due to the strong associations of different strategies (Teng & Huang, 2019; Zhou & Hiver, 2022).

Thus, we dropped each item in the sequence according to the values of error covariance indicated from the modification indices (MI) results of Model 1 to improve CFA fit. Eventually, we dropped three items for environmental SRL strategies (Item 1, Item 3, and Item 7), 1 item for behavioral SRL strategies (Item 4), and two items for personal SRL strategies (e.g., Item 3 and Item 9). The CFA result of this one-factor second-order model (Model 2) whereby the remaining 20 items showed a better fit than Model 1 but were still not good enough:  $\chi^2(167) = 998.308$ ; CFI = 0.845; TLI = 0.824; RMSEA = 0.085; SRMR = 0.052.

Based on the MI results of Model 2, we proposed Model 3, where three pairs of items within the same subfactor were covaried for error terms (see Fig. 2). Model 3 showed a significantly improved model fit than Model 2 [ $\chi^2_{diff}(3) = 333.87$ ,  $p < 0.001$ ]. Model 3 showed adequate fit to the data:  $\chi^2(164) = 664.433$ , CFI = 0.907, TLI = 0.892, RMSEA = 0.066, SRMR = 0.043 (see Table 1). All factor loadings in Model 3 were statistically significant ( $p < 0.001$ ) (see Fig. 2). Therefore, our results indicate the one-factor second-order model was appropriate to proceed to the subsequent SEM analysis (i.e., mediation model analysis).

#### 4.2. Descriptive statistics and correlations of variables

Table 2 presents the means, standard deviations, correlations, and internal consistencies for all the key variables. Following Kline's (2015) recommendation, the skewness and kurtosis values of all the variables were below the threshold, indicating that the responses were normally distributed. Hence, we used raw scores of all measures in the data analysis. The rank order showed that scaffolding feedback ( $M = 4.30$ ,  $SD = 1.05$ ), verification feedback ( $M = 4.09$ ,  $SD = 1.04$ ), and directive feedback ( $M = 3.92$ ,  $SD = 1.14$ ) were the most frequently used types of teacher feedback. As for writing SRL strategies, the students reported a relatively low level of Environmental SRL strategies ( $M = 3.94$ ,  $SD = 0.69$ ), but rated personal SRL strategies on a higher level ( $M = 4.26$ ,  $SD = 0.74$ ). They maintained a medium level of ( $M = 4.05$ ,  $SD = 0.71$ ) on behavioral SRL strategies.

The correlation analysis results showed that all types of students' perceived teacher feedback were positively associated with all writing SRL learning strategies (i.e., ES, BS, and PS) ( $0.16 \leq r \leq 0.44$ ,  $p < 0.01$ ). The correlations between the three types of students' perceived teacher feedback (i.e., verification feedback, scaffolding feedback, teacher praise) and writing SRL strategies were higher than those between directive feedback and writing SRL strategies. Yet, teacher criticism exhibited a relatively low positive correlation with writing SRL strategies. English writing proficiency only yielded weak and positive correlations with three types of students' perceived teacher feedback and writing SRL strategies. All subscales of TFQ and QWSRLS showed satisfactory internal consistencies ranging from 0.69 to 0.91.

#### 4.3. Structural equation model

**No covariate (Model a).** We first tested the hypothesized SEM model (Fig. 1) without any covariate (Model a). The fit indices of Model a were satisfactory:  $\chi^2(834) = 2306.385$ , CFI = 0.912, TLI = 0.905, RMSEA = 0.051, SRMR = 0.053. Furthermore, the variance of the two endogenous variables (as indicated by the r-square of latent endogenous variables), writing SRL strategies and English writing proficiency, are explained about 32.4% and 5.3% by Model a, accordingly. Table 3 presents the results for testing hypotheses. The standardized path coefficients that examined our proposed substantive hypotheses were also displayed in the SEM model (Fig. 3).<sup>1</sup>

**With covariate (Model b).** We then tested the robustness of our SEM results with gender as a covariate (Model b). The fit statistics remained acceptable:  $\chi^2(199) = 803.18$ , CFI = 0.911, TLI = 0.903, RMSEA = 0.050; SRMR = 0.053. Model b accounts for 34.7% of the variance of writing SRL strategies and 6% of the variance of English writing proficiency. Results of Model b found that gender was a significant covariate that significantly predicted writing SRL strategies ( $\beta = 0.16$ ;  $p < 0.01$ ) and English writing proficiency ( $\beta = 0.10$ ;  $p < 0.05$ ). These results revealed that females had higher writing SRL strategies and English writing proficiency. Table 3 presents whether each hypothesis was still accepted after the inclusion of gender as a covariate.

