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A cross-linguistic approach to investigating metacognitive regulation in writing among Chinese EFL learners: Insights for its trait/state distinction

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Abstract

Metacognitive regulation refers to learners' ability to use a repertoire of metacognitive strategies to guide, observe, and manage thoughts, actions, and emotions in learning activities. It has been widely acknowledged as a significant predictor of language learning success, including writing. However, this line of research has been conducted in a single language context, and the interactions across L1 and L2 contexts have received insufficient scholarly attention. Situated in mainland China, we raise an innovative attempt to investigate metacognitive strategies in writing with a cross-linguistic approach, thus illuminating the conceptualization of metacognitive regulation by testing its trait/state distinction. A group of 502 university students from different disciplinary majors were recruited to report their metacognitive strategy use in L1 and L2 task-situated writing by filling in the assigned post-task questionnaires. Multigroup confirmatory factor analysis (MGCFA) on the two questionnaire datasets provided empirical evidence for the cross-language generalizability of metacognitive regulation in writing with the identified measurement invariance of the factor structure between L1 and L2 contexts, indicating its trait facet. How-

ever, the latent mean comparison results revealed that the actual usage frequency of metacognitive strategies scored significantly higher in L1 writing than in L2 writing, suggesting the state facet. These results are discussed extensively in this study to inform relevant theories and pedagogical activities.

KEYWORDS

L1 writing, L2 writing, metacognitive regulation, trait, state

摘要

元认知调控指学习者使用元认知策略的能力,可以引导、监测和调节学习过程中的思维、行为和情绪。元认知调控是预测语言学习(包括写作)成功的重要因素,但是已有的研究大多局限于单一语境,较少关注母语和二语之间的交互关系。采用跨语言的方法,本研究比较分析了来自中国大陆不同专业的大学生在完成一语和二语写作任务过程中元认知策略的使用情况,从而验证其特质/状态属性,进一步厘清元认知调控概念。502名来自不同专业的大学生在完成一语和二语写作任务后填写了元认知策略问卷。根据多群组验证性因子分析结果,元认知调控在一语和二语写作中的因子结构存在测量不变性,表明元认知调控的特质属性。然而,潜在均值差异结果显示,被试在一语写作中元认知策略的使用频率显著高于其在二语写作中元认知策略的使用频率,表明元认知调控的状态属性。本研究将深入讨论这些结果所带来的理论和教学启示。

关键词

一语写作,二语写作,元认知调控,特质,状态

1 | INTRODUCTION

Metacognition is the higher-order cognitive process that enables learners to address challenging learning tasks in a goal-oriented, adaptive, and efficient manner (Roebers, 2017). It closely intertwines with learning success in different domains, including writing. Being a problem-solving process, writing necessitates the processing of diverse types of knowledge coupled with higher-level metacognitive control over these processings in L1 (Hayes, 2012) as well as in L2 (Hyland, 2019) contexts. In L1 writing, student writers rely on metacognitive strategies to interpret the task requirements, devise and execute the plan, engage in online monitoring, and evaluate writing subprocesses and the quality of writing outcomes, ultimately leading to successful writing performance (Schoonen et al., 2011; Teng et al., 2022a). In L2 writing, metacognitive strategies assume an even more prominent role due to the additional challenges posed by cognitive, linguistic, and affective arenas (Hirvela et al., 2016). L2 writers are more compelled to regulate their restricted

linguistic knowledge and overcome heightened cognitive constraints when processing automatization is insufficient (Skehan, 1998).

Researchers have extensively identified, described, and classified the metacognitive aspects embodied in the acquisition of general language proficiency and specific language skills (Goh, 1997; Negretti, 2012; Zhang, 2001). Metacognitively competent writers are expected to use a wide range of strategies, that is, planning, organizing, monitoring, evaluating, editing, reflection, information managing, and debugging (Alfaifi, 2022; Sasaki, 2000; Teng et al., 2022a; Whalen & Ménard, 1995) to gain control over their writing processes and engage in thoughts, behaviors, and emotions that are conducive to writing improvement. A plethora of empirical evidence has supported that metacognitive regulation is an important individual difference factor that distinguishes high-achieving writers from low-achieving ones. For instance, Chien (2012) found that successful writers focused more on formulating their position on the topic and engaged more actively in rethinking and revising their composing texts than unsuccessful peers. Qin and Zhang (2019) revealed significantly positive associations between tertiary students' self-reported usage frequency of planning, monitoring, and evaluating strategies and their multimedia writing scores. It is safe to declare the importance of metacognition in writing. However, this field has flourished in parallel with unresolved conceptual ambiguities regarding its very nature since metacognition has been defined and operationalized differently even within a same field (Haukås, 2018; McCormick et al., 2013). It has been conceptualized as a transient and temporary state that diversifies in intensity as well as a stable and ongoing trait that exhibits continuity across times and situations (Sato, 2022). The lack of consensus on the nature of metacognition has caused confusion, which not only troubles researchers in their effort to define metacognition precisely but also creates difficulties for teachers to appropriately integrate related pedagogical instruction in writing classrooms and for students to adopt effective practices to enhance the capacity of metacognitive control. Given this background, examining the trait/state distinction is hoped to enhance our understanding of metacognition, which in turn informs metacognitive instruction and learning practices for writing.

In mainland China, university education places a relatively high demand on students' metacognitive competence and self-autonomy to achieve writing progress, as the learning environment is inherently directed and independent. Nonetheless, Chinese university students, in most cases, are passive recipients of linguistic knowledge, lacking metacognitive regulation to self-initiate, self-sustain, and self-regulate online processing in writing after years of examination-oriented and teacher-centered classroom instruction in their earlier schooling (Ruan, 2014; Teng et al., 2022a). These students frequently face challenges in planning, monitoring, and evaluating their writing processes and outcomes. Additionally, they may lack the self-awareness and motivational beliefs to persistently engage in metacognitive control (Hosseinpur & Kazemi, 2022; Yu & Jiang, 2021). The mismatch between university expectations and students' actual metacognitive abilities possibly hinders writing development. Scholarly efforts are needed to explore how well this group of students employs metacognitive strategies in writing, thus generating guidance for metacognitive support.

In response to the theoretical and practical needs, we examined and compared 502 Chinese EFL learners' employment of metacognitive strategies when accomplishing Chinese (L1) and English (L2) writing tasks in this study. Multigroup confirmatory factor analysis (MGCFA) allows for the assessment of measurement invariance to affirm the cross-language generalizability of metacognitive regulation among Chinese EFL undergraduate learners, thus justifying its trait facet. In addition, considering the contextual variations embedded in L1 and L2 writing, it is plausible to anticipate unequal levels of metacognitive regulation exhibited by students in the two writing contexts. For example, L2 writers engaged in a lower amount of overall planning due to linguistic constraints (Jones & Tetroe, 1987). They planned more often at within-sentence stages while less at pre-sentence stages (Chukharev-Hudilainen et al., 2019). Similarly, Guo and Huang (2020) found that formulating advanced plans and evaluating writing tasks and language use accounted for the largest proportion of strategy use in L1 writing while writers' attention and memory resources were predominantly occupied by first-order cognitive processing such as idea generation and thought organization in L2 writing. By testing latent mean differences, this study also seeks to offer illuminative insights into the disparities in utilizing metacognitive strategies between both writing contexts, increasing our knowledge of its state facet.

