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Task complexity and L2 writing performance of young learners: Contributions of cognitive and affective factors

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Abstract

The study investigated the effect of task complexity (TC) on second language (L2) learners' affective responses and writing performance and how these were modulated by cognitive and affective individual difference (ID) factors. A total of 412 Chinese 8th-grade English-as-a-foreign-language learners completed a working memory (WM) test, a scale measuring trait-like L2 writing enjoyment, a simple ($n = 206$) or complex ($n = 206$) argumentative writing task, and posttask scales measuring task-specific enjoyment and motivation. Independent *t*-test results showed that increased TC contributed to a slight but significant enhancement in task motivation and enjoyment and a significant performance improvement in content and organization but not in language. Structural equation modeling results showed that the cognitive and affective ID factors predicted writing performance jointly: WM and task motivation predicted writing performance consistently in both simple and complex tasks, task-specific enjoyment only played its role in the complex task, and trait-like enjoyment became insignificant in predicting task performance. These findings support the integrated task-mediated cognitive–affective model of L2 writing we propose by synthesizing and extending existing models. This study highlights the need to pay attention to the affective dimension of tasks and suggests TC as an intervention strategy to make a task more motivating and enjoyable.

KEYWORDS
integrated task-mediated cognitive-affective model of L2 writing, positive psychology, task complexity, task emotion, task motivation, working memory

Prior literature coalesces to highlight that second language (L2) writing performance is affected by a range of cognitive and affective individual difference (ID) factors in light of task environment (Kormos, 2012, 2023; Li et al., 2023). One research strand stands out and concerns the joint role of task complexity (TC) and ID factors in L2 writing performance (Manchón et al., 2023). The extensively studied ID factors are working memory (WM; e.g., Granena, 2023; Manchón et al., 2023), aptitude (e.g., Kormos & Trebits, 2012), anxiety (e.g., Güvendir & Uzun, 2023; Rahimi & Zhang, 2019), and motivation (e.g., Rahimi & Zhang, 2019); see a recent review article by Manchón and Sanz (2023). In contrast, other ID factors—especially noncognitive ones—have received much less attention. Against this background, Li (2023) called for the need to expand the range of IDs in L2 writing research by including more noncognitive ID factors. Echoing Li's (2023) call, Li et al. (2023) further called for more attention to emotional ID factors, especially positive emotions such as enjoyment, by arguing that L2 writers are emotionally responsive to a specific writing task and rely on positive emotions to spark interest, boost motivation, and sustain efforts in a writing task or long-term L2 writing.

Li (2024a) also noted that the affective variables in both L2 writing and task-based language teaching (TBLT) literature are primarily restricted to long-term situation-independent anxiety and motivation (e.g., Rahimi & Zhang, 2019). Little attention has been paid to short-term affective variables, such as emotional and motivational responses to a specific task with certain features (e.g., TC). Against this, Li (2024a) and Li and Dewaele (2024) called for the need to bridge positive psychology and TBLT, differentiating (positive) trait-like emotions from task-specific emotions and examining their independent and interactive roles in task performance. Kormos (2012) and Kormos and Wilby (2019) also highlighted the essential role of task-specific motivation in writing behaviors, processes, and output. Indeed, no matter how well tasks are designed and sequenced, learners may differ considerably in their emotional and motivational responses and, consequently, differ in whether and how they would take advantage of the opportunities offered by the tasks intended to promote language acquisition (Li & Dewaele, 2024).

In addition, there is insufficient attention to the joint roles of cognitive ID factors and TC in affecting writing performance (Manchón et al., 2023), not to mention their joint roles along with emotional–motivational ID factors at both the trait level and the task-specific level. However, such investigations are warranted as they help to provide a comprehensive understanding of the cognitive–psychological mechanism of writing processes and performance, which potentially offers essential implications for task design, implementation, and assessment.

The present study aims to propose an integrated task-mediated cognitive–affective model of L2 writing by synthesizing and extending existing first language (L1)–L2 writing models (Hayes, 1996; Kellogg, 1996; Kormos, 2012, 2023) and to support the model with empirical evidence on how TC and cognitive and (positive) affective ID factors at different levels of situational specificity combine and relate to L2 writing performance. In terms of the cognitive factor, we focus on WM, a fundamental cognitive capacity in L2 writing (Kormos, 2012, 2023; Manchón & Sanz, 2023). For the affective factors, we adopted a state–trait approach to emotions (Li & Dewaele, 2024), examining both trait-like L2 writing enjoyment—which is relatively stable and reflects long-term affective dispositions toward L2 writing—and task-specific L2 writing enjoyment—which is temporary, short term, and specific to the given writing task, whether simple or complex. Another affective factor was task-specific motivation. TC was manipulated by differing the amount of reasoning demand and the number of elements in the instructions of two argumentative writing tasks. As for L2 writing performance, we assessed three dimensions: language, content, and organization.

THEORETICAL FRAMEWORK

The role of individual differences and task environment in writing

Kellogg's (1996) model of WM in writing has been highly influential and substantially extended and refined in the fields of both L1 and L2 writing (Kormos, 2023). This section delineates the original model as well as its extended models.

Kellogg's (1996) model of working memory in L1 writing

WM refers to the ability to store, maintain, and process information (Baddeley, 2000). It has four core components: (a) the central executive, that is, the supervisory system that performs as an attentional controller and a coordinator between the subsidiary systems; (b) the phonological loop, a subsidiary system that holds and processes verbal information; (c) the visuospatial sketchpad, another subsidiary system that holds and processes visual–spatial information; and (d) the episodic buffer, which links the supervisory–subsidiary systems of WM and links WM with long-term memory (Baddeley, 2000).

Kellogg's (1996) model of WM in L1 writing emphasizes the essential roles of the first three WM elements in L1 writing. In his view, writing is a conscious and effortful cognitive task consisting of three basic interactive and recursive processes: (a) formulation (planning ideas and translating the ideas, which involves conceptual plan, lexical retrieval, syntactic encoding, and cohesive relationship expression), (b) execution (transforming the linguistic plan into written output by actual motor movements such as handwriting or typing), and (c) monitoring (reading and editing the composed text to match the conceptual plan; Kellogg, 1996). Arguably, to meet the cognitive demands involved in these writing processes, writers draw on WM's capacity to utilize knowledge and experiences held in long-term memory, store information temporarily, and process information in the task concurrently.

More pertinent to the current study, Kellogg's (1996) model posited or suggested the role of WM in influencing content, organization, and language of writing. First, writers rely on the visuospatial sketchpad of WM in formulation to visualize ideas and content, such as using diagrams or images for content generation and text organization. This indicates that higher capacity in the visuospatial sketchpad of WM may improve writing performance in terms of content (informativeness and richness of ideas) and organization (cohesiveness, cohesion, and clarity in textual outlining). Second, writers draw on their capacity of the phonological loop to translate their ideas into linguistic forms and read and edit their text. This indicates that higher capacity in the phonological loop of WM may improve writing performance in terms of language (vocabulary and grammar accuracy). As for the central executive, it is argued to be involved in all processes because it is responsible for attention control, coordination, and inhibition of irrelevant information (Kellogg, 1996; Kormos, 2023). This indicates that higher capacity in the central executive may have an enhancement effect on overall writing performance and each performance dimension. As for the episodic buffer, a fourth component of WM, it was not included in Kellogg's (1996) original model. Very recently, Kormos (2023) argued that the episodic buffer is responsible for linking and merging smaller pieces or units of information into episodes. This suggests that higher capacity in the episodic buffer may enhance the performance of the organization in writing.

Hayes's (1996) individual–environmental model of L1 writing

Hayes (1996) extended Kellogg's (1996) WM model by incorporating new individual–environmental factors, arguing that writing depends on the interplay between the individual and the task environment, which was loosely defined as social conditions (e.g., the audience, genres, and collaborators) and

physical conditions (e.g., the text composed so far and the composing medium; Hayes, 1996). Regarding the individual, Hayes (1996) argued that writing is not only an intellectual activity that draws on cognitive abilities (e.g., WM and long-term memory) but also a goal-directed, communicative, and generative activity that requires affect (motivation and emotion).

Pertaining to the current study, Hayes (1996) highlighted the central role of WM, motivation, and emotion in impacting writing processes, including text interpretation, reflection, and text production. For WM, it is assumed to be involved in all the processes that are not fully automated. Writers rely on WM to retrieve information from long-term memory and store and process task information in these processes. Writing also depends on motivation because writers typically have multiple linguistic and communicative goals in writing, for example, to convey content, to communicate information clearly with a moderate text length, to create intended impressions of themselves, and to satisfy the target audience (Hayes, 1996). Motivation is the "basic drive" (Hayes, 1996, p. 9) for writers to engage in writing activities. Hayes (1996) further distinguished state motivation (short-term responses to immediate goals of a specific writing activity) from general trait motivation (long-term predispositions to engage in writing activities). Regarding emotions, Hayes (1996) noted that writers responded emotionally to the linguistic demands and graphic demands of a text (e.g., text's message and organization) and highlighted the potential impairing effect of anxiety in writing.

Hayes's (1996) individual–environmental model highlighted the central role of cognitive–affective ID factors and task environment in writing processes. Nevertheless, no specific predictions were made on writing products, including the content, organization, and language of the written texts produced.

Kormos's (2012) model of cognitive–motivational individual differences in L2 writing

In a similar vein, in L2 writing, there has been a gradual shift from an exclusive focus on the role of WM to including a broader range of cognitive–affective ID factors and task environment factors (Kormos, 2012; Li, 2024a; Li et al., 2023; Papi et al., 2022). For example, Kormos (2012) added aptitude and motivation to the ID list of L2 writing research, which had focused exclusively on WM. Kormos (2012) also emphasized that cognitive ID factors (e.g., aptitude and WM) and motivational ID factors interact with each other, separately and jointly affecting L2 writing processes, including planning, formulation, transcribing, and editing.

Germane to the current study, Kormos (2012) argued that writers' motivational profiles may determine "whether they will engage in writing activities, what kind of writing tasks they will undertake, with what level of effort and attention they will approach the various phases of the writing process, and how they exploit the learning potential of writing tasks" (p. 391). Kormos (2012) differentiated intrinsic writing motivation (e.g., intrinsic interest to write and learn from the writing task) from extrinsic writing motivation (e.g., instrumental goal to gain a reward or opportunity or to avoid certain punishment). In addition, Kormos (2012) highlighted the need to investigate the role of task-specific motivation and interest in affecting the quality of written output, because such findings could be beneficial for designing and assessing writing tasks that are motivating and engaging. In a more recent article, Kormos and Wilby (2019) further argued that task motivation determines the extent to which L2 writers take advantage of the learning opportunities offered by tasks for practice or consolidation and consequently determines how much they can potentially learn from the given writing task. High levels of task motivation promote cognitive engagement (e.g., noticing gaps in one's knowledge and paying more attention to feedback) and behavioral engagement (e.g., engaging in problem-solving behaviors and creating text revisions) with writing tasks that can potentially promote acquisition processes (Kormos, 2012; Kormos & Wilby, 2019). In contrast, low levels of motivation on a task may exacerbate various cognitive biases (e.g., task appraisals and self-efficacy beliefs) and increase the likelihood of superficial low-effort cognitive processing (e.g., simply completing the writing task without in-depth information processing, planning, or revision) or disengagement in a collaborative effort to make use of the opportunities intended by task designers (Li, 2024a; Li et al., 2024).