##### 4.3.1. Direct effects: H1.1 to H1.5

**No covariate (Model a).** The results presented that verification feedback ( $\beta = 0.14$ ;  $p = 0.34$ ), directive feedback ( $\beta = -0.20$ ,  $p = 0.10$ ), scaffolding feedback ( $\beta = 0.24$ ,  $p = 0.79$ ), teacher praise ( $\beta = 0.01$ ;  $p = 0.85$ ) and teacher criticism ( $\beta = -0.02$ ;  $p = 0.72$ ) did not predict English writing proficiency with H1.1 to H1.5 rejected.

**With covariate (Model b).** Verification feedback ( $\beta = 0.18$ ;  $p = 0.25$ ), directive feedback ( $\beta = -0.24$ ;  $p = 0.07$ ), scaffolding feedback ( $\beta = 0.02$ ;  $p = 0.82$ ), teacher praise ( $\beta = 0.03$ ;  $p = 0.66$ ), and teacher criticism ( $\beta = 0.001$ ;  $p = 0.98$ ) were still not significant

<sup>1</sup> Note. Fig. 3 shows the SEM results without covariate in the manner of graph. The path coefficients from VF to WSRLS (H3.1,  $\beta = 0.43$ ) and EWP (H1.1,  $\beta = 0.14$ ) can be displayed in Fig. 3. It's evident that the path from VF to WSRLS is thicker than the path from VF to EWP because the path from VF to WSRLS is significant ( $\beta = 0.43$ ,  $P < 0.01$  [95% C.I. = 0.010, 0.158]).

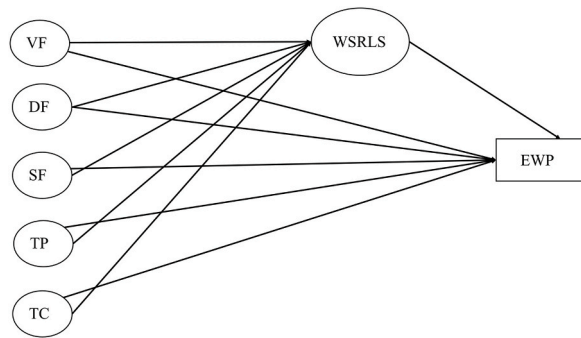


Fig. 1. Conceptual Model. Note. VF = verification feedback, DF = directive feedback, SF = scaffolding feedback, TP = teacher praise, TC = teacher criticism, WSRLS = writing self-regulated learning strategies, EWP = English writing proficiency.

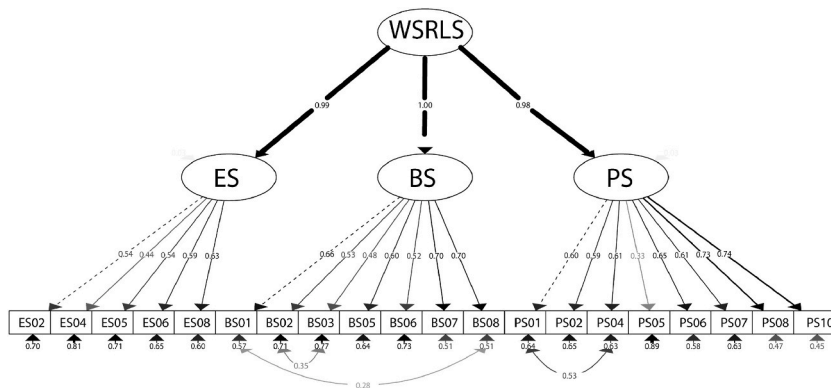


Fig. 2. One-factor second-order model of WSRLS. Note. ES = Environmental SRL strategies; BS = behavioral SRL strategies; PS = personal SRL strategies; EWP = English writing proficiency.

predictors of English writing proficiency, rejecting H1.1 to H1.5.