2 | LITERATURE REVIEW

2.1 | Metacognition

As coined by Flavell (1976), metacognition is "one's knowledge concerning one's own cognitive processes and products or anything related to them" (p. 232). Rooted in the field of cognitive and developmental psychology, this concept has been studied for decades with a consistent acknowledgement of its predictive role in learning success (Donker et al., 2014). Current conceptualizations of metacognition so far have agreed on three subsumed parts: metacognitive knowledge, regulation, and experiences (Brown, 1987; Flavell, 1979; Wenden, 1998). To elaborate, metacognitive knowledge, as the fundamental part of metacognition, involves knowledge or beliefs about the cognitive processors (i.e., person knowledge), the characteristics of learning tasks (i.e., task knowledge), and the effective strategies at learners' disposal to accomplish the desired learning goals (i.e., strategy knowledge). Metacognitive experiences contain cognitive awareness and affective feelings that accompany the execution procedure of any learning task. Metacognitive regulation, the focus of this study, encompasses a set of metacognitive strategies "through which learners manage, direct, regulate, guide their learning" (Wenden, 1998, p. 519). It plays a pivotal role in promoting learners' control over the language learning process. Without awareness and regulation of the language learning process, learners may face difficulties in making informed learning decisions, initiating and sustaining their thoughts and behaviors effectively, and controlling emotional reactions (Sinclair, 2000).

Writing is an important literacy skill for students to master to meet academic and vocational demands. Meanwhile, it is one of the most sophisticated components in language systems (Harris et al., 2019; Panahandeh & Esfandiari Asl 2014). Chinese students struggle to compose a high-quality text, especially when they write in a second or foreign language. This can be partly explained by the limited writing instruction and practice opportunities that they have received (Graham et al., 2013; Teng et al., 2022a). Even worse, traditional writing instruction is exam oriented and teacher centered, in which language-related knowledge such as vocabulary, syntactic rules, and discourse organization is over-emphasized. Consequently, Chinese students are more likely to find themselves exerting many efforts to memorize and recall different levels of linguistic knowledge passively rather than actively engaging in the act of writing (Graham & Harris, 2000). Writing is a recursive meaning-construction process involving purposeful and analytical regulation to produce an intended written product. Thus, it not only presses a need for linguistic processing but also for metacognitive control (McCormick, 2003). In this way, adding learning to regulate metacognitive orientation into the writing research agenda provides a new perspective to interpret and address the writing challenge among Chinese learners which moves beyond a narrow focus on linguistic level.

2.2 | Metacognitive strategies and writing

Metacognitive strategies encompass a variety of mental operations that enable writers to guide, oversee, and manage their cognitive, behavioral, and affective endeavors during the writing process. Researchers have explored these metacognitive strategies along with other language use strategies, as strategic competence to form a constituent component of language ability and as an integral dimension of self-regulation in writing (Hosseinpur & Kazemi 2022; Tadayon & Ravard 2016; Teng et al., 2022b; Zhao & Liao 2021). Adopting the language use strategy approach, Hosseinpur and Kazemi (2022) collected concurrent think-aloud reports from Iranian writers during their essay-writing processes. They found significant differences in the usage patterns between high- and low-scoring groups. High-scoring writers exhibited greater control over their writing process by finding focus (i.e., planning), checking and identifying problems (i.e., monitoring), and reconsidering written texts and writing goals (i.e., evaluating) more frequently than their low-performing counterparts. Following the strategic competence approach, Tadayon and Ravard (2016) empirically supported the importance of metacognitive strategies during the composing process of a graph-writing task. To complete the graph-writing task successfully, writers should assess the instruction, the graphs, and how well they

understand, set goals, and make plans for visual and non-visual encoding and reformulation recursively. With a self-regulation approach, Teng and associates (2022b) corroborated previous findings on writing metacognitive strategies. Their exploratory and confirmatory factor analysis results indicated that young learners relied on the employment of metacognitive strategies such as writing planning, goal-oriented monitoring, goal-oriented evaluation, and metacognitive judgment to achieve self-regulated writing. As discussed above, previous studies along with different theoretical approaches have consistently demonstrated the positive effects of metacognitive strategies on writing performance.

Despite the disparities in used terms, this line of research has agreed on three core types of writing metacognitive strategies, that is, planning, monitoring, and evaluating (Olson & Land, 2007; Qin & Zhang, 2019). Planning strategies allow learners to choose appropriate strategies and distribute cognitive resources before they perform a given task, which can be instantiated in making predictions, setting goals, and making plans to achieve the goals, sequencing the learning procedure, and allocating time and attention. Monitoring allows for online awareness and checking of comprehension and production performance to ensure the task completion is on track. Evaluating involves the self-appraisal of both the learning experience and outcome. Taking these diverse theoretical approaches together, writers' employment of these types of metacognitive strategies fosters active engagement, processing efficiency, higher-order thinking, and executive control, thereby improving their writing performance and facilitating their way to becoming independent and self-regulated writers (Anderson, 2005; Sato, 2022; Shimamura, 2000; Teng & Yue, 2023). However, these studies have mainly involved writing in foreign alphabetical languages like English, and not very few exceptions are in character languages such as Chinese. It is even harder to see the cross-linguistic perspective in this line of research.

2.3 | The trait/state distinction of metacognitive regulation

O'Malley and Chamot (1990) posited that metacognitive strategies were general by nature and displayed broad applicability and transferability across diverse learning tasks and domains. They advocated for perceiving metacognitive strategies as an individual trait irrespective of contextual settings. Veenman et al. (1997) empirically corroborated O'Malley and Chamot's statement by assessing and comparing 14 psychology freshmen' metacognitive skillfulness in learning across physics, statistics, and fictitious domains. They found that metacognitive skillfulness consistently contributed to novice learning outcomes regardless of learning domains and participants' intellectual abilities. In the same vein, Song et al. (2011) found strong associations between individual metacognitive abilities in contrast discrimination and orientation discrimination tasks, despite the significant variance in performance in the two tasks. Their results suggest a general mechanism underlying metacognitive skills that was detached from the first-order cognitive task. Leaner individuals with high trait metacognition are more likely to think about learning reflectively, execute strategies for learning actively, monitor the learning process ongoingly, and seek learning improvement continuously (Coutinho et al., 2005).

By contrast, some researchers recommend and provide empirical evidence for the state facet of metacognition. Kelemen et al. (2000) used four metacognitive tasks, namely ease of learning judgments, feeling of knowing judgments, judgments of learning, and text comprehension monitoring, to measure undergraduate students' metacognitive accuracy. Their results undermined the idea of a general metacognitive ability since the participants performed metacognitive skills inconsistently across the four tasks and even within the same task over a 1-week interval. Wang's (2015) study further supported the state facet of metacognition by observing distinctive employment patterns of metacognitive strategies in two problem-solving tasks. The use of metacognitive skills in one task did not guarantee the success of applying these skills in another one. Therefore, learner individuals are supposed to change their metacognitive strategic behavior dynamically to accommodate task-specific demands (Pieschl et al., 2012) when metacognition is conceived as a state.