Kormos's (2023) task-mediated cognitive model of L2 writing and writing to learn

More recently, Kormos (2023) proposed the task-mediated cognitive model of L2 writing and writing to learn. The model summarizes the complex interplay among the individual, the writing task, and the L2 writing processes. The key assumption is that the role of cognitive ID factors (WM and aptitude components) in affecting the writing process and written L2 text can be mediated by learners' L1 skills and L2 proficiency, task environment, and access to feedback.

The model evidently extends prior writing models in the following essential aspects: First, for the individual, going beyond cognitive abilities (WM and aptitude), the role of learners' linguistic background (L1 skills and L2 proficiency) is also highlighted. Second, the concept of task environment (Hayes, 1996) is extended and specified in the TBLT context as task type and conditions (e.g., the cognitive, linguistic, and genre-based demands of the task; time allocated for the task; and transcribing medium). Third, unlike prior models focused solely on writing processes, written output is also included as a joint outcome of the interplay among the individual, the task, and the L2 writing processes (Manchón et al., 2023). Echoing this model, Manchón et al. (2023) called for research attention to the role of WM in writing processes and the quality of written output in conjunction with task environment and L2 learners' existing linguistic and genre-based knowledge.

An integrated task-mediated cognitive–affective model of L2 writing

In this article, we propose an integrated task-mediated cognitive–affective model of L2 writing by synthesizing and extending previously reviewed writing models, considering the following aspects.

Trait-like emotion and task-specific emotions in L2 writing

Emotion has long been marginalized in the existing L2 writing models despite the long-held consensus that emotion, motivation, and cognition are inseparable from each other in language learning (Dewaele & Li, 2020; Hayes, 1996; Kormos, 2012; Lantolf & Swain, 2019; Li, 2024a; Li et al., 2024; Swain, 2013). Until very recently, inspired by the positive psychology movement, researchers started to argue for the need to include diverse emotions beyond anxiety in the list of IDs in L2 writing (Li, 2024a; Li et al., 2023, 2024; Papi et al., 2022).

Echoing Hayes (1996), Li (2024a) argued that L2 writers not only bring long-term emotional dispositions into a specific writing task but also respond emotionally to the immediate task environment (e.g., the cognitive, linguistic, genre-based, and communicative demands of the task). Li (2024a) further distinguished trait-like L2 writing emotions (i.e., long-term, situation-independent emotional predispositions tied to L2 writing in general) from task-specific L2 writing emotions (short-term, situation-dependent emotional responses to the ongoing writing task with specific features such as TC).

Trait-like emotions and task-specific emotions are interconnected during the writing process. Specifically, trait-level emotions tend to persist across tasks, shaping task-specific emotions. For example, learners with higher levels of trait-like boredom in writing are more likely to experience short-term boredom in specific writing tasks although they may occasionally find a writing task enjoyable (Li, 2024a). However, task-specific enjoyment, although fleeting, if recurrently and habitually experienced, may feed into long-term trait-like enjoyment (Li & Dewaele, 2024).

Emotions and their links with cognition and motivation in L2 writing

Emotions are assumed to impact cognitive and motivational processes in L2 writing and, consequently, the quality of written output (Li, 2024a; Li et al., 2023, 2024; Papi et al., 2022). The links between

emotions and motivation are inconclusive. Positive emotions (like enjoyment or interest) are assumed to be precursors of the initiation of motivated learning behaviors (Li & Li, 2024; Papi et al., 2022). Writers may rely more on cheerful emotional repertoire and competence to energize themselves and boost their motivation to meet the linguistic and cognitive demands involved in challenging tasks (Li, 2024a; Li et al., 2023). In contrast, negative emotions such as boredom may impair learning motivation and lead to disengagement. Notably, negative emotions such as anxiety could be either debilitative in impairing task motivation or facilitative in heightening one's desire to perform well and avoid failure (Li, 2024a; MacIntyre, 2017).

The effects of emotions on cognition are far more inconclusive. For example, both positive and negative emotional arousals may interfere with information processing as an individual's cognitive capacity is limited (Eysenck & Calvo, 1992; Osaka et al., 2013; Pekrun & Stephens, 2010). However, both positive and negative emotional arousals may also facilitate other cognitive processes. For example, anxiety could be facilitative in focusing attention on certain task aspects to avoid failures in performance (Li, 2024a; MacIntyre, 2017). Enjoyment could be beneficial in broadening an individual's thinking repertoire, such as divergent thinking, and boosting one's desire to explore (Dewaele & MacIntyre, 2014; Pekrun & Stephens, 2010).

More germane to the current study, Li (2024a) claimed that general trait-level and task-specific L2 writing enjoyment are intertwined, co-forming the core element of task motivation and enhancing cognitive functions such as attention and memory. Implicated by the broaden-and-build theory of positive emotions (Fredrickson, 2001) and the control-value theory of achievement emotions (Pekrun, 2006), it is convincing to assume that an individual who finds the writing task enjoyable is more likely to be motivated and fully immersed in the task, have in-depth information processing and broadened cognitive resources, and engage in the task with genuine efforts and persistence. All these motivational and cognitive benefits of enjoyment allow the learner to perform better and more effectively in the task.

Li (2024a) and Li and Dewaele (2024) further argued for the need to bridge positive psychology and TBLT and adopt a person–task interaction perspective to examine how diverse trait-like emotions and task-specific emotions (e.g., positive emotions like enjoyment) interact to affect task performance in light of TC as well as other task features (e.g., clarity, topic familiarity, prior knowledge, task format, time constraints, a second chance to retake the task, and task reward-and-punishment system).

The integrated task-mediated cognitive–affective model of L2 writing

The above literature review highlights the immediate relevance of emotions—both positive and negative, both trait like and task specific—to writing processes and products. Consequently, we add diverse emotions at different time scales and levels of situational specificity to Kormos's (2012, 2023) influential models of L2 writing and integrate them into a new extended model, named the task-mediated cognitive–affective model of L2 writing.

The integrated model echoes Li's (2023) call for including more noncognitive ID factors in L2 writing research, as well as Li's (2024a) and Li and Dewaele's (2024) call for bridging positive psychology and TBLT with a person–task interaction perspective. This model assumes that cognitive ID factors (e.g., WM, aptitude, procedural memory, declarative memory, and creativity) interact with affective ID factors (e.g., trait-like or task-specific emotion, motivation, and self-efficacy), linguistic factors (e.g., L1 skills and L2 proficiency), and the task environment (e.g., genre, TC, task difficulty, task clarity, task formats such as open-ended or forced choice, topic novelty, planning, time constraints, task repetition, and task reward and punishment system) to affect writing processes and, finally, written L2 text. The current study is a tentative empirical attempt to testify to the new integrated model and support Manchón and Sanz's (2023) call to make L2 writing more central in L2 acquisition research.

Task complexity: Effects on linguistic and affective dimensions

Task complexity and L2 performance

Task complexity is defined as "the result of the attentional, memory, reasoning and other information processing demands imposed by the structure of the task on the language learner" (Robinson, 2001, p. 29). Skehan's (1998) limited capacity hypothesis and Robinson's (2001) cognition hypothesis are two influential theoretical frameworks on how TC affects L2 learners' attentional allocation and, thus, their L2 oral production. The limited capacity hypothesis assumes that an individual has a limited pool of attentional resources and, therefore, cannot attend to all the task dimensions equally. Correspondingly, there will be a trade-off relationship among those dimensions. Specifically, Skehan predicted that increasing TC requires more cognitive resources for content formulation, which in turn reduces the available attention resources directed to linguistic dimensions (e.g., complexity and accuracy). Skehan also predicted a trade-off relationship between the complexity and accuracy of L2 output as a result of increasing TC.

In contrast, Robinson's (2001) cognition hypothesis assumes that an individual has multiple resource pools for attention and is flexible in channeling the attentional resources to multiple needed aspects of a task simultaneously, as long as these aspects do not interfere with different attentional pools. This suggests the simultaneous enhancement effect of TC on multiple task aspects, which is distinct from the trade-off relationship assumed in Skehan's (1998) limited capacity hypothesis.

Robinson (2011) further distinguished TC manipulations along the resource-directing (making cognitive or conceptual demands such as ±few elements, ±here and now, ±causal reasoning, and ±spatial reasoning) and resource-dispersing dimensions (making performative or procedural demands such as ±planning time or prior knowledge, ±single task, and ±independency of steps). Pertaining to the current study, Robinson argued that for monologic tasks, increasing TC along the resource-directing dimension (e.g., ±reasoning elements) will trigger learners to activate the use of their additional attentional resources to meet the greater cognitive demands. Specifically, Robinson (2001, 2011) predicted that increasing TC along resource-directing dimensions should lead to enhancement in linguistic forms (both complexity and accuracy).

Regarding the effect of TC on the content (degree of relevance and informativeness) and organization of L2 production (degree of being coherent and cohesive), neither of the two models made direct predictions. However, Robinson (2011) argued that increasing TC by increasing the number of reasoning elements leads to greater conceptual demands and thus has the potential to direct learners' attention, memory resources, and efforts to conceptualization (macroplanning of utterance type and microplanning of linguistic realization of content) and formulation before overt production of speech sounds. Such demands should arguably be met by allocating attentional resources to the analyses, description, connection, and comparisons of the increased number of reasoning elements using certain language forms and specific language codes, such as logical connectors (e.g., "because," "so," "therefore," "if" ..."for" reasoning). In this way, TC may generate positive consequences for well-structured, coherent, and cohesive production containing sufficient, relevant, and informative content. That is, TC may strengthen the organization and content, which theoretically underpins the current study.

Both Skehan's (1998) limited capacity hypothesis and Robinson's (2001) cognition hypothesis initially targeted speech production yet have been adapted to conceptualize TC research in L2 writing (Kuiken & Vedder, 2008; Vasylets et al., 2017) based on the following agreement. First, dominant models of speech production in both L1 (Levelt, 1989) and L2 (Kormos, 2014) posit similar components of language production: (a) conceptualization, which involves the generation (macroplanning and microplanning) of the ideational content; (b) formulation, which entails the linguistic realization of the preverbal message; (c) articulation, that is, producing speech sounds overtly; and

(d) monitoring, which means checking the accuracy of both the preproduced and articulated results (Vasylets et al., 2017). Second, theories of written production targeting L1 (e.g., Hayes, 1996; Kellogg, 1996) assume "a similar set of processes with functions largely analogous to those that account for speech production" (Vasylets et al., 2017; p. 396). As production mechanisms in L2 writing have been agreed tacitly to be generally comparable with those in L1 writing (Vasylets et al., 2017), it is plausible that processes involved in L2 speaking and L2 writing are also largely similar.

Resonating with the integrated task-mediated cognitive–affective model of L2 writing we proposed earlier in this study, Robinson's (2011) cognition hypothesis also posits that cognitive factors (e.g., WM and aptitude) and affective factors (e.g., state–trait emotions and motivation) impact (oral) task performance in tandem and that their performance effects will be more noticeable in more complex tasks, especially cognitive factors such as WM, because of their close conceptual links to TC.

Task complexity–affect assumptions

Task environment or condition can be an affective stimulus for L2 learners (Li, 2024a; Li et al., 2024). An individual's emotional and motivational responses to tasks of differing complexity might be different, leading to variations in the extent to which learners take advantage of the opportunities provided by the task.

We propose the TC-affect assumptions based on the definition of TC (Robinson, 2001, 2011) and the control-value theory (Pekrun, 2006). By definition, TC is closely tied to the cognitive demands and perceived difficulty of the task, determining the extent to which learners perceive the task to be manageable. As assumed by control-value theory (Pekrun, 2006; Pekrun & Stephens, 2010), learners feel enjoyment and motivation when they perceive a skill–demand balance in the ongoing task. Such positive affect is assumed to sustain along with the demand–skill balance and vanish or turn negative when the balance breaks, that is, when task demand exceeds or falls behind an individual's skills (Li, 2024a; Li & Dewaele, 2024). More specifically, it can be assumed that an individual tends to find a task enjoyable and motivating if the task poses manageable cognitive demands, anxiety provoking and demotivating if the task poses overly high cognitive demands, and boredom inducing and disengaging if the task poses excessively high or low cognitive demands.