4.3.2. Direct effect: H2.1

**No covariate (Model a).** Results showed that writing SRL strategies was a significant positive predictor of English writing proficiency ( $\beta = 0.19$ ;  $p < 0.001$ ), suggesting that the greater students' use of writing SRL strategies, the higher their English writing proficiency; so H2.1 was supported.

**With covariate (Model b).** H2.1 was still supported that demonstrated writing SRL strategies ( $\beta = 0.17$ ;  $p < 0.01$ ) were still a significant and positive predictor of English writing proficiency.

4.3.3. Direct effects: H3.1 to H3.5

**No covariate (Model a).** We also found support for H3.1, H3.3, and 3.4 that verification feedback ( $\beta = 0.43$ ;  $p < 0.01$ ), scaffolding feedback ( $\beta = 0.23$ ,  $p < 0.01$ ), and teacher praise ( $\beta = 0.26$ ;  $p < 0.001$ ) had a significant positive direct effect on students' writing SRL strategies. However, directive feedback ( $\beta = -0.33$ ,  $p < 0.01$ ) and teacher criticism ( $\beta = -0.09$ ;  $p < 0.05$ ) negatively predicted writing SRL strategies in support of H3.2 and H3.5, suggesting that the more frequent directive feedback/teacher criticism students perceive, the lower their use of writing SRL strategies.

**With covariate (Model b).** H3.1, H3.2, H3.3, and H3.4 were still supported. Verification feedback ( $\beta = 0.48$ ;  $p < 0.01$ ), scaffolding feedback ( $\beta = 0.22$ ;  $p < 0.05$ ), teacher praise ( $\beta = 0.29$ ;  $p < 0.001$ ) significantly and positively predicted writing SRL strategies. Directive feedback ( $\beta = -0.38$ ;  $p < 0.01$ ) was still a significant negative predictor of writing SRL strategies. H3.5 failed to be accepted anymore, suggesting that teacher criticism was no longer a significant predictor of writing SRL strategies ( $\beta = -0.06$ ;  $p = 0.21$ ).

4.3.4. Indirect effects: H4.1 to H4.5

**No covariate (Model a).** H4.1 to H4.4 were supported. Specifically, writing SRL strategies fully mediated the positive effect of verification feedback on English writing proficiency ( $\beta = 0.08$ ,  $p < 0.05$  [95% C.I. = 0.010, 0.158]). However, writing SRL strategies fully mediated the negative relationship between directive feedback and English writing proficiency ( $\beta = -0.06$ ,  $p < 0.05$  [95% C.I. = -0.120, -0.008]).

Scaffolding feedback also had a significant indirect effect ( $\beta = 0.05$ ,  $p < 0.05$  [95% C.I. = 0.003, 0.008],) on English writing