The extent to which metacognitive strategies are identical across writing tasks in different languages also provides a window into the trait/state distinction of metacognitive regulation. There is an increasing interest in investigating the

relationship between metacognitive skills and writing performance, while not much research offers a cross-linguistic perspective into the trait and state facets of how metacognitive strategies are instigated and executed. Whalen and Ménard (1995) compared student writers' metacognitive processes in terms of planning, evaluation, and revision in L1 (English) and L2 (French) argumentative writing. Their results revealed that the three types of strategies were distributed parallelly in L1 and L2 writing, although the limited knowledge of L2 did prevent the use of these strategies from occurring at more global levels of discourse processing. Also, Guo and Huang (2020) observed a generally similar strategic behavior pattern in the type of metacognitive strategies among Chinese writers. However, as Zhang and Zhang (2013) posited, "metacognition should be treated as dynamic systems, and it should be construed as something embedded in language learners, which is intertwined with many modifiable variables, both cognitive and sociocultural" (p. 114). Student learners possibly transfer their metacognitive competence across writing in different languages (Xu & Zhu, 2024), while the actual use of metacognitive strategies is somewhat susceptible to contextual factors including the target language (Forbes & Fisher, 2020). However, this line of cross-linguistic investigations so far yielded no conclusive statements concerning the trait/state distinction of metacognitive abilities in writing, highlighting the need for more cross-linguistic comparison studies in this domain.

Rather than taking a single side, Reyes (2011) opts to conceive metacognition as a complex construct combining dual facets of trait and state. Metacognitive regulation can be an inherently stable trait for learner individuals to form the tendency to think and control cognitive endeavors, behaviors, and emotions spontaneously. Therefore, we expect to find a similar underlying mechanism of metacognitive regulation in support of the completion of L1 and L2 writing tasks. Meanwhile, it is initiated and executed differently in intensity as a state due to external stimuli. We hypothesize that students' strategy usage frequency varies between the two writing contexts. The limited number of comparative studies on L1 and L2 writing processes has so far relied on qualitative reports from a small sample of participants which only allow for descriptive statistics and correlation analysis. The structural equation modeling (SEM) technique used in this study offers a more efficient tool for hypothesis testing of whether metacognitive regulation comparably applies to L1 and L2 writing (i.e., the trait facet of metacognitive regulation) and whether the means of latent metacognitive strategy factors vary across both writing contexts (i.e., the state facet of metacognitive regulation) (Pae, 2018).

3 | PURPOSE OF THE STUDY

As previously stated, most strategy studies have been administered in either L1 or L2 and tend to largely neglect the potential interactions between the two contexts (Forbes, 2019). With a cross-linguistic comparison, this study examined and compared Chinese EFL student writers' metacognitive strategy use when completing L1 and L2 writing tasks, thus shedding light on the trait–state distinction of metacognitive regulation. The following two research questions guide this study:

1. Is metacognitive regulation applicable comparably to L1 and L2 writing among Chinese EFL students as an individual trait?
2. In what ways is metacognitive regulation executed differently by Chinese EFL students in L1 and L2 writing, indicating its state facet?

4 | METHOD

4.1 | Participants

This study included 502 Grade 2 college students from different disciplinary majors (129 boys and 373 girls). Their ages spanned from 18 to 22 ($M = 19.46$, $SD = 0.75$). These students were Chinese native speakers who had received

more than 10 years of English instruction at the time of data collection. Writing has constituted a vital section of Chinese and English classroom instruction of the participants. In this study, they were required to respond to the validated Metacognitive Strategy Questionnaire immediately after completing the assigned Chinese (L1) and English (L2) writing tasks. Questionnaire administration following the writing task completion allows for referencing to a particular writing context when the participants recalled and reported their metacognitive processes. We introduced the research purposes and procedure to all the participants and they signed the consent form before data collection to show voluntary participation.

4.2 | Instruments

The Writing Metacognitive Strategy Questionnaire was framed under sound theories concerning metacognition and language learning strategy and proved as a reliable and valid instrument to measure writers' metacognitive strategy use in both L1 and L2 contexts with empirical evidence in Xu's (2024) study. In her study, the multi-methods, including focus-group interviews, literature consultation, researcher judgment, teacher comments, and student feedback, were adopted to establish the construct validity of the initial item pool. Exploratory and confirmatory factor analyses (EFA and CFA) were performed on two questionnaire datasets from a group of 522 participants, which extracted and confirmed the five-factor correlated construct of metacognitive regulation with reasonable psychometric quality. In EFA, five common strategy factors were retained in both writing contexts according to the Kaiser criterion for eigenvalues exceeding 1 and the scree plots. These factors altogether explained 62.56% and 64.59% of the total variance of students' usage frequency of metacognitive strategies in L1 and L2 writing separately. In CFA, the five-factor correlated model fitted the datasets well according to the following indices: $\chi^2/df = 2.731$, RMSEA = 0.081, SRMR = 0.055, and CFI = 0.905 in L1 writing and $\chi^2/df = 2.455$, RMSEA = 0.074, SRMR = 0.054, and CFI = 0.910 in L2 writing. The theoretically and statistically valid questionnaire comprises 33 items eliciting self-reports of the actual usage of five subcategories of metacognitive strategies in both writing contexts: task interpreting (6 items), planning (7 items), linguistic monitoring (5 items), non-linguistic monitoring (6 items), and evaluating (9 items) strategies. The 6-point Likert scale with 1 indicating strong disagreement and 6 denoting strong agreement was used to detect changing patterns of L1 and L2 writing metacognitive strategy use. These items were raised in Chinese, the participants' L1, to avoid information loss and misunderstanding caused by linguistic constraints. There was no time limit for the questionnaire completion.

The participants in this study were required to complete two argumentative writing tasks. In the Chinese (L1) writing task, they should compose a written text of more than 600 words on the controversial topic of early education within a time limit of 45 min. In the English (L2) writing task, they were also provided with the same time to articulate their opinions about online and offline education in a written discourse, and the required length was more than 200 words. Topics and other requirements of the two writing tasks were designed in alignment with commonly used writing practices and assessments with their teachers' perspectives collected. The writing tasks and questionnaires were conducted in class via a computer-based format. To mitigate the impact of the task administration sequence, we adopted a counterbalanced design. Half of the participants first completed the Chinese writing task and the corresponding strategy questionnaire. They then accomplished the English writing task and its corresponding strategy questionnaire after a 1-week interval. The other half completed the writing tasks and questionnaires in a converse order.

4.3 | Data analysis

The two research questions were addressed via a SEM analysis technique. The SEM technique possesses a significant edge compared to traditional correlation and regression analysis methods (Bollen, 1989; Pae, 2018). It allows for the simultaneous examination of the structural relationship among a range of latent and observable factors when multiple

measurement errors are present. Moreover, the SEM technique offers a rigorous and robust method for measurement invariance and latent mean comparison tests via the use of multiple-group analysis, which holds the key to answering the two research questions in this study. The whole data analysis procedure was performed using AMOS software ver.24.