PREVIOUS EMPIRICAL RESEARCH

Individual differences and L2 writing

Influenced by Kormos's (2012) seminal paper, explorations into the role of IDs in L2 writing have gradually gained momentum (Manchón & Sanz, 2023). Considerable research has been devoted to examining the effects of cognitive ID factors (e.g., WM and aptitude) and specific affective ID factors at the trait level (e.g., general long-term, task-independent motivation; anxiety; beliefs; and self-efficacy; Manchón & Sanz, 2023). In contrast, little attention has been paid to emotions other than anxiety (e.g., enjoyment and boredom), and even less attention has been paid to task-specific affective variables, such as task-specific enjoyment or motivation.

Working memory in L2 writing

Among the ID factors, WM has attracted the most research attention, which is understandable and can be attributed to assumptions on the central role of WM in current L1 and L2 writing models

(Manchón & Sanz, 2023). Empirical research has provided mixed evidence on its role in predicting writing quality (e.g., Kormos & Sáfár, 2008; Michel et al., 2019; Vasylets & Marín, 2021). In a recent systematic review, Li (2023) found that WM was only predictive of specific linguistic aspects, including complexity, accuracy, and fluency (CAF) in L2 writing (e.g., Vasylets & Marín, 2021), but largely not predictive of overall L2 writing performance (e.g., Kormos & Sáfár, 2008; Michel et al., 2019).

The inconclusive picture suggests that the effect of WM in the written text may be subject to critical variables such as task conditions (e.g., TC, genre, planning, time limits, and word limits), L2 proficiency and L1 skills, learner age, and other noncognitive ID factors such as (positive) emotions (cf. Kormos, 2012, 2023; Li, 2023; Li, 2024a; Manchón & Sanz, 2023; Vasylets & Marín, 2021). Against this background, Manchón et al. (2023) highlighted that it is essential to consider the role of WM in conjunction with the above learner- and task-related variables. Echoing Manchón et al.'s (2023) call, the current study further investigates the role of WM in combination with affective ID factors and TC.

Motivation and L2 writing

Research interest in the role of writing motivation in the writing process and quality has been sparked by the influential work of Kormos (2012). Empirical evidence has generally supported the facilitative role of long-term task-independent writing motivation in writing performance (e.g., Tahmouresi & Papi, 2021; Zhu et al., 2022), and the predictive effects of general motivation were more noticeable in complex task performance (e.g., Rahimi & Zhang, 2019).

In contrast, as pointed out by Kormos and Wilby (2019), there is insufficient attention paid to the effect of task-specific motivation in light of different task characteristics, including TC. However, task-specific motivation reflects how motivated learners are in performing a given language-learning task (Kormos, 2012). It may determine how effectively learners perform in the task and the extent to which learners take advantage of the opportunities provided by the task because of its close links with cognitive functions (e.g., information processing and attention), engagement, and genuine efforts (Kormos, 2012; Kormos & Wilby, 2019).

Task enjoyment is argued to be a core emotional precursor of task motivation, especially intrinsic task motivation (Li, 2024a; Li & Li, 2024). Following Boekaerts's (2002) definition of task motivation and the classification of intrinsic and extrinsic task motivation (Kormos, 2012; Kormos & Wilby, 2019), we define task motivation as state-like positive feelings evoked in response to the ongoing writing task for its inherent interest or/and instrumental value.

Trait-like enjoyment and task-specific enjoyment in L2 writing

Prior research has exclusively focused on the role of anxiety in L2 writing (e.g., Cheng, 2004; Rahimi & Zhang, 2019), largely overlooking other emotions, especially positive ones (e.g., Li et al., 2023). In addition, relevant research focused on general foreign language anxiety (e.g., Rahimi & Zhang, 2019) or long-term L2 writing anxiety (e.g., Cheng, 2004), neglecting anxiety arising in a specific writing task. Nevertheless, in a recent empirical study, enjoyment was found to be the most frequent in L2 writing, followed by boredom, excitement, and anxiety (Li et al., 2023). The authors also found that learners could enjoy L2 writing in general or a particular L2 writing task with specific features. By implication, L2 writing enjoyment involves both trait-level and task-specific enjoyment. The trait-level enjoyment is a long-term, task-independent emotional disposition, which is relatively stable and enduring over a long period, while the enjoyment evoked in a specific writing task is situation dependent, temporary, and transient.

There is a recent research interest in the role of long-term trait-like L2 writing enjoyment in writing performance, providing mixed results (positive: Li et al., 2023; Wang & Xu, 2023; null: Tahmouresi & Papi, 2021). The differences may be attributed to the differences in writing enjoyment measures, sample sizes, and age groups, necessitating more empirical investigations across different groups with sound measures. In sharp comparison, little attention has been paid to the role of short-term task-specific enjoyment. However, as reviewed earlier, task enjoyment is the proximal determinant of intrinsic task motivation, and it may affect task performance for its associations with cognitive functions, engagement, and effort in a task.

Task complexity, individual difference factors, and L2 writing task performance

Previous empirical research has provided mixed results on the effect of TC on L2 writing performance, typically assessed with a range of linguistic measures such as CAF indices (Johnson, 2017). The inconclusive picture highlights that the effect of TC may be dependent on a range of ID factors, such as WM (Güvendir & Uzun, 2023; Manchón et al., 2023; Zalbidea, 2017), aptitude (Kormos & Trebits, 2012), anxiety (Güvendir & Uzun, 2023; Rahimi & Zhang, 2019), and motivation (Rahimi & Zhang, 2019).

Notably, the affective variables are restricted mainly to long-term task-independent anxiety (e.g., L2 writing anxiety; Güvendir & Uzun, 2023; Rahimi & Zhang, 2019) or motivation (e.g., L2 motivation; Rahimi & Zhang, 2019). Very few studies have paid attention to the affective dimension of specific tasks, examining the immediate emotional and motivational responses to differing levels of TC. Even fewer studies have examined how cognitive and affective ID factors operate with each other to affect writing performance in tasks of varying complexity.

RESEARCH QUESTIONS AND CONCEPTUAL FRAMEWORK

To address the gaps identified above, the current study aimed to examine how TC contributes to learners' affective responses as well as their writing performance in conjunction with cognitive–affective ID factors based on the integrated task-mediated cognitive–affective model of L2 writing we propose. Specifically, the following research questions (RQs) guided the current study along with relevant hypotheses (Hs):

RQ1: What are the effects of TC on learners' task enjoyment and task motivation?
RQ2: What is the effect of TC on L2 writing task performance?
RQ3: How do the cognitive–affective ID factors (i.e., WM, trait enjoyment, task enjoyment, and task motivation) of interest predict L2 writing performance in simple and complex tasks?

For RQ1, we propose H1 based on the TC–affect assumptions without specifying the direction. For RQ2, we propose H2 without specifying the direction of the TC effect on task performance, given the limited capacity hypothesis (Skehan, 1998), the cognition hypothesis (Robinson, 2001), and mixed findings (Johnson, 2017). For RQ3, we propose H3 and H4 based on the integrated task-mediated cognitive–affective model of L2 writing and task emotion literature (Li, 2024a; Li & Dewaele, 2024), respectively.

H1: TC would predict task enjoyment and task motivation.
H2: TC would predict L2 writing task performance (language, content, organization, and overall).
H3: The cognitive and affective ID factors would predict writing performance in simple and complex tasks separately and jointly.

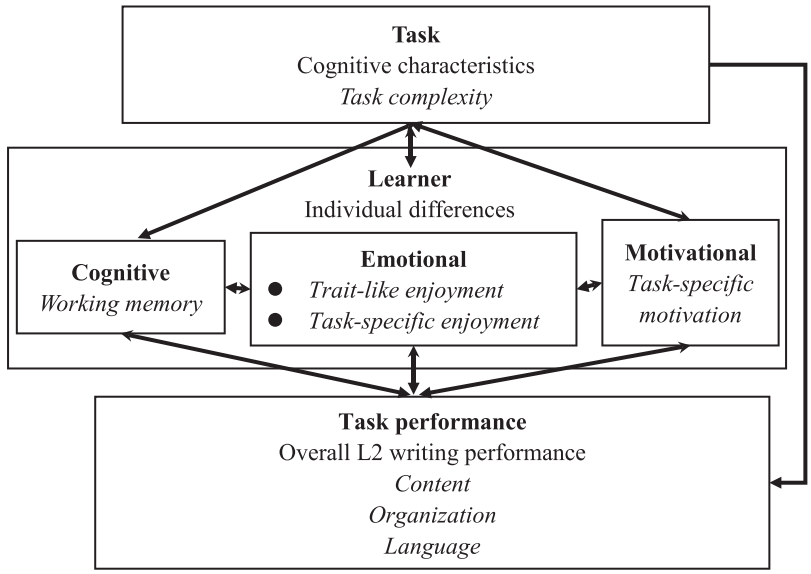

FIGURE 1 Conceptual framework of the current study.

H4: Task enjoyment would have a stronger positive predictive effect on task performance than trait enjoyment.

The conceptual framework of the current study is visualized in Figure 1.

METHOD

The local L2 context

The research site was a junior secondary school in rural China. Participants were eighth-grade English-as-foreign-language (EFL) learners. They attended six to nine 40-minute English sessions on a weekly basis. The English curriculum at the school featured explicit grammar instruction, rote learning, and guided mechanical practice, with little attention paid to speaking skills. All participants had Chinese and English as their L1 and L2, respectively, and they had no experience traveling to English-speaking countries. Following the local education policy, the participants started formal learning of English in Grade 3 and received English writing instruction since Grade 7. They were all beginners in English according to the requirements for English proficiency regulated by the Chinese Ministry of Education.

Participants

Participants of this study were young learners under the age of 18 (Ellis, 2014), with a mean age of 13.30 (SD = .73), ranging from 12 to 17 years old. Our initial participants were 1036 EFL learners from 26 classes who participated in pretask tests (an English proficiency test using a practice version of the Cambridge A2 Key for Schools English Test, a WM test, and a questionnaire survey for trait L2 writing enjoyment). Ten classes whose average scores on the Cambridge test fell within the middle of the 26 classes were selected to participate in the subsequent L2 writing tasks and posttask question-

naire survey. We hoped such a choice would help to avoid the potential ceiling and floor effects of the designed writing tasks.

Resultantly, 412 eighth graders from 10 classes participated in the main study. Among them, 249 (60.4%) were males and 163 (39.6%) were females. Their scores on Listening, Reading, Writing 1, and Writing 2 of the Cambridge test fell into the ranges of 0−22 (out of 25), 0−27 (out of 30), 0−15 (out of 15), and 0−15 (out of 15), respectively, with average scores of 10.51 (SD = 4.09), 14.43 (SD = 4.90), 12.21 (SD = 3.81), and 11.05 (SD = 3.91). This indicates that our participants' English proficiency was relatively low, roughly between A1 and A2 in the Common European Framework of Reference for Languages. ANOVA results show that there were no significant differences among the 10 selected classes in terms of their L2 writing proficiency ($F = 1.87$, $p = .060$).

The classes were assigned to either a simple or a complex task condition. Specifically, there were 120 males and 86 females in the simple task group and 129 males and 77 females in the complex task group. Further independent-sample *t*-tests indicated no significant difference between the simple and complex groups in terms of L2 writing proficiency (see Table 4).