**Table 3**  
Testing hypotheses.

	Model a			Model b		
		95%CI <sup>a</sup>			95%CI <sup>a</sup>	
		LL	UL		LL	UL
<b>Direct effects</b>						
H1.1: VF→EWP	0.144	-0.151	0.440	0.182	-0.128	0.492
H1.2: DF→EWP	-0.198	-0.436	0.040	-0.235	-0.448	-0.018
H1.3: SF→EWP	0.024	-0.154	0.202	0.021	-0.159	0.201
H1.4: TP→EWP	0.013	-0.129	0.156	0.032	-0.112	0.177
H1.5: TC→EWP	-0.018	-0.116	0.080	0.001	-0.098	0.099
H2: WSRLS→EWP	0.194***	0.087	0.300	0.173**	0.064	0.281
H3.1: VF→WSRLS	0.432**	0.128	0.735	0.479**	0.157	0.801
H3.2: DF→WSRLS	-0.331**	-0.569	-0.092	-0.381**	-0.636	-0.126
H3.3: SF→WSRLS	0.234**	0.061	0.407	0.219*	0.042	0.396
H3.4: TP→WSRLS	0.260***	0.125	0.396	0.285***	0.151	0.419
H3.5: TC→WSRLS	-0.094*	-0.185	-0.003	-0.059	-0.152	0.033
<b>Indirect effects</b>						
H4.1:VF→WSRLS→EWP	0.084*	0.010	0.057	0.083*	0.009	0.156
H4.2:DF→WSRLS→EWP	-0.064*	-0.120	-0.008	-0.066*	-0.123	-0.009
H4.3:SF→WSRLS→EWP	0.045**	0.003	0.088	0.038	-0.002	0.077
H4.4:TP→WSRLS→EWP	0.050**	0.013	0.088	0.049*	0.011	0.087
H4.5:TC→WSRLS→EWP	-0.018	-0.039	0.002	-0.010	-0.028	0.007
<b>Total effects</b>						
VF→EWP	0.228	-0.065	0.521	0.265	-0.041	0.570
DF→EWP	-0.262*	-0.496	-0.028	-0.301	-0.548	-0.054
SF→EWP	0.069	-0.112	0.251	0.059	-0.125	0.543
TP→EWP	0.064	-0.080	0.208	0.082	-0.064	0.227
TC→EWP	-0.036	-0.135	0.063	-0.010	-0.109	0.090
<b>Covariate</b>						
Gender → WSRLS	-	-	-	0.163**	0.085	0.241
Gender → EWP	-	-	-	0.095*	0.011	0.179
<b>R<sup>2</sup></b>						
WSRLS	32.4%			34.7%		
Writing	5.3%			6%		
<b>Fit indices</b>						
Chi-square	17,667.789			17,814.520		
df	903			946		
P-value	P < 0.001			P < 0.001		
CFI	0.912			0.911		
TLI	0.905			0.903		
RMSEA	0.051			0.050		
SRMR	0.053			0.053		

Note.VF = verification feedback; DF = directive feedback; SF = scaffolding feedback; TP = teacher praise; TC = teacher criticism; WSRLS = writing self-regulated learning strategies; EWP = English writing proficiency.

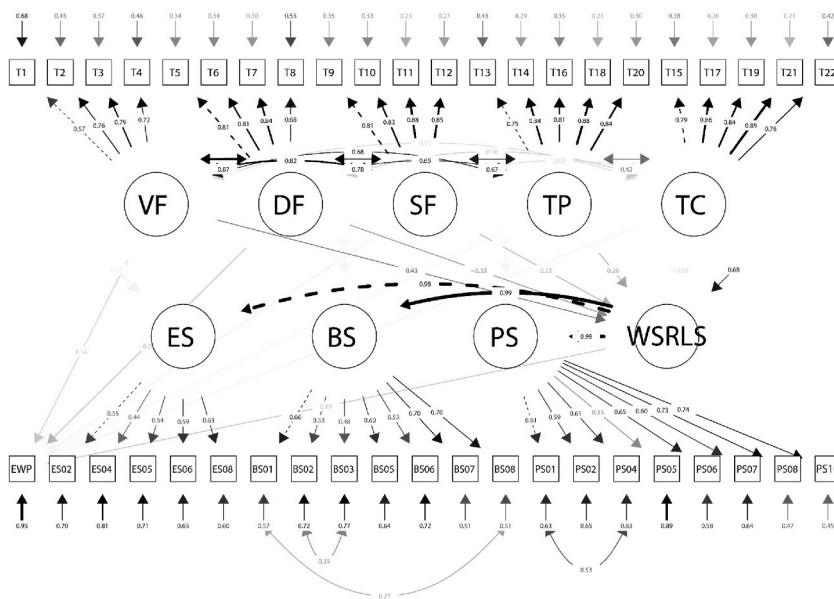
<sup>a</sup> 95% confidence interval (CI) with bootstrapping (5000 samples), standardized estimates. \*p < .05, \*\*p < .01, \*\*\*p < .001.

proficiency through writing SRL strategies. Moreover, writing SRL strategies also fully mediated the effect of teacher praise on English writing proficiency. Nevertheless, writing SRL strategies did not play a mediating role regarding the effect of teacher criticism on English writing proficiency ( $\beta = -0.02$ ,  $p = 0.83$  [95% C.I. =  $-0.039$ ,  $0.002$ ]).