The MGCFA was used to examine whether metacognitive regulation was comparably applicable to L1 and L2 writing contexts. As recommended by Widaman and Reise (1997), whether or not the factorial structure underlying the measured construct of metacognitive regulation operates equivalently across both writing contexts was assessed in terms of a series of hierarchical steps of invariance testing: configural invariance with the factorial model restricted to be equivalent across the two language contexts, metric invariance with only factor loadings constrained equally, scalar invariance with an extra equality constraint on item intercepts, and residual invariance with the equality constraint also placed on item residuals. Among these invariance tests, metric and scalar invariances were the prerequisites for performing the latent mean difference test. The following criteria were adopted to evaluate the model fitness: the ratio of chi-square divided by the difference of freedom value (χ^2/df) ≤ 5, the root mean square error of approximation (RMSEA) ≤ 0.08, the standardized root mean residual (SRMR) ≤ 0.10, and the comparative goodness-of-fit index (CFI) ≥ 0.90 (Phakiti, 2018). We adopted the chi-square difference test ($\Delta\chi^2$) to examine whether the added equality constraint brings a detrimental model fit. To elaborate, a non-significant $\Delta\chi^2$ is suggestive of the equivalent model fit of the constraint model in comparison to the less constraint one. Worth noting is that the chi-square difference may be substantively biased as a result of the large sample size and the high model complexity. Since the sample size in this study exceeded 500, CFI, RMSEA, and RMR difference tests, independent of the sample size, were also used to assess model fit for measurement invariance, following Chen's (2007) recommendations. A lack of measurement invariance was detected if decreases in CFI ≥ 0.01, increases in RMSEA ≥ 0.015, increases in SRMR ≥ 0.03 for the metric invariance test, and SRMR ≥ 0.01 for scalar and residual invariance tests were found.

5 | RESULTS

5.1 | Descriptive statistics and correlation results

Descriptive statistics and correlation results of the 502 participants' responses for each questionnaire item were provided in the Supporting Information. On average, the participants in this study rated from 3.96 to 5.32 for Metacognitive Strategy Questionnaire items in L1 writing (SD ranging from 0.79 to 1.31) and from 3.86 to 5.07 for these items in L2 writing (SD ranging from 0.83 to 1.38), indicating a medium and upper level of usage frequency in the two writing contexts. The two questionnaire datasets met the normality assumption for inferential analysis with skewness and kurtosis statistics falling within the acceptable range of ± 1. The Cronbach's alpha coefficients for L1 and L2 writing Metacognitive Strategy Questionnaire datasets were 0.967 and 0.965, proving the high internal reliability in both writing contexts. Correlation analysis results demonstrated significant and positive associations between the pair of L1–L2 metacognitive strategies at the item level.

5.2 | The MGCFA results

Before performing MGCFA, a five-factor correlated model was tested separately for L1 and L2 writing questionnaire datasets. An examination of model fit indices demonstrated that this hypothesized model was well fitted in the datasets generated from the two language contexts (for L1 writing questionnaire dataset: $\chi^2/df = 3.193$, RMSEA = 0.066, SRMR = 0.053, CFI = 0.918; for L2 writing questionnaire dataset: $\chi^2/df = 2.791$, RMSEA = 0.060, SRMR = 0.052, CFI = 0.930). Figures 1 and 2 present the five-factor (i.e., task interpreting, planning, non-linguistic monitoring, linguistic monitoring, and evaluating strategy factors) correlated model with standardized estimates in the
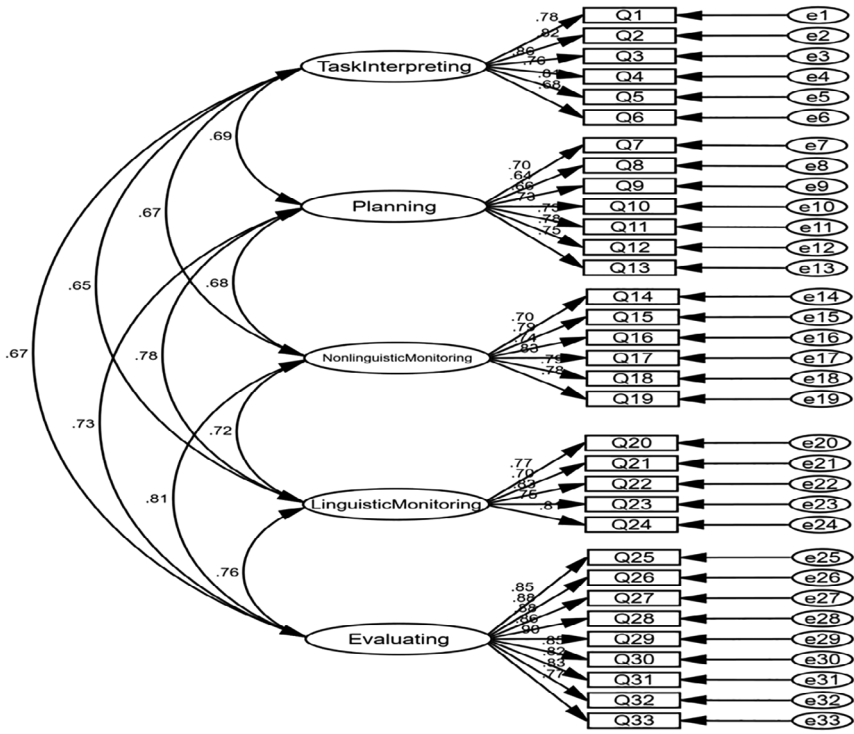
FIGURE 1 The five-factor correlated model of metacognitive strategies in L1 writing.
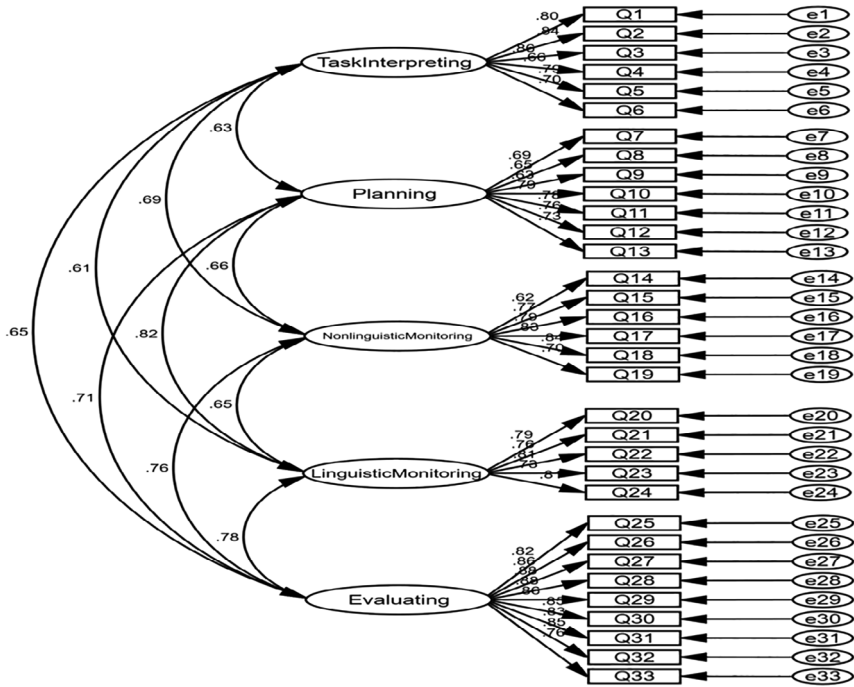

FIGURE 2 The five-factor correlated model of metacognitive strategies in L2 writing.

TABLE 1 Model fit indices on L1 and L2 writing Metacognitive Strategy Questionnaire datasets.