Simple and complex L2 writing tasks

The participants were asked to write an essay of over 80 words in English within 40 minutes. The word limit and the time given for task completion were in line with the requirements of English course examinations for eighth graders at the research site as well as requirements of the admission examination for ninth graders. The simple and complex L2 writing tasks used in the study (see Appendix A) were adapted from Cho (2015). The participants in both conditions were asked to choose the best roommate and explain their reasons. In the simple task, there were four candidates, each marked by three properties—hobby, strength, and weakness—while in the complex task, there were six candidates, each marked by four properties—hobby, strength, weakness, and academic performance. Given the participants' relatively low English proficiency, the information about the candidates in the prompts was given in both English and Chinese, and the task instructions were in Chinese.

Task complexity: Manipulation, assessment, and validation

TC was operationalized by differentiating the amount of reasoning demand and the number of elements in the instructions of the two L2 writing tasks (Robinson, 2022). Specifically, in the simple task version, participants were required to choose the best roommate taking into account 12 elements, that is, 4 (candidates) × 3 (properties). In contrast, in the complex task, they considered 24 elements, that is, 6 (candidates) × 4 (properties). The increased number of elements in the task instructions is expected to pose greater conceptual and reasoning demands to meet, thus increasing TC (Cho, 2015; Robinson, 2001).

TC of the writing task(s) was assessed with the following two items tapping perceived task difficulty and mental effort, respectively: "The task was not difficult at all/extremely difficult" and "The task required no/extreme mental effort at all" (Révész et al., 2017; Robinson, 2001). Both items were in Chinese to ensure a complete understanding and were judged on a 9-point Likert scale. Higher scores on the scale indicated higher levels of TC.

We employed expert judgments and students' posttask ratings to check the validity of TC manipulation. Before our main study, 20 out of 23 applied linguists we had invited provided their ratings for TC of both the simple and the complex task versions. After the completion of the assigned task, our participants were also asked to provide their ratings for TC. TC manipulation was successful (see results in Tables 2 and 3).

Quantitative instruments

Working memory

An automatic Chinese version of the operation span task (Ospan; Unsworth et al., 2005) was utilized to measure complex WM capacity. This Ospan task was selected for two reasons. First, Ospan is a complex integrated task with processing components (i.e., math operations) and interleaving storage components (e.g., letter recall) concurrently. In this way, the Ospan task taps both the storage and processing functions of WM, contrasting with those simple span tasks concerning only short-term memory storage, such as simple digit span and word span (Shin & Hu, 2022). Second, the reliability and validity of the Ospan task in Chinese have been evaluated and proved to be sound among Chinese students (Mei et al., 2021).[1] During the task, participants were required to respond to math–letter combinations as quickly as possible, each comprising a simple math equation judgment task followed by an English letter memorizing task (e.g., "6 – 1 × 2 = 2? M"). After being presented with a set of three to seven math–letter combinations, participants were asked to recall the letters in the order that they were displayed. The whole test lasted for about 20 minutes.

Trait L2 writing enjoyment

L2 writing enjoyment at the trait level was measured with the foreign language writing enjoyment scale (Li et al., 2023). The scale is concerned with long-term dispositions and recurrent emotional experiences of enjoyment in L2 writing. It was developed and validated in a Chinese EFL context similar to that of the current study. It consists of nine items measuring private writing enjoyment and social writing enjoyment, respectively. It follows a 5-point Likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Its construct validity in the current study was checked using exploratory structural equation modeling (ESEM). Its reliability was assessed with Cronbach's alpha. The scale showed acceptable reliability and validity in the current study (see Table 1).

Task-specific L2 writing enjoyment

To assess state enjoyment arising in the specific L2 writing task, we developed the task enjoyment scale based on: (a) the definition of enjoyment (e.g., interest, joy, and engagement as core elements; Ainley & Hidi, 2014), (b) proxies for describing enjoyment in relation to L2 writing (e.g., enjoyment, engagement, positive, and smooth; Li et al., 2023), and (c) existing relevant scales, such as the foreign language writing enjoyment scale (Li et al., 2023) and the oral task enjoyment scale (Li & Dewaele, 2024). An example item is "I enjoyed the task." The initial item pool consisted of nine items. Following the posttask rating literature (Robinson, 2001), all the items were responded to on a 9-point Likert scale with higher scores indicating higher levels of agreement with the item. The construct validity of the task enjoyment scale was checked using exploratory factor analysis (EFA) followed by confirmatory factor analysis (CFA). Its reliability was assessed with Cronbach's alpha. Resultantly, a unidimensional 5-item task enjoyment scale was obtained and validated (see Appendix B for the final version of the scale and Table 1 for its psychometric properties).

Task-specific L2 writing motivation

To assess state motivation in the specific L2 writing task, we developed the 3-item task motivation scale based on: (a) the definitions of intrinsic and extrinsic task motivation (e.g., state-like positive feelings

evoked in response to the ongoing task for its inherent interest or instrumental value; Boekaerts, 2002; Hayes, 1996; Kormos, 2012; Kormos & Wilby, 2019), (b) proxies for describing task-specific motivation (e.g., the desire to do more tasks like this in future; Li, 2021; Robinson, 2001), and (c) existing relevant scales in the L2 literature, such as the (English) intrinsic/extrinsic value appraisal scale (Li, 2021) and the single-item measuring task motivation (Robinson, 2001). An example item for intrinsic and extrinsic task motivation is "I want to do more tasks like this" and "I hope to get high scores on the task," respectively (see Appendix B). All the items were responded to on a 9-point scale ranging from 1 = *strongly agree* to 9 = *strongly disagree*. The construct validity and reliability of the scale were checked using CFA and Cronbach's alpha (see Table 1).

Procedure and ethics

The study consisted of three general steps spanned over 3 weeks: (a) pretask tests, (b) L2 writing tasks, and (c) posttask scales (see Figure 2). Specifically, in week 1, all the students from 26 classes participated in the Cambridge A2 Key for Schools English Test in the classroom. This was followed in week 2 by a WM test and a questionnaire survey for trait L2 writing enjoyment in a computer lab. Simultaneously, 20 experts were invited to evaluate the simple and complex writing tasks in terms of their TC. In week 3, 10 out of the 26 classes comparable in their prior L2 writing proficiency performed simple and complex writing tasks followed by a questionnaire for TC, task enjoyment, and task motivation.

Data collection in the research site was approved officially by the institution of the first author (along with an official recommendation letter for data collection) and the local education authority before formal consent was obtained from the school principal, administrative teachers, students, and their guardians. All the participants received stationery gifts as rewards after completing the project.

Data analysis

Participants' performance in the L2 writing tasks was assessed with the rating rubrics of the writing assessment subscales for Cambridge A2 Key for Schools.[2] The grading dimensions included con-

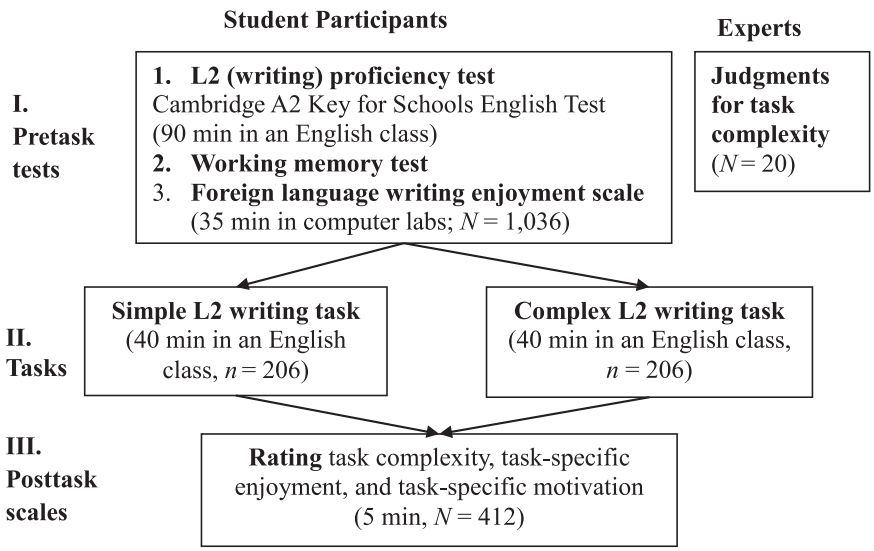

FIGURE 2 Design and procedure.

tent, organization, and language with a point range from 0 to 5 for each. Higher scores mean better performance in relevant dimensions (see Online Supporting Information).

For content, Band 5 means all content is relevant to the writing task and the target reader is fully informed; Band 3 describes occasional minor irrelevance and omissions, while Band 0 means the content is totally irrelevant and that the target reader is not informed at all. For organization, Band 5 means that text is connected and coherent, using basic linking words (conjunctions such as "firstly," "most importantly," "so," "because," "last but not least," "and," and so on), a limited number of cohesive devices (relative clauses such as "…which…") and pronouns (such as "theirs," "she") to provide a logical argumentative sequence to the text and avoid repetition. Band 3 means that text is connected using basic high-frequency linking words ("and," "so," "because," "but," etc.). Band 1 means the text is unlikely to be connected, despite the occasional use of punctuation (e.g., capitalized letters to signify the beginning of a new sentence) and simple linking words (e.g., "and"). For language, Band 5 means generally appropriate use of everyday vocabulary (words and phrases used often in the context involved in the writing task), despite occasional overuse of certain lexis; correct use of simple and grammatical forms (e.g., present tense forms) with a good degree of control; determined meaning despite some noticeable errors. Band 3 means using basic vocabulary (those for basic survival such as transactions in shopping and restaurant ordering) reasonably appropriately, using simple grammatical forms with some degree of control, and having errors that may impede meaning. Band 1 means text with few full sentences, isolated basic vocabulary only, and few grammatical forms with only limited control.

Six experienced L2 English teachers were recruited to score the texts. Before rating, all teachers had participated in three 60-minute training sessions guided by the first author. In the first session, they were trained to understand the rating rubrics fully. In the second session, they practiced the assessment of sample answers to several sample tasks from the *Cambridge Writing Assessment Guide* and then compared their assessment with real examiners' assessments. In the final session, they assessed three writing samples collected in the current research project, followed by group comparison and discussion to reach an agreement. Each text was rated by two teachers, and the final mark for each dimension was the average score of the two raters. The intraclass correlations (ICC) for all dimensions were desirable: content, ICC (3, 2) = .83, $p < .001$; organization, ICC (3, 2) = .79, $p < .001$; language, ICC (3, 2) = .82, $p < .001$ (Koo & Li, 2016).

Statistical analysis

Prior to the main analyses in accordance with the two proposed RQs, we conducted a series of preliminary analyses, including (a) validity tests (EFA and CFA or ESEM), (b) reliability tests (Cronbach's alpha), (c) normality tests (skewness: between −2 and +2; kurtosis: between −7 and +7; West et al., 1995), (d) pretask comparisons of L2 writing proficiency, WM, and trait L2 writing enjoyment between participants in the two task conditions (independent *t*-tests), (e) TC manipulation validity test (experts: paired *t*-tests; participants: independent *t*-tests), and (f) descriptive analyses of all target variables (means, ranges, and Pearson correlation analyses between main variables).