**With covariate (Model b).** H4.1, H4.2, and H4.4 were still supported. Specifically, writing SRL strategies still fully mediated the positive effects of verification feedback ( $\beta = 0.08$ ,  $p < 0.05$  [95% C.I. =  $0.009$ ,  $0.156$ ]), teacher praise ( $\beta = 0.05$ ,  $p < 0.05$  [95% C.I. =  $0.011$ ,  $0.087$ ]), on English writing proficiency. A full mediation still held through writing SRL strategies in the negative link between the directive feedback and English writing proficiency ( $\beta = -0.01$ ,  $p = 0.25$  [95% C.I. =  $-0.123$ ,  $-0.009$ ]). However, writing SRL strategies were no longer a mediator in the link between scaffolding feedback and English writing proficiency ( $\beta = 0.04$ ,  $p = 0.06$  [95% C.I. =  $-0.002$ ,  $0.077$ ]). Writing SRL strategies still did not play a mediating role in the effect of teacher criticism on English writing proficiency ( $\beta = -0.01$ ,  $p = 0.25$  [95% C.I. =  $-0.028$ ,  $0.007$ ]).

## 5. Discussion

The purpose of this study was to explore the relationships between teacher feedback, writing SRL strategies, and English writing proficiency. We first tested a model to examine the direct and indirect effects of five types of students' perceived teacher feedback and writing SRL strategies on their English writing proficiency. Given that past studies indicated the potential gender differences in students' writing proficiency and their use of writing SRL strategies (Noororzi et al., 2022; Teng et al., 2022), we also examined whether the hypothesized model still holds constant when adding gender as a covariate. Here, we revisit our hypotheses and discuss the SEM results.



**Fig. 3.** SEM model of teacher feedback, writing SRL strategies, and English writing proficiency (Model a). Note. VF = verification feedback; DF = directive feedback; SF = scaffolding feedback; TP = teacher praise; TC = teacher criticism; ES = environmental SRL strategies; BS = behavioral SRL strategies; PS = personal SRL strategies; WSRLS = writing SRL strategies; EWP = English writing proficiency.

5.1. Teacher feedback and English writing proficiency

In our first research hypotheses, we speculated that five types of teacher feedback (i.e., verification feedback, directive feedback, scaffolding feedback, teacher praise, and teacher criticism) predict English writing proficiency, but we did not specify the positive or negative direction of the relationships because not all types of feedback equally enhance writing and SRL (Chou & Zou, 2020; Hattie & Timperley, 2007; Lipnevich & Smith, 2008; Shute, 2008). Consistent with Zhu’s (2023) study, our results also demonstrated that verification feedback, directive feedback, scaffolding feedback, teacher praise, and teacher criticism did not significantly predict English writing proficiency.

Although teacher feedback has been conceptualized as an important facilitator of improving students’ learning outcomes (Hattie, 2012; Shute, 2008), it’s not always true since some studies indicate that teacher feedback has either no effect or debilitating effects on learning (Yan, King, & Haw, 2021; Yan & Chiu, 2023). One of the viable explanations is that students did not make use of the received feedback or failed to take action.

Another speculation is that mass higher education squeezes the teacher-student interactions, so teachers sometimes feel uncertain or misunderstand which type of teacher feedback is the best for different stages of the writing process and L2 writers (Evans, 2013). In this sense, the expectations for feedback between teachers and students are not matched (Boud & Molloy, 2013), inhibiting students’ use of feedback information to regulate their writing process and improve their written product. Therefore, it’s of great importance that teachers should recognize no type of feedback is optimal for L2 writing improvement (Sinclair & Cleland, 2007; Biber et al., 2016; Butler & Winne, 1995; Chandler, 2003). To maximize the value of teacher feedback for different L2 writers, it’s suggested that teachers can provide directive feedback for low achievers in the beginning stage of writing, helping them set corrective writing goals and enhancing their willingness to use explicit feedback to make successful revisions. For high achievers, scaffolding feedback is more effective in creating an environment to self-regulate their writing process in their own space. Also, it increases students’ cognitive and behavioral engagement for this more complicated feedback information.