Model fit indices	χ^2 (df)	RMSEA	SRMR	CFI	$\Delta\chi^2$ (p)	ΔRMSEA	ΔSRMR	ΔCFI
Unconstrained	2902.11 (970)	0.045	0.053	0.924	–	–	–	–
Model 1: Metric	2931.87 (998)	0.044	0.054	0.924	29.76 (p = 0.375)	0.001	0.001	0.000
Model 2: Scalar	3077.02 (1031)	0.045	0.053	0.919	145.16 (p < 0.001)	0.001	0.001	0.005
Model 3: Residual	3288.91 (1064)	0.046	0.058	0.912	211.89 (p < 0.001)	0.001	0.005	0.007

two writing tasks. As displayed by the two figures, the item responses loaded well on the corresponding metacognitive strategy factors in both writing contexts with a value above 0.60.

Table 1 presents the MGCFA results to verify the trait facet of metacognitive regulation in L1 and L2 writing. The configural invariance was first tested with all parameters estimated freely within the same five-factor correlated model. The configural invariance was confirmed for the following fit indices of the configural model: $\chi^2/df = 2.992$, RMSEA = 0.045, SRMR = 0.053, CFI = 0.924. It suggests the factorial model with corresponding items operates equivalently across L1 and L2 writing contexts. Then, an equality constraint was imposed on all factor loadings to test the metric invariance. A non-significant chi-square difference ($\Delta\chi^2 = 29.753$, $p = 0.375$) was obtained, suggesting the metric invariance model remained identical to the configural invariance one across L1 and L2 writing. Also, the limited changes for RMSEA, SRMR, and CFI further confirmed the metric invariance (ΔRMSEA = 0.001, ΔSRMR = 0.001, and ΔCFI = 0.000). The identified metric invariance indicates that the items contribute to the corresponding latent strategy factors at a similar level across the two writing tasks. Then we tested the scalar invariance with additional equality constraints on item intercepts. Constraining item intercepts to be equal led to a significant chi-square difference ($\Delta\chi^2 = 145.159$, $p < 0.001$), indicating that the scalar invariance model differed significantly from the metric invariance one. However, as mentioned above, the chi-square difference test is vulnerable to the influence of sample size and model complexity. The changes for fit indices, that is, CFI, RMSEA, and SRMR, were used to examine the scalar invariance further. According to the following results: ΔRMSEA = 0.001, ΔSRMR = 0.001, ΔCFI = 0.005, the scalar invariance was also held in this study, thereby supporting that the participants interpreted strategy items equally when completing the two questionnaires for Chinese and English writing tasks. Finally, item residuals were also constrained to be equal, which again caused a significant chi-square difference ($\Delta\chi^2 = 211.89$, $p < 0.001$). However, the RMSEA, SRMR, and CFI changes were minimal (ΔRMSEA = 0.001, ΔSRMR = 0.005, and ΔCFI = 0.007), still supporting the residual invariance. Thus, the variance of item responses left unexplained by the latent strategy factors was similar across the two writing contexts. Taken together, these results supported the trait facet of metacognitive regulation, which works equally across L1 and L2 writing. All the standardized path coefficients (ranging from 0.684 to 0.896 for L1 writing, ranging from 0.615 to 0.882 for L2 writing) reached statistical significance at a $p < 0.001$ level.

5.3 | Latent mean difference test results

The identified metric and scalar invariance satisfied the prerequisite for performing the latent mean difference test to examine the state facet of metacognitive regulation in writing. When performing the latent mean difference test, one dataset is freely estimated while another dataset should be constrained equal to zero (Byrne, 2016). The choice of which dataset to be fixed at zero is made arbitrarily, which has no bearing on the final estimated mean values. In the present study, the latent means of the five metacognitive strategy factors in L1 writing were fixed to be zero,

TABLE 2 Parameter estimates for the means structure model—L2 writing.

Metacognitive strategies	Estimate	S.E.	C.R.	p
Task interpreting	−0.218	0.044	−0.4.947	***
Planning	−0.160	0.049	−3.297	***
Non-linguistic monitoring	−0.116	0.040	−2.915	0.004
Linguistic monitoring	−0.179	0.047	−3.776	***
Evaluating	−0.188	0.048	−3.896	***

***$p < 0.001$.

while those in L2 writing were freely estimated for the structured means model (χ^2/df = 2.972, RMSEA = 0.044, SRMR = 0.053, and CFI = 0.920). Given that the L1 writing dataset was chosen as the reference group within which strategy factor means were set to be zero, the reported values represent differences in participants' usage frequency of five metacognitive strategy factors between the two writing contexts. After examining latent mean difference test results (see Table 2), we can find that the participants, on average, have reported a significantly higher frequency of metacognitive strategies including task interpreting (Δmean = −0.218, $p < 0.001$, d = 1.039), planning (Δmean = −0.160, $p < 0.001$, d = 0.722), non-linguistic monitoring (Δmean = −0.116, $p < 0.01$, d = 0.58), linguistic monitoring (Δmean = −0.179, $p < 0.001$, d = 0.826), and evaluating (Δmean = −0.188, $p < 0.001$, d = 0.858) strategies in L1 writing than in L2 writing. These significant differences altogether suggest the state facet of metacognitive regulation between both writing tasks.

6 | DISCUSSION

Following Spielberger's (1983) state–trait distinction, the state is situation dependent and fluctuates in intensity, whereas the trait endures within individuals as an inherent disposition that consistently shapes one's patterns of reaction with predictable regularity. The state versus trait distinction has been examined in individual difference factors in the affective domain, such as trait and state anxiety. The present study extends such distinction to a cognitive domain of metacognitive regulation. It investigates metacognitive regulation cross-linguistically to inform its trait and state facets.

Earlier research has empirically supported the conceptualization of metacognition as a trait since it can be operationalized equally across learning tasks (Hong & O'Neil Jr, 2001; Meijer et al., 2013; O'Neil & Abedi, 1996; Veenman et al., 1997). Similar to these studies, the MGCFA results in this study affirmed the trait facet of metacognitive regulation that Chinese EFL students in both writing contexts had comparable metacognitive skills for use, which were characterized by five distinct but correlated strategy subcategories: task interpreting, planning, linguistic monitoring, non-linguistic monitoring, and evaluating. The observed measurement invariance indicated a certain degree of generality of metacognitive regulation across L1 and L2 writing tasks. It verified that metacognitive regulation supports writing consistently with the five correlated strategy factors, which is not tied to a specific language context. It, as a cognitive trait, re-engages students with the learning task in a similar active and analytical way. Individuals with well-developed metacognitive traits are more likely to exhibit consistent metacognitive engagement across various learning tasks. They are apt to take a metacognitive view of thoughts, feelings, and behaviors and act on this view to proactively observe, inhibit, and control their learning processes (Roebers, 2017).

There has been a shift in the conceptualization of metacognition with more attention paid to the less stable and more contextualized state aspect of metacognition (Sato, 2022). In this study, the latent mean difference test results suggested that the participants had greater use of the five types of metacognitive strategies in L1 task-situated writing than in L2 one, thus suggesting the state facet of metacognitive regulation. More specifically, the participants exerted more metacognitive regulation in L1 writing to build an understanding of the task requirements, formulate advanced

plans for subsequent composing, monitor linguistic and non-linguistic processing, and assess the produced texts and the writing experience, which was statistically significant. Regarding the state facet, student writers are less likely to display their metacognitive skills evenly across different writing tasks; instead, they will be more self-regulatory in one writing context but far less metacognitively committed in another.