To address RQ1 and RQ2 concerning the effects of TC on task enjoyment and motivation and writing performance, we performed independent *t*-tests. To answer RQ3, we utilized structural equation modeling (SEM) to determine how cognitive and affective factors predicted writing performance in simple and complex tasks. SEM can measure latent variables simultaneously and thus can reduce measurement errors and make more accurate estimations compared to traditional mean score-based regression (Hair et al., 2010). The independent variables for modeling included WM, trait writing enjoyment, task-specific enjoyment, and motivation, and the dependent variables were overall writing performance in the simple task and the complex task, respectively. The effects of age and gender were controlled.

TABLE 1 Validity and reliability of measures.

	Construct validity						Reliability
Variable	Statistics	χ^2/df	RMSEA (< .08)	CFI (> .90)	TLI (> .90)	SRMR (< .08)	Cronbach's α (> .70)
Trait enjoyment	ESEM	33.63/19***	.05	0.99	.97	.02	.90
Task enjoyment	CFA	1.41/1***	.03	1.00	1.00	.01	.89
Task motivation	CFA	1.00/0***	.00	1.00	1.00	.00	.63
Writing proficiency	CFA	5.31/2*	.06	1.00	.99	.01	.95
Task performance	CFA	1.00/0***	.00	1.00	1.00	.00	.90

Abbreviations: CFA, confirmatory factor analysis; CFI, comparative fit index; ESEM, exploratory structural equation modeling; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; TLI, Tucker–Lewis index.
*$p < .05$; ***$p < .001$.

The goodness of model fit indices and the criteria used in CFA and ESEM were as follows: comparative fit index (CFI ≥ .90), Tucker-Lewis index (TLI ≥ .90), root mean square error of approximation (RMSEA ≤ .08), and standardized root mean square residual (SRMR ≤ .08) (Kline, 2023).

RESULTS

Preliminary analysis

Prior to the main results concerning the three RQs, we present the preliminary results relating to: (a) the construct validity, (b) the reliability of all measures, (c) normality, (d) the comparability of the simple and complex groups, (e) TC manipulation validity, and (f) descriptive analyses.

Scale reliability and validity

Regarding the construct validity of the measures, we used different statistics. Specifically, ESEM was used to assess the construct validity of the established foreign language writing enjoyment scale (Li et al., 2023). Considering that the task enjoyment scale was newly developed in the current study without a priori theoretical or hypothesized structure, we conducted an EFA to explore its underlying structure first, followed by a CFA to confirm further the structure (Brown, 2015; Kline, 2023). For other measures with only three items or a priori structure, we conducted CFA to assess their construct validity.

As displayed in Table 1, ESEM/CFA results show that all measures had excellent construct validity. The prior desirable EFA results for the task enjoyment scale were as follows but not displayed in the table: Kaiser–Meyer–Olkin measure of sampling adequacy = .92, $p < .001$ in Bartlett's test of sphericity, initial eigenvalues = 6.05, cumulative variances explained = 67.23%, and a one-factor structure. Cronbach's alphas show that all measures had excellent reliability over .80 except the task motivation scale.

Task complexity manipulation validity

The results based on expert judgments (see Table 2) and student posttask ratings (see Table 3) both indicated that our TC manipulation was successful. Table 2 presents expert judgments of TC. Paired-samples *t*-test results confirmed that the experts perceived the task with more reasoning elements

TABLE 2 Expert judgments of task complexity ($k = 2$, $N = 20$).

		Simple			Complex		
Complexity	**Possible range**	***M***	**SD**	**95% CI**	***M***	**SD**	**95% CI**
Mental effort	1–9	4.30	1.84	[3.49, 5.11]	6.20	1.82	[5.40, 7.00]
Task difficulty	1–9	3.40	1.60	[2.70, 4.10]	5.10	1.83	[4.30, 5.90]

TABLE 3 Descriptive statistics for participants' ratings of task complexity.

		Simple			Complex		
Complexity	**Possible range**	***M***	**SD**	**95% CI**	***M***	**SD**	**95% CI**
Mental effort	1–9	4.78	1.83	[4.53, 5.03]	5.31	1.78	[5.07, 5.55]
Task difficulty	1–9	4.47	1.76	[4.23, 4.71]	4.96	1.91	[4.70, 5.22]

TABLE 4 Descriptive statistics for the simple task ($n = 206$).

Variable	**Possible range**	***M***	**SD**	**Skewness**	**SE**	**Kurtosis**	**SE**
Writing proficiency	0–15	11.39	3.93	−1.62	.17	1.72	.34
Working memory	0–75	60.07	8.48	−1.37	.17	3.51	.34
Trait enjoyment	1–5	3.58	0.85	−0.04	.20	0.36	.39
Task enjoyment	1–9	5.88	1.75	0.11	.17	−0.73	.35
Task motivation	1–9	6.40	1.60	−0.08	.18	−0.45	.35
Task performance	0–15	11.14	2.26	−0.81	.17	0.36	.36
Content	0–5	3.70	0.69	−1.78	.17	2.36	.37
Organization	0–5	3.61	0.80	−1.48	.17	0.91	.37
Language	0–5	3.46	0.87	−0.96	.17	−0.42	.37

as involving more mental effort, $t(19) = -4.57$, $p < .001$, $d = 1.03$; and/or posing more difficulty, $t(19) = -6.24$, $p < .001$, $d = 0.99$; both with large effect sizes.

Table 3 displays participants' posttask TC ratings. Independent *t*-tests confirmed that our participants rated the task with more reasoning elements as requiring more mental effort, $t(410) = -2.97$, $p = .003$, $d = .29$; and/or being more difficult, $t(410) = -2.68$, $p = .008$, $d = .26$; both with small effect sizes.

Pretask comparisons and descriptive statistics

Tables 4 and 5 display the descriptive statistics for all variables of participants in the two task conditions. Independent *t*-tests confirmed no significant difference between the simple and the complex groups in terms of their prior L2 writing proficiency, $t(410) = -1.39$, $p = .164$, $d = -.14$; WM, $t(410) = 409.79$, $p = .890$, $d = -.01$; and trait L2 writing enjoyment, $t(410) = -.59$, $p = .559$, $d = -.06$.

TABLE 5 Descriptive statistics for the complex task ($n = 206$).

Variable	Possible range	*M*	SD	Skewness	SE	Kurtosis	SE
Writing proficiency	0–15	11.86	3.39	−1.83	.17	3.09	.34
Working memory	0–75	6.03	9.55	−1.65	.17	4.02	.34
Trait enjoyment	1–5	3.70	0.85	−.17	.18	−0.02	.37
Task enjoyment	1–9	6.06	1.66	−.27	.17	−0.06	.35
Task motivation	1–9	6.71	1.43	−.22	.17	−0.39	.35
Task performance	0–15	11.89	2.06	−1.81	.17	3.04	.34
Content	0–5	3.79	0.64	−2.80	.17	9.71	.34
Organization	0–5	3.87	0.52	−3.82	.17	9.68	.34
Language	0–5	3.58	0.76	−1.57	.17	2.53	.34

The effect of task complexity on learner affect and task performance

In accordance with RQ1, independent *t*-tests showed that TC had a nonsignificant effect on task enjoyment, $t(390) = -1.06$, $p = .290$, $d = -.12$, 95% CI [−.52, .16]; but a significant albeit small positive effect on task motivation, $t(380) = -2.06$, $p = .040$, $d = -.20$, 95% CI [−.62, −.01]. That is, participants in the complex task had significantly higher task motivation compared to their counterparts in the simple task.

As for RQ2, independent *t*-tests yielded significant but small positive effects of TC on content, $t(410) = -2.54$, $p = .012$, $d = -.25$, 95% CI [−.32, −.04]; organization, $t(410) = -2.91$, $p = .004$, $d = -.28$, 95% CI [−.29, −.06]; and overall task performance, $t(410) = 3.53$, $p = .001$, $d = -.30$, 95% CI, [−1.17, −.33]. In contrast, TC showed no significant effect on language, $t(410) = -1.51$, $p = .132$, $d = -.15$, 95% CI [−.28, .04]. Figure 3 shows that participants in the complex task had significantly higher scores in terms of task motivation, content, organization, and overall performance compared to their counterparts in the simple task. No significant differences were detected in terms of their task enjoyment and language performance.

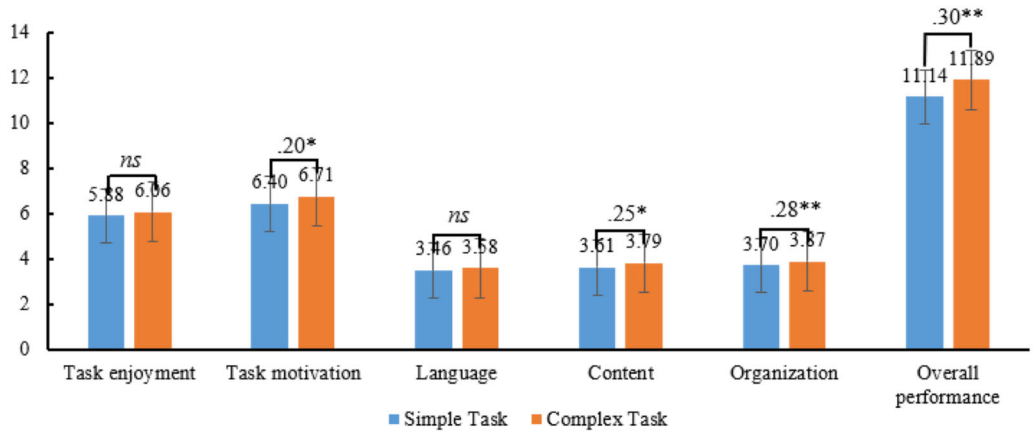

FIGURE 3 Effects of task complexity on learner affect and L2 writing performance. [Color figure can be viewed at wileyonlinelibrary.com]

Independent and joint roles of cognitive and affective factors in L2 writing performance in light of task complexity

Correlation analysis

Pearson correlation results are displayed in Tables 6 and 7, showing that all cognitive and affective factors under discussion were significantly linked to overall L2 writing task performance independently, with small-to-medium effect sizes ($.20 < r_s < .27$ and $.16 < r_s < .35$ in simple and complex task conditions, respectively). These positive associations allow for subsequent SEM that examined how cognitive and affective factors were combined to co-predict task performance.

Structural equation modeling results

SEM results are displayed in Tables 8 and 9, showing the joint roles of cognitive and affective factors in simple and complex tasks as well as their relative weights. Figure 4 and Table 8 display the results for the simple task condition. First, the hypothesized model (H3) was a good fit for the data: RMSEA = .05, CFI = .93, TLI = .91, SRMR = .05, $p < .0001$, explaining 18.6% of the variances in overall task performance. Second, WM and task motivation predicted task performance positively, with standardized $\beta = .23$ ($p = .001$) and $\beta = .24$ ($p = .011$), respectively, representing small effect sizes. Third, trait enjoyment and task enjoyment became insignificant when combined with WM and task motivation. Last, as shown in Figure 4, trait enjoyment was significantly related to task enjoyment (medium effect size: $r = .32$), and task enjoyment was significantly related to task motivation (large effect size: $r = .50$).

Figure 5 and Table 9 display the results for the complex task condition. First, the hypothesized model (H_3) was a good fit for the data: RMSEA = .03, CFI = .98, TLI = .97, SRMR = .05, $p < .0001$, explaining 17.2% of the variances in overall task performance. Second, WM, task motivation, and

TABLE 6 Correlations between cognitive and affective factors and writing performance in the simple task condition ($n = 206$).

Variables		1	2	3	4	5
1	Working memory	1				
2	Trait enjoyment	.10	1			
3	Task enjoyment	.02	.29**	1		
4	Task motivation	.06	.47**	.57**	1	
5	Task performance	.27**	.22**	.23**	.20**	1

**$p < .01$.

TABLE 7 Correlations between cognitive and affective factors and writing performance in the complex task condition ($n = 206$).