5.2. Writing SRL strategies and English writing proficiency

Our second hypothesis that writing SRL strategies predict English writing proficiency was supported, suggesting that the more frequently students use writing SRL strategies, the greater levels of their English writing proficiency. This finding is in support of the SRL model in writing and a cognitive model of writing (Zimmerman & Risemberg, 1997; Flower & Hayes, 1981), indicating that using SRL writing strategies is essential to help L2 students become self-planned, self-initiated, and self-sustained writers and yields a favorable effect on regulating their writing process. Our results also echo previous studies conducted with EFL students that demonstrated a positive effect of writing SRL strategies on English writing proficiency (Bai & Wang, 2021; Teng & Zhang, 2016, 2022; Zhang & Qin, 2018).

### 5.3. Teacher feedback, writing SRL strategies, and L2 writing

Our results provided support for the positive relationships between verification feedback, scaffolding feedback, teacher praise, and writing SRL strategies, suggesting that the more these types of feedback students perceived in the English writing classroom, the higher the frequency of their use of writing SRL strategies. This finding not only supports Nicol and Macfarlane-Dick's (2006) feedback and self-regulation model but also confirms the argument that teacher feedback is the inherent catalyst promoting students' use of SRL strategies (Chou & Zou, 2020; Guo et al., 2019; Yang et al., 2023; Zheng et al., 2023).

On the other hand, writing SRL strategies fully mediated the effects of four types of teacher feedback (e.g., verification feedback, directive feedback, scaffolding feedback, and teacher praise) and English writing proficiency. Nonetheless, only the indirect effect of directive feedback on English writing proficiency was negative. While other researchers (e.g., Teng & Zhang, 2016) have reported that SRL strategies promote writing for university students, our findings emphasized that writing SRL strategies is a crucial mediator in bridging the relationship between different types of teacher feedback and English writing proficiency, that is to say, students need to develop abilities to use SRL strategies in order to apply these affordances offered by these feedback information. This finding reflects the social cognitive theory that the effect of feedback on learning is mediated by behavioral factors (e.g. writing SRL strategies) (Bandura, 2011; Shute, 2008).

Verification feedback points out a discrepancy exists between the current and desired performance (Chou & Zou, 2020). This information motivates L2 students to self-evaluate their essays and seek assistance from teachers or peers to refine their writing it's possible for students to employ writing SRL strategies, such as organization or critical thinking, to know how to write correctly.

When students know the gap indicated by verification feedback (Shute, 2008), it's possible for students to employ writing SRL strategies, such as organization or critical thinking, to know how to write correctly.

Scaffolding feedback (e.g., prompts, cues, hints) is more likely to get students trapped in unsuccessful attempts and errorful learning. When facing this challenge, students are more likely to resort to writing SRL strategies (persistence strategies, seeking assistance strategies, and revising strategies) to improve their work. Scaffolding feedback is more complex than other simple feedback (Shute, 2008). In that case, L2 students tend to employ more strategies from the environmental, behavioral, and personal aspects (e.g., planning, reviewing, monitoring, goal-setting) in different phases of the writing process (Zimmerman, 2000) to decode hints, cues, and partial resolutions until their cognitive footing is formed. For example, teachers scaffold L2 students to use goal-setting strategies in the pre-writing stage, so students can establish a clear writing goal and understand writing criteria to regulate their cognitive behaviors in the writing process (Lee, 2017). In the revision stage, teachers scaffold students to use organization and transformation strategies to integrate multiple drafts or ideas to produce the highest-quality written product and gradually remove their help when L2 students develop more sophisticated cognitive systems.

Teacher praise is an affirmation of their current writing performance and expresses enjoyment, warmth, and approval for the self or their tasks. Such feedback enhances students' extrinsic motivation and self-esteem by conveying positive emotions (e.g., enjoyment) (Shen et al., 2023). Thus, students tend to respond to these compliments positively by using SRL strategies to evaluate and review their writing process and know what counts as good points in their writing for improving writing proficiency in subsequent writing (O'Malley & Chamot, 1990).

Partly consistent with Guo et al. (2019) findings, students who perceive directive feedback in the English writing classroom showed less use of writing SRL learning strategies, resulting in lower English writing proficiency (Chao, 1994; Chen & Flowerdew, 2018; Comings et al., 1999; Devolder et al., 2012; Ene & Kosobucki, 2016; Fisher & Frey, 2009; Gan & Ma, 2023; Graham et al., 2015). This finding suggests that although writing SRL strategies are beneficial, they may not be sufficient to overcome the total negative effect of directive feedback on English writing proficiency. It is possible directive feedback in Chinese writing classrooms is form-focused by providing corrective answers directly, undermining students' motivation and self-efficacy to use writing SRL strategies to control their writing process or self-correct errors in their written product (Guo & Wei, 2019; Lee, 2008, 2017).