The significant differences in strategy usage frequency are possibly explained by individual and contextual factors relevant to the two writing contexts. Standing in the position of Chinese EFL learners in this study, composing a quality English text is highly demanding (Hyland, 2019). Their English writing experience has long been examination oriented which leads to higher levels of aversive affect including anxiety, frustration, and apathy (Yu & Jiang, 2021). Students may be reluctant to perform metacognitive strategies during the L2 writing process because they do not enjoy doing so or do not feel their metacognitive effort would pay off. Meanwhile, writing in L2 itself features a more language-oriented and problem-solving-centered process with an extra cognitive load posed on formulating ideas, translating ideas into linguistic forms, retrieving and executing mental representation into actual written texts, adhering to conventional standards, and managing influential factors to meet the task requirements (Abdel Latif, 2021; Manchón et al., 2009; Wang & Wen, 2002). Metacognitive regulation and linguistic processing compete fiercely for cognitive resources during the real-time L2 writing process. As a result of inadequate language proficiency, linguistic processing involved in L2 writing is highly effortful and conscious. It presses a high demand for individual attention and memory resources while other types of processing such as metacognitive regulation are possibly inhibited (Schoonen et al., 2011). Therefore, the usage frequency of metacognitive strategies is lower in L2 task-situated writing. By contrast, linguistic encoding in the L1 text production process occurs automatically and below conscious awareness (Kormos, 2012), which allows for more metacognitive strategies.

7 | CONCLUSION

With a cross-linguistic comparison, the present study is conducted to advance our understanding of the trait and state facets of metacognitive regulation by collecting and analyzing metacognitive strategy use data from Chinese EFL learners when undertaking L1 and L2 writing tasks. Theoretically, a relatively full understanding of metacognition will emerge during the process of solving the puzzle concerning the trait/state distinction of this concept. MGCFA and latent mean comparison test results altogether validated Reyes' (2011) dual facets concerning metacognition. It is more profitable to characterize metacognitive regulation as a dynamic process that encompasses the stable trait facet embedded within learner individuals as well as the transient state facet fluctuating across learning tasks. More specifically, it is a stable trait invariantly supporting the writing process as well as a transient state confined to the specific language context in actual use. In addition to adding knowledge concerning the core of metacognition, we can also draw several pedagogical implications from the results. First, the trait facet of metacognitive regulation promotes collaborative instruction activities between L1 and L2 writing teachers to share and discuss students' metacognitive disposition to better know students' learning autonomy and their strengths and weaknesses. It offers valuable information for designing instruction activities well aligned with students' learning styles. Second, the occurrence of writing metacognitive strategies varies depending on the L1/L2 context. It highlights a careful examination of linguistic, educational, and sociocultural factors embedded in the two writing contexts to design appropriate external stimuli for evoking effective metacognitive strategy use. Also, Chinese student writers in this study utilized metacognitive strategies less frequently in L2 writing than in L1 writing. Given the positive effects of metacognitive strategy use on writing performance found in previous studies (e.g., Teng et al., 2022a), teachers should explicitly introduce and exemplify what metacognitive strategies can be used and how they influence writing performance, especially in L2 writing classroom instruction, to compensate for the linguistic adequacy and scaffold students' writing development. Metacognitive scaffolding tools such as the metacognitive process sheet, which breaks down the writing process into different stages and graphic schemas and leading questions concerning how, when, and where to perform metacognitive strategies, can also be used to aid students in internalizing the knowledge and applying these strategies

effectively in the actual writing. The trait–state distinction is not clear-cut in metacognition (Hong, 1995). Considering the malleability of metacognition, students possibly develop their metacognitive traits of being goal oriented, analytical, reflective, adaptive, and self-regulated through ongoing dedication and strategy training that increases state metacognitive engagement across domains.

However, we should acknowledge some limitations of this study. As a result of limited resources, this study only involves a group of college students from mainland China. Factors such as educational levels and cultural background possibly influence metacognitive regulation in writing. Generalizing these results to diverse populations beyond the participants in this study is possibly inappropriate without further research. Additionally, the cross-sectional design adopted in this study allows to capture writers' metacognitive control at a particular time point. Researchers are recommended to have a longitudinal investigation to examine the dynamic development of metacognitive regulation. Also, this study provided empirical evidence for the state facet of metacognitive regulation according to the discrepant usage frequency of metacognitive strategies between the two writing tasks. However, we did not take a further step to explore how and to which extent individual and contextual factors concerning writing in the two languages led to such discrepancy. Therefore, researchers are advised to take these influential factors seriously and better explain the nuances and complexity of metacognitive regulation in writing. Last but not the least, qualitative insights should be taken into account to fine tune the intrinsic features of metacognitive regulation, with particular reference to its trait and state facets.

AUTHOR CONTRIBUTIONS

Wandong Xu: Conceptualization; methodology; formal analysis; investigation; writing—original draft. **Xinhua Zhu**: Conceptualization; resources; supervision; writing—review and editing.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are made available on request from the corresponding author. The data are not publicly available due to privacy and ethical restrictions.

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REFERENCES

Abdel Latif, M. M. M. (2021). Remodeling writers' composing processes: Implications for writing assessment. *Assessing Writing*, *50*, 100547. https://doi.org/10.1016/j.asw.2021.100547

Alfaifi, M. J. (2022). A suggested model for metacognitive strategy instruction in EFL writing classrooms. *Reading & Writing Quarterly*, *38*(4), 323–339. https://doi.org/10.1080/10573569.2021.1954569

Anderson, N. J. (2005). L2 learning strategies. In E. Hinkel (Ed.), *Handbook of research in second language teaching and learning* (pp. 757–771). Lawrence Erlbaum Associates.

Bollen, K. A. (1989). *Structural equations with latent variables*. John Wiley & Sons.

Brown, A. (1987). Metacognition, executive control, self-regulation and other more mysterious mechanisms. In F. E. Weinert & R. H. Kluwe (Eds.), *Metacognition, motivation and understanding* (pp. 65–116). Lawrence Erlbaum Associate.

Brown, D. W., & Aull, L. L. (2017). Elaborated specificity versus emphatic generality: A corpus-based comparison of higher-and lower-scoring Advanced Placement exams in English. *Research in the Teaching of English*, *51*(4), 394–417. https://www.jstor.org/stable/44821273

Byrne, B. M. (2016). *Structural equation modelling with Amos: Basic concepts, applications, and programming* (3rd ed.). Routledge.