Variable		1	2	3	4	5
1	Working memory	1				
2	Trait enjoyment	−.09	1			
3	Task enjoyment	.03	.48**	1		
4	Task motivation	.04	.40**	.58**	1	
5	Task performance	.16*	.18*	.35**	.18*	1

*$p < .05$; **$p < .01$.

TABLE 8 Joint predictive effects of cognitive and affective factors on writing performance in the simple task condition ($n_1 = 206$).

	Path effects			Model fit					
Predictors	**β**	***p***	**95% CI**	R^2	χ^2/df	**RMSEA (< .08)**	**CFI (< .90)**	**TLI (< .90)**	**SRMR (< .08)**
Working memory	.23	.001	[.03, .09]	.19	265.48/17*	.05	.93	.91	.05
Task motivation	.25	.011	[.09, .06]						
Task enjoyment	.05	.641	[.21, .37]						
Trait enjoyment	.13	.238	[−.14, .84]						

Abbreviations: CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; TLI, Tucker–Lewis index.
*$p < .001$.

TABLE 9 Joint predictive effects of cognitive and affective factors on writing performance in the complex task condition ($n = 206$).

	Path effects			Model fit					
Predictors	**β**	***p***	**95% CI**	R^2	χ^2/df	**RMSEA (< .08)**	**CFI (< .90)**	**TLI (< .90)**	**SRMR (< .08)**
Working memory	.14	.03	[.01, .05]	.17	205.23/17*	.03	.98	.97	.05
Task motivation	.16	.04	[.16, .36]						
Task enjoyment	.29	.02	[.12, .61]						
Trait enjoyment	.003	.98	[−.43, .45]						

Abbreviations: CFI, comparative fit index; RMSEA, root mean square error of approximation; SRMR, standardized root mean square residual; TLI, Tucker–Lewis index.
*$p < .001$.

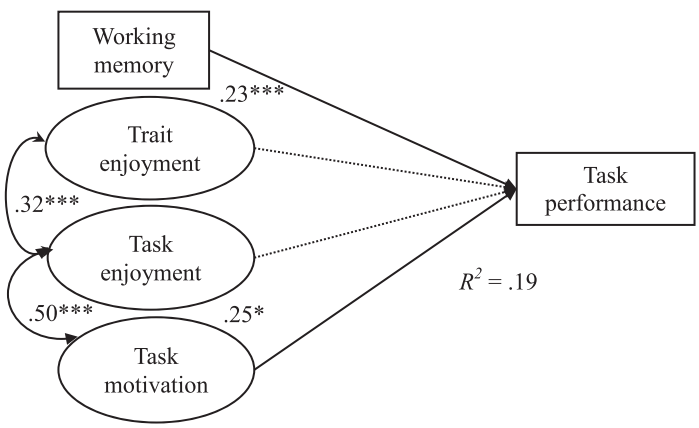

FIGURE 4 Contributions of cognitive and affective factors to writing performance in the simple task. *Note*: Dotted lines represent insignificant paths. Circles represent latent variables. Squares represent nonlatent variables. *$p < .05$; ***$p < .001$.

task enjoyment predicted task performance positively, with standardized $\beta = .14$ ($p = .028$), $\beta = .16$ ($p = .038$), and $\beta = .29$ ($p = .017$), respectively, representing small-to-medium effect sizes. Third, trait enjoyment became insignificant when combined with the other cognitive and affective variables. Last, as shown in Figure 4, trait enjoyment was significantly related to task enjoyment (large effect size: $r = .32$).

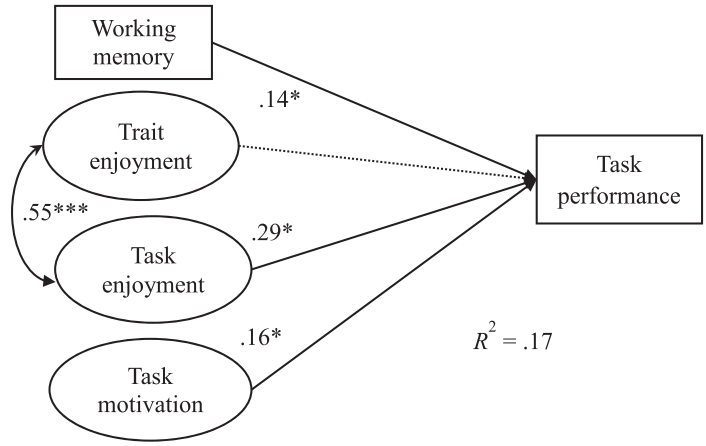

FIGURE 5 Contributions of cognitive and affective factors to writing performance in the complex task. *Note*: Dotted lines represent insignificant paths. Circles represent latent variables. Squares represent mean nonlatent variables. *$p < .05$; ***$p < .001$.

DISCUSSION

Effects of task complexity on learner affect

Figure 3 shows that increased TC generally improved both the affective dimension and the writing performance of the task. In accordance with RQ1, our results broadly support H1; that is, increased TC, operationalized as increasing reasoning elements, contributed to a significant increase in learners' task motivation, as well as a slight but not significant increase in learners' task enjoyment. Echoing the TC–affect assumption we propose, the results indicate that a task could be made more enjoyable and motivating by improving its TC to achieve a perceived skill–demand balance until a specific limit is reached (Li, 2024a).

Effects of task complexity on task performance

RQ2 concerned the effect of TC on overall L2 writing performance as well as the performance in language, content, and organization. Our results largely support H2: Increased TC contributed to a significant enhancement in overall writing performance as well as in the content and organization aspects with small effect sizes ($.25 < ds < .30$), and a slight yet not significant increase in the language dimension (accuracy and appropriateness in language). This indicates that participants in the more complex L2 writing task generally performed better than their counterparts in the simple writing task. Specifically, texts produced in the complex task condition were generally more relevant and informative in terms of the content and more coherent and connected in terms of its organization (e.g., using appropriate linking words and cohesive devices). In contrast, participants' output in the complex task was not lexically or grammatically more appropriate or accurate than what their counterparts produced in the simple task.

The significant but small enhancement in content and organization could be explained by the way we manipulated TC. To be specific, TC was increased by increasing the number of reasoning elements (i.e., more roommate candidates with more qualities for selection), which imposes greater conceptual, structural, and organizational demands in formulation (e.g., richer content and more ideas to plan, translate, encode, and express cohesively; Kellogg, 1996). Such demands could be met by having more linguistically relevant representations for these elements, which further requires more extensive use of linking strategies and logical connectors (e.g., "because," "so," "therefore," "if … compared to …") to make the text more cohesive and coherent. Notably, the effect sizes for both dimensions

were relatively small, which may be due to the significant yet small difference in TC between the two tasks perceived by our participants.

The nonsignificant increase in language-related performance dovetails with the findings of Vasylets et al. (2017). The first possible explanation is that the role of TC on language performance may be less noticeable among young learners because their writing processes (both in L1 and L2) are less automatic than cognitively mature adult writers. Also, due to their less developed L2 proficiency, they are less able to direct attentional resources sufficiently and simultaneously to all writing processes (formulation, execution, and monitoring; Kellogg, 1996) and all dimensions entailed in the written product (content, organization, and language; Kormos, 2023; Kuiken & Vedder, 2008). In accordance with Skehan's (1998) limited capacity hypothesis, their limited cognitive resources should be directed to the dimensions that need most attention as a result of increased cognitive complexity. As we increased TC by increasing the number of reasoning elements, the increased cognitive demands should be more closely linked to content and organization (e.g., richer and more content to formulate) compared to language (more in the processes of linguistic encoding and monitoring). This indicates that TC may only improve the performance in particular dimension(s) that accord with the manipulation of TC if L2 writing ability and/or proficiency does not reach the threshold level that allows TC to have a significant effect. The second possible explanation for the nonsignificant effect is that fossilized errors may have prevented our participants from taking advantage of the opportunities offered by the increased cognitive complexity entailed in the task (Vasylets et al., 2017).

Independent and joint contributions of cognitive and affective factors to L2 writing performance in tasks of differing complexity

The third RQ centered on the independent and joint contributions of cognitive and affective factors to writing performance in light of TC. Our correlation results (Tables 6 and 7) suggest that all the ID factors (WM, trait-like enjoyment, task-specific enjoyment, and motivation) were significantly linked to writing performance in both simple and complex tasks independently. Further SEM results in Tables 8 and 9 show that these cognitive and affective factors predicted overall writing performance jointly, explaining 18.6% and 17.2% of the variances in simple and complex tasks, respectively. This supports the integrated task-mediated cognitive–affective model of L2 writing we propose by extending and synthesizing existing models (Kormos, 2012, 2023), highlighting the facilitative role of positive emotions in L2 writing, which has long been neglected either in relevant theoretical models or empirical investigations in L2 writing research and TBLT research.

A closer look at the models shows that WM and task motivation consistently predicted overall writing performance positively in both simple and complex task conditions. The significant WM effect contrasts with the nonsignificant WM effect on overall L2 writing performance in Li's (2023) review article. Our findings empirically support the essential role of WM in written output, as Kormos (2023) assumed in her recent task-mediated cognitive model of L2 writing and writing to learn. In Kormos's model, WM resources should be particularly relevant to task performance for L2 writers like our participants, whose L1 literacy skills and L2 proficiency were relatively low, whose linguistic repertoire was limited, and whose L2 writing process was less automatized or proceduralized (Kormos, 2012, 2023; Révész et al., 2017; Serafini & Sanz, 2016).

Moving to task motivation, as Kormos and Trebits (2012) and Kormos and Wilby (2019) argued, it determines the level of desire and effort to complete the given task and the extent to which L2 writers engage in the task and make use of the learning opportunities offered by the tasks. Arguably, task motivation is a determinant of successful task performance. Higher task motivation contributed to higher cognitive engagement with the task (e.g., effort-demanding cognitive processes including noticing gaps in one's knowledge), more motivated behaviors (e.g., more initiative problem-solving behaviors and revisions in writing and more careful planning before linguistic representations), and more collaborative efforts to take advantage of the opportunities offered by the task, which further

promote task performance (Kormos, 2012, 2023). Our findings also extend prior empirical literature, which is exclusively focused on general, context-independent, long-term L2 motivation rather than short-term, task-specific motivational responses.

Turning to the role of emotion, task-specific enjoyment predicted writing performance in the complex task but not in the simple task. In contrast, trait-like writing enjoyment completely lost its significant links with overall writing performance in both tasks when combined with other cognitive–affective ID factors. The two levels of enjoyment were significantly correlated with each other in both tasks. The results support the fourth hypothesis that task-specific enjoyment would have a stronger effect on task performance than general trait enjoyment. The results also echo the call to differentiate the two interconnected yet distinct constructs, examining their independent and joint roles in task performance (Li, 2024a; Li & Dewaele, 2024).

The significant effects of task enjoyment can be explained by drawing on broaden-and-build theory (Fredrickson, 2001) and control-value theory (Pekrun, 2006). In the simple task, task enjoyment acted as a significant emotional source for task motivation and thus might exert an indirect effect on task performance through task motivation (Li, 2024a). In the complex task, task enjoyment facilitated task performance, and this could be attributed to the cognitive benefits of enjoying an ongoing task, as argued in the literature review, such as broadening an individual's thinking repertoire, increasing the depth of information processing, and focusing an individual's attention on the task (Li, 2024a).