Our study proved that teacher criticism led to a reduction in students' use of SRL strategies in EFL writing. This finding conflicts with Zheng et al. (2023) outcome showing that teacher criticism is seen as promoting students to manage time and tasks well and self-evaluate their learning in online classrooms (Zheng et al., 2023). This inconsistency may be due to the different learning environments. In face-to-face classrooms, teacher criticism makes students lose face in front of classmates causing further education problems but online criticism can avoid this embarrassing scenario and decrease students' uneasiness (Yin & Shi, 2022).

We infer that teacher criticism triggers negative emotions (e.g. anger or shame) and causes defensiveness since L2 writers see it as a failure of their writing or a personal attack on their competence (Mahfoodh, 2017; Zhou et al., 2024). Therefore, students are reluctant to employ students' use of SRL strategies and gain beneficial insights from negative comments to revise their work in subsequent writing. The above results support the claim that the types of feedback affect SRL differently in the flexible writing process from affective and behavioral aspects.

### 5.4. Gender effect in the relationships between teacher feedback, writing SRL strategies, and English writing proficiency

Gender differences were revealed in writing SRL strategies and writing proficiency. The findings align with recent studies that females outperform males in writing proficiency (Al-Saadi, 2020; Cheong et al., 2022; Noroozi et al., 2022). Besides, females reported using more self-regulated writing strategies (Teng & Zhang, 2022) because females are more likely to be organized and have good self-discipline and time management skills (Bidjerano, 2005). However, most results in Model 1a were still held and robust after the inclusion of gender as a covariate. That is, gender as a covariate did not yield a significant effect on these relationships.

Gender effects were significant in two associations. Firstly, teacher criticism was no longer a significant and negative predictor of

writing SRL strategies when gender acted as a covariate. The findings suggest that teacher criticism did not make an independent contribution to writing SRL strategies. Gender at least partially explains a significant proportion of variance of writing SRL strategies beyond what was accounted for by teacher criticism. Another possible cause is that females are more interpersonally sensitive to negative feedback than males, while males are less likely to be influenced, leading to their different responses to teacher criticism (Chen et al., 2018).

Secondly, writing SRL strategies no longer significantly mediated the effect of scaffolding feedback on English writing proficiency. Hence, gender at least partially contributed to a significant proportion variance of the mediated effect of writing SRL strategies in the association between scaffolding feedback and English writing proficiency. This may result from the personality differences between male and female students. Males are bold, aggressive, risk-taking, and assertive with higher estimates of their self-confidence, while females are cautious, emotionally sensitive, and withdrawn with more compliance (Weisberg et al., 2011). It's likely that males tend to prefer a bolder essay writing style, so they are more likely to use some SRL strategies to use scaffolding feedback that may result in unsuccessful attempts. Females are less willing to decode scaffolding feedback through applying SRL strategies because they try to avoid incorrect usage and worsen make writing performance.

Thus, it's important for L2 teachers to be aware of the gender variations in providing scaffolding feedback and teacher criticism. Teachers should try to ensure that males and females benefit from these two feedback practices by discussing their feedback preferences, experiences, and expectations. To avoid gender-based challenges that teacher criticism may cause, it's necessary to balance the quantity and quality of criticism to make male and female students feel respective. Given that using writing SRL strategies is an individual conscious regulation and control of cognitive activity females and males treat it differently. Thus, L2 teachers give special attention to finding specific problems in using SRL strategies for male and female students and conduct tailor-made interventions to make both groups use them effectively.

## 6. Implications and limitations

Our study revealed that teacher feedback did not exert an effect on students' writing proficiency. This finding echoes the learning-centered feedback paradigm that students play an active role in the feedback process by using strategies or adapting their behaviors, otherwise, feedback has little or no effect on improving learning (Carless & Boud, 2018; Little et al., 2023).