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, *14*(3), 464–504. https://doi.org/10.1080/10705510701301834

Chien, S. C. (2012). Students' use of writing strategies and their English writing achievements in Taiwan. *Asia Pacific Journal of Education*, *32*(1), 93–112. https://doi.org/10.1080/02188791.2012.655240

Chukharev-Hudilainen, E., Saricaoglu, A., Torrance, M., & Feng, H. H. (2019). Combined deployable keystroke logging and eye tracking for investigating L2 writing fluency. *Studies in Second Language Acquisition*, *41*, 583–604. https://doi.org/10.1017/S027226311900007X

Coutinho, S., Wiemer-Hastings, K., Skowronski, J. J., & Britt, M. A. (2005). Metacognition, need for cognition and use of explanations during ongoing learning and problem solving. *Learning and Individual Differences*, *15*(4), 321–337. https://doi.org/10.1016/j.lindif.2005.06.001

Donker, A., de Boer, H., Kostons, D., van Ewijk, C. D., & van der Werf, M. (2014). Effectiveness of learning strategy instruction on academic performance: A meta-analysis. *Educational Research Review*, *11*, 1–26. https://doi.org/10.1016/j.edurev.2013.11.002

Flavell, J. H. (1976). Metacognitive aspects of problem solving. In L. Resnick (Ed.), *The nature of intelligence* (pp. 231–235). Lawrence Erlbaum Associate.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive-developmental inquiry. *American Psychologist*, *34*(10), 906–911. https://doi.org/10.1037/0003-066X.34.10.906

Forbes, K. (2019). The role of individual differences in the development and transfer of writing strategies between foreign and first language classrooms. *Research Papers in Education*, *34*(4), 445–464. https://doi.org/10.1080/02671522.2018.1452963

Forbes, K., & Fisher, L. (2020). Strategy development and cross-linguistic transfer in foreign and first language writing. *Applied Linguistics Review*, *11*(2), 311–339. https://doi.org/10.1515/applirev-2018-0008

Goh, C. (1997). Metacognitive awareness and second language listeners. *ELT Journal*, *51*(4), 361–369. https://doi.org/10.1093/elt/51.4.361

Graham, S., & Harris, K. R. (2000). The role of self-regulation and transcription skills in writing and writing development. *Educational Psychologist*, *35*, 3–12. https://doi.org/10.1207/S15326985EP3501_2

Graham, S., Gillespie, A., & Mckeown, D. (2013). Writing: Importance, development, and instruction. *Reading and Writing*, *26*, 1–15. https://doi.org/10.1007/s11145-012-9395-2

Guo, X., & Huang, L. S. (2020). Are L1 and L2 strategies transferable? An exploration of the L1 and L2 writing strategies of Chinese graduate students. *The Language Learning Journal*, *48*(6), 715–737. https://doi.org/10.1080/09571736.2018.1435710

Harris, K. R., Ray, A., Graham, S., & Houston, J. (2019). Answering the challenge: SRSD instruction for close reading of text to write to persuade with 4th and 5th Grade students experiencing writing difficulties. *Reading and Writing*, *32*, 1459–1482. https://doi.org/10.1007/s11145-018-9910-1

Haukås, Å. (2018). Metacognition in language learning and teaching: An overview. In Å. Haukås, C. Bjørke, & M. Dypedahl (Eds.), *Metacognition in language learning and teaching* (pp. 11–30). Routledge.

Hayes, J. R. (2012). Modeling and remodeling writing. *Written Communication*, *29*, 369–388. https://doi.org/10.1177/0741088312451260

Hirvela, A., Hyland, K., & Manchón, R. M. (2016). Dimensions of L2 writing theory and research: Learning to write and writing to learn. In R. M. Manchón & P. K. Matsuda (Eds.), *Handbook of second and foreign language writing* (pp. 45–63). Walter de Gruyter GmbH & Co KG.

Hong, E. (1995). A structural comparison between state and trait self-regulation models. *Applied Cognitive Psychology*, *9*(4), 333–349. https://doi.org/10.1002/acp.2350090406

Hong, E., & O'Neil Jr, H. F. (2001). Construct validation of a trait self-regulation model. *International Journal of Psychology*, *36*(3), 186–194. https://doi.org/10.1080/00207590042000146

Hosseinpur, R. M., & Kazemi, Z. (2022). Composing strategies employed by high-and low-performing Iranian EFL students in essay writing classes. *Assessing Writing*, *51*, 100601. https://doi.org/10.1016/j.asw.2021.100601

Hyland, K. (2019). *Second language writing* (2rd ed.). Cambridge University Press.

Jones, S., & Tetroes, J. (1987). Composing in a second language. In A. Matsuhashi (Ed.), *Writing in real time: Modelling production processes* (pp. 34–57). Ablex.

Kelemen, W. L., Frost, P. J., & Weaver, C. A. (2000). Individual differences in metacognition: Evidence against a general metacognitive ability. *Memory & Cognition*, *28*(1), 92–107. https://doi.org/10.3758/bf03211579

Kormos, J. (2012). The role of individual differences in L2 writing. *Journal of Second Language Writing*, *21*(4), 390–403. https://doi.org/10.1016/j.jslw.2012.09.003

Lee, I., & Mak, P. (2018). Metacognition and metacognitive instruction in second language writing classrooms. *TESOL Quarterly*, *52*(4), 1085–1097. https://doi.org/10.1002/tesq.436

Manchón, R. M., de Larios, J. R., & Murphy, L. (2007). A review of writing strategies: Focus on conceptualizations and impact of first language. In A. D. Cohen & E. Macaro (Eds.), *Language learner Strategies: 30 years of research and practice* (pp. 229–250). OUP.

Manchón, R., Roca de Larios, J., & Murphy, L. (2009). The temporal dimension and problem-solving nature of foreign language composing processes: Implications for theory. In R. Manchón (Ed.), *Writing in foreign language contexts: Learning, teaching, and research* (pp. 77–101). Multilingual Matters.

McCormick, C. B., Dimmitt, C., & Sullivan, F. R. (2013). Metacognition, learning, and instruction. In I. B. Weiner, W. M. Reynolds & G. E. Miller (Eds.), *Handbook of psychology: Educational psychology (2nd edition)* (pp. 69–97). John Wiley & Sons.

Meijer, J., Sleegers, P., Elshout-Mohr, M., van Daalen-Kapteijns, M., Meeus, W., & Tempelaar, D. (2013). The development of a questionnaire on metacognition for students in higher education. *Educational Research*, *55*(1), 31–52. https://doi.org/10.1080/00131881.2013.767024

Negretti, R. (2012). Metacognition in student academic writing: A longitudinal study of metacognitive awareness and its relation to task perception, self-regulation, and evaluation of performance. *Written Communication*, *29*(2), 142–179. https://doi.org/10.1177/0741088312438529

O'Neil, H. F., & Abedi, J. (1996). Reliability and validity of a state metacognitive inventory: Potential for alternative assessment. *Journal of Educational Research*, *89*(4), 234–245. https://www.jstor.org/stable/27542038

Olson, C. B., & Land, R. (2007). A cognitive strategies approach to reading and writing instruction for English language learners in secondary school. *Research in the Teaching of English*, *41*(3), 269–303. https://www.jstor.org/stable/40171732

O'Malley, J. M., & Chamot, A. U. (1990). *Learning strategies in second language acquisition*. Cambridge University Press.

Pae, T. (2018). Effects of task type and L2 proficiency on the relationship between L1 and L2 in reading and writing. *Studies in Second Language Acquisition*, *40*, 63–90. https://doi.org/10.1017/S0272263116000462

Panahandeh, E., & Esfandiari Asl, S. (2014). The effect of planning and monitoring as metacognitive strategies on Iranian EFL learners' argumentative writing accuracy. *Procedia-Social and Behavioral Sciences*, *98*, 1409–1416. https://doi.org/10.1016/j.sbspro.2014.03.559

Phakiti, A. (2018). Confirmatory factor analysis and structural equation modelling. In A. Phakiti, P. De Costa, L. Plonsky, & S. Starfield (Eds.), *The Palgrave handbook of applied linguistics research methodology* (pp. 459–500). The Palgrave Macmillan.