The nonsignificant performance effect of trait enjoyment indicates that the cognitive–affective ID factors interact with each other in light of TC, and such interaction may prevent any of the factors from exerting their independent effect on task performance because the original effects may cancel out each other. One possible explanation is that trait enjoyment could be brought to a specific task, affecting learners' emotional responses to the ongoing task (Li, 2024a; Li & Dewaele, 2024). That is, trait enjoyment may exert its influence on task performance under the disguise of task enjoyment.

IMPLICATIONS, LIMITATIONS, AND SUGGESTIONS FOR FUTURE RESEARCH

Theoretical implications

From a theoretical perspective, first, SEM results support the integrated task-mediated cognitive–affective model of L2 writing we extend from the synthesis of relevant models (Kormos, 2012, 2023) and echo relevant arguments for the joint role of cognition and (trait-state) affect in writing (Hayes, 1996; Kormos, 2012; Li et al., 2023; Li & Li, 2024) and TBLT (Robinson, 2022). Second, our findings largely support the TC–affect assumptions we propose, underscoring the potential affective benefits of TC in TBLT practice. Third, our results suggest a simultaneous enhancement in multiple writing dimensions (i.e., organization, content, and language) due to increased TC. The findings point out the need to bridge Robinson's (2011) cognition hypothesis and Skehan's (1998) limited capacity hypothesis, considering the essential role of L2 proficiency in L2 writing processes and output (Kormos, 2023). More specifically, there should be a threshold level of L2 proficiency that allows TC to exert its effect on different task performance dimensions, as L2 proficiency is closely linked to the degree of automatization involved in the writing processes. If learners' L2 proficiency reaches this level, as assumed by the cognition hypothesis, they can flexibly allocate their attention to multiple needed aspects of a task simultaneously, such as the three dimensions of language, content, and organization, and basic writing processes (i.e., formulation, execution, and monitoring). However, if learners' L2 proficiency does not reach this level, as assumed by the limited capacity hypothesis, the limited cognitive resources would only be directed to the most relevant process(es), prioritizing the most needed task aspect(s) and dimension(s) (i.e., content and organization in the current study) to meet the corresponding increased cognitive demands.

Last, our findings point out the need for more theoretical attention to the effects of TC beyond the linguistic dimension of writing, which is dominantly assessed with CFA measures. As reviewed, neither Robinson (2001) nor Skehan (1998) made direct assumptions about how TC affects the content and organization of L2 production. However, effective writing depends on successful linguistic as well as nonlinguistic performance (content and organization; Shi, 2001). In addition, CAF-based findings may be limited in providing pedagogical implications because they are not commonly used in writing assessment practice by L2 teachers, especially for low-proficiency L2 learners, among which there may be very few variations in the levels of CAF in their L2 production.

Pedagogical implications

Our findings also provide pedagogical implications. First, L2 teachers should pay more attention to the affective dimension of the task. More effort should be put forth to make the task more enjoyable in task design and implementation, because not only is enjoyment crucial for learner well-being but it may also feed into task motivation and predict task performance. Another implication is that TC manipulation (i.e., increasing the number of reasoning elements) could be used as a strategy not only to facilitate task performance but also to intervene in learners' affective experiences, such as making a task more enjoyable and motivating.

Limitations and suggestions for future research

Our study has several limitations. First, the study focused exclusively on the positive emotion of enjoyment. It is suggested that the distinctive and combined roles of diverse emotions, such as anxiety, boredom, excitement, and pride, be investigated as they are prevalent in the writing context (Li et al., 2023). Second, the study focused exclusively on one modality (written), one genre (argumentative writing), young beginning-level L2 learners, and TC manipulated by increasing reasoning demands. The findings need cross-validation by extending the modality (e.g., speaking), genre (e.g., narrative), population (e.g., high-proficiency L2 learners), and manipulation methods (e.g., resource-dispersing). Last, the study was focused on the effects of cognition and affect on writing performance in light of TC, neglecting writing processes (e.g., planning, translation, and monitoring). Future research could examine the interplay between these psychological and behavioral processes and how they affect writing outcomes in different task conditions. Such investigations are vital for understanding the mechanisms of L2 writing production and development.

CONCLUSION

The primary aim of the study was to explore how TC affects learner affect and contributes to L2 writing performance in conjunction with cognitive and affective ID factors. Generally, we found a slight and significant enhancement in learners' task enjoyment, task motivation, and task performance as a result of increased TC. We also found that the cognitive and affective ID factors of WM, trait L2 writing enjoyment, and task-specific L2 writing enjoyment and motivation predicted writing performance hand in hand across tasks of different levels of complexity. Our results support the integrated task-mediated cognitive–affective model of L2 writing we extend from relevant models (Kormos, 2012, 2023), highlighting the crucial role of affective factors in L2 writing. We conclude with a call for more empirical research to test the integrated model, a comprehensive description of the joint role of diverse cognitive and affective ID factors in L2 writing processes and products in light of task conditions. We also call for more attention to the (positive) affective dimension in TBLT practice.

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ENDNOTES

[1] The Chinese version of the Ospan task generated in E-prime 2.0.10 can be downloaded from https://englelab.gatech.edu/translatedtasks.html#chinese

[2] https://www.cambridgeenglish.org/pl/Images/603898-cer-6647-v1c-jul20_teacher-guide-for-writing-a2-key-for-schools.pdf

REFERENCES

Ainley, M., & Hidi, S. (2014). Interest and enjoyment. In R. Pekrun & L. Linnenbrink-Garcia (Eds.), *International handbook of emotions in education* (pp. 205–227). Routledge.

Baddeley, A. (2000). The episodic buffer: A new component of working memory? *Trends in Cognitive Sciences*, *4*, 417–423. http://doi.org/10.1016/s1364-6613(00)01538-2

Boekaerts, M. (2002). *Motivation to learn*. International Academy of Education.

Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). Guilford publications.

Cheng, Y.-S. (2004). A measure of second language writing anxiety: Scale development and preliminary validation. *Journal of Second Language Writing*, *13*, 313–335. https://doi.org/10.1016/j.jslw.2004.07.001

Cho, H. (2015). Effects of task complexity on English argumentative writing. *English Teaching*, *70*, 107–131. https://doi.org/10.15858/engtea.70.2.201506.107

Dewaele, J.-M., & Li, C. (2020). Emotions in second language acquisition: A critical review and research agenda. *Foreign Language World*, *196*, 34–49. https://eprints.bbk.ac.uk/id/eprint/32797

Dewaele, J.-M., & MacIntyre, P. D. (2014). The two faces of Janus? Anxiety and enjoyment in the foreign language classroom. *Studies in Second Language Learning and Teaching*, *4*, 237–274. https://doi.org/10.14746/ssllt.2014.4.2.5

Ellis, G. (2014). 'Young learners': Clarifying our terms. *ELT Journal*, *68*, 75–78. https://doi.org/10.1093/elt/cct062

Eysenck, M. W., & Calvo, M. G. (1992). Anxiety and performance: The processing efficiency theory. *Cognition & Emotion*, *6*, 409–434. https://doi.org/10.1080/02699939208409696

Fredrickson, B. L. (2001). The role of positive emotions in positive psychology: The broaden-and-build theory of positive emotion. *American Psychologist*, *56*, 218–226. https://doi.org/10.1037//0003-066x.56.3.218

Granena, G. (2023). Cognitive individual differences in the process and product of L2 writing. *Studies in Second Language Acquisition*, *45*, 765–785. https://doi.org/10.1017/S0272263123000347

Güvendir, E., & Uzun, K. (2023). L2 writing anxiety, working memory, and task complexity in L2 written performance. *Journal of Second Language Writing*, *60*, 101016. https://doi.org/10.1016/j.jslw.2023.101016

Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2010). *Multivariate data analysis* (7th ed.). Prentice Hall.

Hayes, J. R. (1996). A new framework for understanding cognition and affect in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences and applications* (pp. 1–27). Lawrence Erlbaum Associates.

Johnson, M. D. (2017). Cognitive task complexity and L2 written syntactic complexity, accuracy, lexical complexity, and fluency: A research synthesis and meta-analysis. *Journal of Second Language Writing*, *37*, 13–38. https://doi.org/10.1016/j.jslw.2017.06.001

Kellogg, R. T. (1996). A model of working memory in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 57–72). Lawrence Erlbaum Associates.

Kline, R. B. (2023). *Principles and practice of structural equation modeling*. Guilford Publications.

Koo, T. K., & Li, M. Y. (2016). A guideline of selecting and reporting intraclass correlation coefficients for reliability research. *Journal of Chiropractic Medicine*, *15*, 155–163. https://doi.org/10.1016/j.jcm.2016.02.012

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

Kormos, J. (2014). *Speech production and second language acquisition*. Routledge.

Kormos, J. (2023). The role of cognitive factors in second language writing and writing to learn a second language. *Studies in Second Language Acquisition*, *45*, 622–646. https://doi.org/10.1017/S0272263122000481

Kormos, J., & Sáfár, A. (2008). Phonological short-term memory, working memory and foreign language performance in intensive language learning. *Bilingualism*, *11*, 261–271. https://doi.org/10.1017/S1366728908003416

Kormos, J., & Trebits, A. (2012). The role of task complexity, modality, and aptitude in narrative task performance. *Language Learning*, *62*, 439–472. https://doi.org/10.1111/j.1467-9922.2012.00695.x

Kormos, J., & Wilby, J. (2019). Task motivation. In M. Lamb, K. Csizér, A. Henry, & S. Ryan (Eds.), *The Palgrave handbook of motivation for language learning* (pp. 267–286). Springer International Publishing.

Kuiken, F., & Vedder, I. (2008). Cognitive task complexity and written output in Italian and French as a foreign language. *Journal of Second Language Writing*, *17*, 48–60. https://doi.org/10.1016/j.jslw.2007.08.003

Lantolf, J. P., & Swain, M. (2019). On the emotion–cognition dialectic: A sociocultural response to Prior. *Modern Language Journal*, *103*, 528–530. https://doi.org/10.1111/modl.12574

Levelt, W. J. (1989). *Speaking: From intention to articulation*. MIT Press.

Li, C. (2021). A control–value theory approach to boredom in English class among university students in China. *Modern Language Journal*, *105*, 317–334. https://doi.org/10.1111/modl.12693

Li, C. (2024a). Task emotions in L2 writing: A control-value approach from a positive psychology perspective. *Studies in Second Language Learning and Teaching*.

Li, C., & Dewaele, J.-M. (2024). Understanding, measuring, and differentiating task enjoyment from foreign language enjoyment. In S. Li (Ed.), *Individual differences in task-based language learning and teaching* (pp. 87–114). John Benjamins.

Li, C., & Li, W. (2024). The joint contributions of cognitive abilities and emotions to second language writing proficiency. *Modern Foreign Languages*, *4*, 465–477. https://doi.org/10.20071/j.cnki.xdwy.20240523.011

Li, C., Li, W., & Jiang, G. (2024). Emotions in second language learning: Retrospect and prospect. *Modern Foreign Languages*, *1*, 63–75. https://doi.org/10.20071/j.cnki.xdwy.20231027.006

Li, C., Li, W., & Lu, X. (2023). Contributions of foreign language writing emotions to writing achievement. *System*, *116*, 103074. https://doi.org/10.1016/j.system.2023.103074

Li, S. (2023). Working memory and second language writing: A systematic review. *Studies in Second Language Acquisition*, *45*, 647–679. https://doi.org/10.1017/S0272263123000189

Li, S. (2024b). Individual differences and task-based language teaching: Theory, research, and practice. In S. Li (Ed.), *Individual differences in task-based language learning and teaching* (pp. 10–51). John Benjamins.