Secondly, SRL strategies are of great importance to enhancing students' writing proficiency, supporting the social cognitive model of self-regulated writing that writing is a cyclical process involved with "environmental processes, behavioral processes, and personal processes (Zimmerman & Risemberg, 1997). It conveys a fairly favorable message that L2 students must recognize the importance of SRL strategies for effective writing and learn to use environmental, behavioral, and personal SRL strategies like planning, and monitoring to regulate their writing processes and write well.

Thirdly, the mediator of SRL strategies played in the interplay between teacher feedback and English writing proficiency supports the SRL model and social cognitive theory (Butler & Winne, 1995; Zimmerman, 2008; Bandura, 2011), showing that feedback is a crucial catalyst of all SRL activities and the interaction with teachers in a social context facilitating students' use of writing SRL strategies from an environmental aspect. When processing feedback in different stages of writing, L2 writers can understand information on their performance, which directs students to develop a variety of SRL strategies to regulate their writing process and the quality of their written product (Yang et al., 2023). This finding also added valuable information in the L2 writing context, showing that L2 teachers not only need to provide feedback information for writing enhancement but also foster students' use of a repertoire of SRL strategies in the feedback process to enhance their writer proficiency.

However, the unequal effects of different types of teacher feedback on students' writing proficiency by their writing SRL strategies, reflecting there is no consensus for which feedback practice is the best to enhance writing and its effectiveness is related to feedback types (Hattie & Timperley, 2007; Shute, 2008). Therefore, teachers should consider the integration of different types of feedback to maximize the value of teacher feedback. Among them, scaffolding feedback is more powerful than others in promoting students' use of SRL strategies from our findings, requiring L2 teachers to pay attention to providing interactive and dialogic feedback activities so that students have opportunities to use varied SRL strategies after making sense of prompts, hints, and cues to improve their writing.

Despite these promising results, some limitations remain. First, our study was cross-sectional research in nature, which may not elaborate on the dynamics and the development of students' writing SRL strategies and English writing proficiency. Further researchers can use a longitudinal design to establish casual relationships. Additionally, our data was collected from self-reported measures. Future research can consider collecting data through other approaches, such as an experimental design, observation, interview, or stimulated recalls, to shed additional light on the effects of teacher feedback on both writing SRL strategies and English writing proficiency. A third limitation is associated with the generalizability of our results. Our study focused on Chinese university EFL students. Chinese Confucian-heritage culture places high value on standardized testing and emphasizes teacher authority and EFL students generally have lower writing proficiency (Guo & Xu, 2021). Therefore, we are not sure whether the same findings would emerge because of the different writing proficiency of L1 and L2 learners, the assessment system, and the teacher-student relationship. Future studies can test a similar model with learners in a diverse range of linguistic, cultural, and educational settings.

## 7. Conclusion

The present study is one of the few endeavors that concurrently explore teacher feedback, writing SRL strategies, and English writing proficiency in a single study to examine the mediating role of writing SRL strategies in Chinese EFL students. The results have shown that verification feedback, scaffolding feedback, and teacher praise are antecedents of students' use of writing SRL strategies,

which jointly improve students' English writing proficiency. Nevertheless, directive feedback leads to a reduction in students' use of writing SRL strategies, and both jointly decrease students' English writing proficiency. After adding gender as a covariate in our SEM model, teacher criticism no longer negatively predicted writing SRL strategies. Likewise, writing SRL strategies no longer played a mediating role in the relationship between scaffolding feedback and English writing proficiency. It implies that gender differences influence the effects of teacher criticism and scaffolding feedback on students' use of writing strategies and its mediation effect. This study attests to the varied effects of different types of teacher feedback, and the complex relationship between teacher feedback, writing SRL strategies, and English writing proficiency. To achieve the desired learning outcomes, teachers need to meticulously shape their feedback and consider the role of writing SRL strategies in the feedback process.

### CRedit authorship contribution statement

**Jinyu Zhu:** Methodology, Conceptualization, Data curation, Formal analysis, Investigation, Project administration, Writing – original draft. **Yongle Yang:** Investigation, Project administration, Resources, Writing – review & editing. **Zi Yan:** Conceptualization, Investigation, Methodology, Resources, Supervision, Writing – review & editing.

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