Pieschl, S., Stahl, E., Murray, T., & Bromme, R. (2012). Is adaptation to task complexity really beneficial for performance? *Learning and Instruction*, *22*(4), 281–289. https://doi.org/10.1016/j.learninstruc.2011.08.005

Qin, L., & Zhang, L. J. (2019). English as a foreign language writers' metacognitive strategy knowledge of writing and their writing performance in multimedia environments. *Journal of Writing Research*, *11*(2), 393–413. https://doi.org/10.17239/jowr-2019.11.02.06

Reyes, M. L. (2011). Domain specificity of motivation and learning strategies: Filipino science high school students' profiles in science and social studies. *Asia-Pacific Education Researcher*, *20*(2), 308–321.

Roebers, C. M. (2017). Executive function and metacognition: Towards a unifying framework of cognitive self-regulation. *Developmental Review*, *45*, 31–51. https://doi.org/10.1016/j.dr.2017.04.001

Ruan, Z. (2014). Metacognitive awareness of EFL student writers in a Chinese ELT context. *Language Awareness*, *23*(1–2), 76–91. https://doi.org/10.1080/09658416.2013.863901

Sasaki, M. (2000). Toward an empirical model of EFL writing processes: An exploratory study. *Journal of Second Language Writing*, *9*(3), 259–291. https://doi.org/10.1016/S1060-3743(00)00028-X

Sato, M. (2022). Metacognition. In S. Li, P. Hiver, & M. Papi (Eds.), *The Routledge handbook of second language acquisition and individual differences* (pp. 95–110). Routledge.

Schoonen, R., van Gelderen, A., Stoel, R. D., Hulstijn, J., & de Glopper, K. (2011). Modelling the development of L1 and EFL writing proficiency of secondary school students. *Language Learning*, *61*(1), 31–79. https://doi.org/10.1111/j.1467-9922.2010.00590.x

Shimamura, A. P. (2000). Toward a cognitive neuroscience of metacognition. *Consciousness and Cognition*, *9*(2), 313–323. https://doi.org/10.1006/ccog.2000.0450

Sinclair, B. (2000). Learner autonomy: The next phase? In B. Sinclair, I. McGrath, & T. Lamb (Eds.), *Learner autonomy, teacher autonomy: Future directions* (pp. 4–14). Longman.

Skehan, P. (1998). *A cognitive approach to language learning*. Oxford University Press.

Song, C., Kanai, R., Fleming, S. M., Weil, R. S., Schwarzkopf, D. S., & Rees, G. (2011). Relating inter-individual differences in metacognitive performance on different perceptual tasks. *Consciousness and Cognition*, *20*(4), 1787–1792. https://doi.org/10.1016/j.concog.2010.12.011

Spielberger, C. D. (1983). *Manual for the state-trait anxiety inventory*. Consulting Psychologists Press.

Tadayon, F., & Ravand, H. (2016). Using grounded theory to validate Bachman and Palmer's (1996) strategic competence in EFL graph-writing. *Language Testing in Asia*, *6*(8), 1–29. https://doi.org/10.1186/s40468-016-0031-y

Teng, M. F., & Huang, J. (2019). Predictive effects of writing strategies for self-regulated learning on secondary school learners' EFL writing proficiency. *TESOL Quarterly*, *53*, 232–247. https://doi.org/10.1002/tesq.462

Teng, M. F., & Yue, M. (2023). Metacognitive writing strategies, critical thinking skills, and academic writing performance: A structural equation modeling approach. *Metacognition and Learning*, *18*(1), 237–260. https://doi.org/10.1007/s11409-022-09328-5

Teng, M. F., Qin, C., & Wang, C. (2022a). Validation of metacognitive academic writing strategies and the predictive effects on academic writing performance in a foreign language context. *Metacognition and Learning*, *17*, 167–190. https://doi.org/10.1007/s11409-021-09278-4

Teng, M. F., Wang, C., & Zhang, L. J. (2022b). Assessing self-regulatory writing strategies and their predictive effects on young EFL learners' writing performance. *Assessing Writing*, *51*, 100573. https://doi.org/10.1016/j.asw.2021.100573

Veenman, M. V. J., Elshout, J. J., & Meijer, J. (1997). The generality vs domain-specificity of metacognitive skills in novice learning across domains. *Learning and Instruction*, *7*(2), 187–209. https://doi.org/10.1016/S0959-4752(96)00025-4

Wang, C.-Y. (2015). Exploring general versus task-specific assessments of metacognition in university chemistry students: A multitrait–multimethod analysis. *Research in Science Education*, *45*(4), 555–579. https://doi.org/10.1007/s11165-014-9436-8

Wang, W., & Wen, Q. (2002). L1 use in the L2 composing process: An exploratory study of 16 Chinese EFL writers. *Journal of Second Language Writing*, *11*(3), 225–246. https://doi.org/10.1016/S1060-3743(02)00084-X

Wenden, A. L. (1998). Metacognitive knowledge and language learning. *Applied Linguistics*, *19*(4), 515–537. https://doi.org/10.1093/applin/19.4.515

Whalen, K., & Ménard, N. (1995). L1 and L2 writers' strategic and linguistic knowledge: A model of multiple-level discourse processing. *Language Learning*, *45*(3), 381–418. https://doi.org/10.1111/j.1467-1770.1995.tb00447.x

Widaman, K. F., & Reise, S. P. (1997). Exploring the measurement invariance of psychological instruments: Applications in the substance use domain. In K. J. Bryant & M. Windle (Eds.), *The science of prevention: Methodological advances from alcohol and substance abuse research* (pp. 281–324). American Psychological Association.

Xu, W. (2024). *Metacognitive strategy use in Chinese (L1) and English (L2) writing: A within-subject comparison* [Doctoral dissertation, The Hong Kong Polytechnic University]. https://theses.lib.polyu.edu.hk/handle/200/13044

Xu, W., & Zhu, X. (2024). Examining metacognitive strategy use in L1 and L2 task-situated writing: Effects, transferability, and cross-language facilitation. *Metacognition and Learning*, https://doi.org/10.1007/s11409-024-09387-w

Yu, S., & Jiang, L. (2021). L2 university students' motivational self system in English writing: A sociocultural inquiry. *Applied Linguistics Review*, *14*(3), 553–578. https://doi.org/10.1515/applirev-2020-0110

Zhang, L. J. (2001). Awareness in reading: EFL students' metacognitive knowledge of reading strategies in an acquisition-poor environment. *Language Awareness*, *10*(4), 268–288. https://doi.org/10.1080/09658410108667039

Zhang, L. J. (2016). Reflections on the pedagogical imports of western practices for professionalizing ESL/EFL writing and writing-teacher education. *Australian Review of Applied Linguistics*, *39*(3), 203–232. https://doi.org/10.1075/aral.39.3.01zha

Zhang, L. J., & Zhang, D. (2013). Thinking metacognitively about metacognition in second and foreign language learning, teaching, and research: Toward a dynamic metacognitive systems perspective. *Contemporary Foreign Language Studies*, *396*(12), 111–121.

Zhao, C. G., & Liao, L. (2021). Metacognitive strategy use in L2 writing assessment. *System*, *98*, 102472. https://doi.org/10.1016/j.system.2021.102472

SUPPORTING INFORMATION

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