MacIntyre, P. D. (2017). An overview of language anxiety research and trends in its development. In C. Gkonou, M. Daubney, & J.-M. Dewaele (Eds.), *New insights into language anxiety: Theory, research and educational implications* (pp. 11–30). Multilingual Matters.

Manchón, R. M., McBride, S., Martínez, M. D. M., & Vasylets, O. (2023). Working memory, L2 proficiency, and task complexity: Independent and interactive effects on L2 written performance. *Studies in Second Language Acquisition*, *45*, 737–764. https://doi.org/10.1017/S0272263123000141

Manchón, R. M., & Sanz, C. (2023). Introduction to the special issue on working memory and L2 writing: Implications for SLA individual differences research. *Studies in Second Language Acquisition*, *45*, 599–621. https://doi.org/10.1017/S0272263123000359

Mei, G., Xiao, X., Chen, S., Gou, L., & Li, X. (2021). Reliability and validity of a Chinese version of the automated version of the operation span task. *Journal of Guizhou Normal University (Natural Sciences)*, *4*, 98–103. https://doi.org/10.16614/j.gznuj.zrb.2021.04.014

Michel, M., Kormos, J., Brunfaut, T., & Ratajczak, M. (2019). The role of working memory in young second language learners' written performances. *Journal of Second Language Writing*, *45*, 31–45. https://doi.org/10.1016/j.jslw.2019.03.002

Osaka, M., Yaoi, K., Minamoto, T., & Osaka, N. (2013). When do negative and positive emotions modulate working memory performance? *Scientific Reports*, *3*, 1375. https://doi.org/10.1038/srep01375

Papi, M., Vasylets, O., & Ahmadian, M. J. (2022). Individual difference factors for second language writing. In S. Li, P. Hiver, & M. Papi (Eds.), *The Routledge handbook of second language acquisition and individual differences* (pp. 381–396). Routledge.

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review*, *18*, 315–341. https://doi.org/10.1007/s10648-006-9029-9

Pekrun, R., & Stephens, E. J. (2010). Achievement emotions: A control–value approach. *Social and Personality Psychology Compass*, *4*, 238–255. https://doi.org/10.1111/j.1751-9004.2010.00259.x

Rahimi, M., & Zhang, L. J. (2019). Writing task complexity, students' motivational beliefs, anxiety and their writing production in English as a second language. *Reading and Writing*, *32*, 761–786. https://doi.org/10.1007/s11145-018-9887-9

Révész, A., Kourtali, N., & Mazgutova, D. (2017). Effects of task complexity on L2 writing behaviors and linguistic complexity. *Language Learning*, *67*, 208–241. https://doi.org/10.1111/lang.12205

Robinson, P. (2001). Task complexity, task difficulty, and task production: Exploring interactions in a componential framework. *Applied Linguistics*, *22*, 27–57. https://doi.org/10.1093/applin/22.1.27

Robinson, P. Ed. (2011). *Second language task complexity: Researching the cognition hypothesis of language learning and performance* (Vol. 2). John Benjamins Publishing.

Robinson, P. (2022). The cognition hypothesis and individual difference factors. In S. Li, P. Hiver, & M. Papi (Eds.), *The Routledge handbook of second language acquisition and individual differences* (pp. 3–33). Routledge.

Serafini, E. J., & Sanz, C. (2016). Evidence for the decreasing impact of cognitive ability on second language development as proficiency increases. *Studies in Second Language Acquisition*, *38*, 607–646. https://doi.org/10.1017/S0272263115000327

Shi, L. (2001). Native-and nonnative-speaking EFL teachers' evaluation of Chinese students' English writing. *Language Testing*, *18*, 303–325. https://doi.org/10.1177/026553220101800303

Shin, J., & Hu, Y. (2022). A methodological synthesis of working memory tasks in L2 research. In J. W. Schwieter & Z. Wen (Eds.), *The Cambridge handbook of working memory and language* (pp. 722–745). Cambridge University Press.

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

Swain, M. (2013). The inseparability of cognition and emotion in second language learning. *Language Teaching*, *46*, 195–207. https://doi.org/10.1017/s0261444811000486

Tahmouresi, S., & Papi, M. (2021). Future selves, enjoyment and anxiety as predictors of L2 writing achievement. *Journal of Second Language Writing*, *53*, 100837. https://doi.org/10.1016/j.jslw.2021.100837

Unsworth, N., Heitz, R. P., Schrock, J. C., & Engle, R. W. (2005). An automated version of the operation span task. *Behavior Research Methods*, *37*, 498–505. https://doi.org/10.3758/BF03192720

Vasylets, O., Gilabert, R., & Manchón, R. M. (2017). The effects of mode and task complexity on second language production. *Language Learning*, *67*, 394–430. https://doi.org/10.1111/lang.12228

Vasylets, O., & Marín, J. (2021). The effects of working memory and L2 proficiency on L2 writing. *Journal of Second Language Writing*, *52*, 100786. https://doi.org/10.1016/j.jslw.2020.100786

Wang, Y., & Xu, J. (2023). A latent profile analysis of L2 writing emotions and their relations to writing buoyancy, motivation and proficiency. *Applied Linguistics Review*. https://doi.org/10.1515/applirev-2022-0080

West, S. G., Finch, J. F., & Curran, P. J. (1995). Structural equation models with nonnormal variables: Problems and remedies. In R. H. Hoyle (Ed.). *Structural equation modeling: Concepts, issues, and applications* (pp. 56–75). SAGE.

Zalbidea, J. (2017). 'One task fits all'? The roles of task complexity, modality, and working memory capacity in L2 performance. *Modern Language Journal*, *101*, 335–352. https://doi.org/10.1111/modl.12389

Zhu, X., Guan, Y., & Yao, Y. (2022). Transfer of ideal L1 and L2 writing selves and their impacts on L2 writing enjoyment and integrated writing performance. *Assessing Writing*, *54*, 100674. https://doi.org/10.1016/j.asw.2022.100674

SUPPORTING INFORMATION

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APPENDIX A: WRITING TASKS

Simple Task (Original)

请根据以下提示和要求用英语进行写作:
下学期你可以从表格中的四名同学中选择一名作为你的室友, 你会选谁呢?
下表总结了四名同学的爱好、优点和缺点, 请仔细阅读。
注意, 表中的同学均与你性别相同(即这些姓名既可以是男生的姓名, 也可以是女生的姓名)。

要求:

1) 必须选出一名室友, 并将室友的姓名填在答题纸的空格中;
2) 必须从爱好、优点和缺点三个方面充分说明选择的理由;
3) 字数:超过80词, 不设上限;
4) 写作时间:40分钟。

Simple Task (Translated)

Please read the following instructions and requirements before writing in English:
You are given an opportunity to select one student out of the four candidates as your roommate for the next semester. Who will you choose?
The table below summarizes the hobbies, strength, and weaknesses of the four candidates.
The candidates in the table are of the same gender as you. In other words, the names can be either for boys or for girls.

Instructions:

1) Select one roommate and complete the first sentence in the answer sheet with the name.
2) Write an essay to provide reasons for your choice in terms of the candidate's hobby, strengths, and weaknesses.
3) Word limit: Over 80 words
4) Time limit: 40 minutes

备选同学信息 (Candidates' Information)

姓名 Name	Wang Fei	Zhang Jie	Li Wei	Chen Yue
爱好	看电视	运动	听音乐	玩游戏
Hobby	Watching TV	Doing sports	Listening to music	Playing games
优点	慷慨大方	乐于助人	风趣幽默	善良
Strength	Generous	Ready to help others	Humorous	Kind-hearted
缺点	习惯邋遢	睡觉打呼噜	爱随便用别人东西	喜欢喧哗
Weakness	Have messy habits	Snore during sleep	Like to use others' items without permission	Like to make noises

Complex Task (Original)

请根据以下提示和要求用英语进行写作:
下学期你可以从表格中的六名同学中选择一名作为你的室友, 你会选谁呢?
下表总结了六名同学的爱好、优点、缺点和学习成绩, 请仔细阅读。
注意, 表中的同学均与你性别相同(即这些姓名既可以是男生的姓名, 也可以是女生的姓名)。

要求:

1) 必须选出一名室友, 并将室友的姓名填在答题纸的空格中;
2) 必须从爱好、优点、缺点和学习成绩四个方面充分说明选择的理由;
3) 字数:超过80词, 不设上限;
4) 写作时间:40分钟。

Complex Task (Translated)

Please read the following instructions and requirements before writing in English:
You are given an opportunity to select one student out of the six candidates as your roommate for the next semester. Who will you choose?
The table below summarizes the hobbies, strengths, weaknesses, and the academic performance of the six candidates.
The candidates in the table are of the same gender as you. In other words, the names can be either for boys or for girls.

Instructions:

1) Select one roommate and complete the first sentence in the answer sheet with the name.
2) Write an essay to provide reasons for your choice in terms of the candidate's hobby, strength, weakness, and academic performance.
3) Word limit: Over 80 words
4) Time limit: 40 minutes

备选同学信息 (Candidates' Information)

姓名 Name	Wang Fei	Zhang Jie	Li Wei	Chen Yue	Sun Yu	Huang Zhen
爱好	看电视	运动	听音乐	玩游戏	画画	唱歌
Hobby	Watching TV	Doing sports	Listening to music	Playing games	Drawing	Singing
优点	慷慨大方	乐于助人	风趣幽默	善良	努力	负责
Strength	Generous	Ready to help others	Humorous	Kind-hearted	Hard-working	Responsible
缺点	习惯邋遢	睡觉打呼噜	爱随便用别人东西	喜欢喧哗	晚睡	爱炫耀
Weakness	Have messy habits	Snore during sleep	Like to use others' items without permission	Like to make noises	Go to bed very late	Like to show off
学习成绩	班级前20名	班级倒数第1名	班级前10名	班级20到40名	班级后10名	班级第1名
Academic performance	Top 20 in class	Last one in class	Top 10 in class	Between 20 and 40 in class	Bottom 10 in class	Top one in class

Writing task answer sheet

I choose _____ to be my roommate for the new semester.

_____

_____

_____

_____

_____

APPENDIX B: SCALES FOR TASK ENJOYMENT AND MOTIVATION

说明:请回忆刚才完成的英语写作任务, 阅读以下描述, 并对各条描述进行评分, 评分区间1到9, 分值越高代表越赞成该描述。

Instructions: Please recall the writing task you have just completed, read the following statements, and then give your ratings for each statement. Higher scores from 1 to 9 mean higher levels of agreement.

Task Enjoyment Scale

《任务愉悦量表》	*Task Enjoyment Scale*	Level of agreement
1. 在刚才的任务中, 我很愉快。	I enjoyed the task.	1 2 3 4 5 6 7 8 9
2. 在刚才的任务中, 我收获感很强。	I had a strong sense of accomplishment in the task.	1 2 3 4 5 6 7 8 9
3. 任务过程中, 我很投入。	I was fully engaged in the task.	1 2 3 4 5 6 7 8 9
4. 我积极完成了刚才的作文。	I felt positive during the completion of the essay.	1 2 3 4 5 6 7 8 9
5. 刚才我写得很顺畅。	The writing task was completed very smoothly.	1 2 3 4 5 6 7 8 9

Task Motivation Scale

《任务动机量表》	*Task Motivation Scale*	Level of agreement
1.我希望能在刚才的写作任务中得到高分。	I hope to get high scores on the task.	1 2 3 4 5 6 7 8 9
2. 我不得不听从老师的安排来写刚才的作文。[a]	I completed the task just because the teacher required us to do so.[a]	1 2 3 4 5 6 7 8 9
3. 我还想写这样的作文。	I want to do more tasks like this.	1 2 3 4 5 6 7 8 9

[a]Reverse coding is required.