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Development of a self-regulated learning module for English argumentative writing in China

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ABSTRACT

Undergraduate English as a foreign language (EFL) learners often encounter difficulties in English argumentative writing, particularly in argument organization, idea development, self-regulation, and feedback-based revision. To respond to these challenges, this study aimed to design and develop a self-regulated learning module (SRLM) for English argumentative writing in a Chinese tertiary EFL context. Framed by design and development research and organized through the ADDIE framework, the study drew on multiple sources of evidence, including 364 valid needs analysis questionnaires, five focus group discussions with 28 students, design artifacts, and two rounds of expert review. The needs analysis revealed moderate argumentative writing difficulty, uneven self-regulated learning strategy use, and general openness to automated writing evaluation (AWE) despite concerns about its limitations. In response, the module integrated self-regulated strategy development, the adapted Toulmin model, and AWE-supported revision through sequenced units, learner materials, scaffolding tools, and guided revision procedures. Expert review refined the module's objectives, instructional sequence, modeling, assessment, scaffolding, and AWE use. The study provides design-based evidence for a context-sensitive instructional prototype and a systematic development pathway for tertiary EFL argumentative writing pedagogy.

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1. INTRODUCTION

Argumentative writing is a central component of academic literacy in second language (L2) higher education, because it requires students to express positions, justify claims, evaluate evidence, and respond to alternative viewpoints in a logical and persuasive manner. These abilities are closely related to students' academic success, critical thinking development, and readiness for university-level literacy practices [1], [2]. Within the Chinese English as a foreign language (EFL) context, argumentative writing has become an important instructional and assessment focus, as it is commonly required in international examinations such as TOEFL, IELTS, and the GRE, as well as in high-stakes national assessments, including the National College Entrance Examination, CET-4/6, and TEM-4/8. Nevertheless, it remains a demanding task for many EFL learners. Existing research indicates that many students experience difficulties in constructing focused claims, linking reasons and evidence logically, maintaining coherence across paragraphs, and responding to counterarguments effectively. These difficulties may lead to predictable argument patterns and insufficient depth in argument development [3]–[5]. These difficulties indicate that EFL learners need instructional support. To respond to this problem, the study developed a self-regulated learning module (SRLM) for

English argumentative writing that brings together self-regulated strategy development (SRSD), the adapted Toulmin model, and automated writing evaluation (AWE). Through this integrated design, the module aims to help Chinese EFL learners plan, develop, revise, and reflect on argumentative writing.

Writing is a complex and recursive process in which learners need to generate ideas, organize content, monitor progress, evaluate drafts, and make targeted revisions. In L2 argumentative writing, these demands are intensified because students need to articulate clear viewpoints, substantiate claims with appropriate evidence, and sustain logical reasoning across the whole text. For this reason, self-regulated learning (SRL) has been recognized as a key basis for developing writing skills [6]. In the context of writing, SRL refers to the learner's capacity to establish goals, make plans, track their progress, assess drafts, and manage the revision process [7], [8]. Recent studies have linked SRL to writing performance, writing-related emotions, and self-efficacy, suggesting that students benefit when writing instruction supports both text production and strategic regulation [9]–[11]. However, many SRL studies in L2 writing have focused on learners' strategy use and its relationship with writing performance, while offering less guidance on how SRL can be operationalized as teachable and scaffolded classroom practices for argumentative writing.

To address this strategic dimension of writing, learners need more than general encouragement to regulate their learning; they also need explicit instructional support that makes self-regulation teachable in classroom practice. SRSD meets this instructional requirement by weaving writing strategy instruction into self-regulatory practices, namely goal setting, self-monitoring, self-instruction, and self-evaluation [8], [12], [13]. Its emphasis is not limited to the quality of the final written product; rather, it guides learners to acquire and internalize writing strategies through explicit modeling, scaffolded practice, and structured instructional support [14]. Previous studies have shown that SRSD can strengthen writing performance [15]–[17], text quality [18], [19], self-efficacy [16], [20], [21], motivation [8], [15], [16], and emotional engagement [22], [23]. However, much existing SRSD research has examined intervention effects or writing outcomes, while fewer studies have explored how SRSD principles can be adapted into a classroom-ready module for tertiary EFL argumentative writing.

Argumentative writing instruction also requires a clear framework for making argument structure visible and teachable. The Toulmin model [24] has been widely used to clarify key components of argumentation, but its original formulation may be too abstract for direct classroom use in EFL contexts, especially for novice writers who need more visible and text-based support. Therefore, pedagogically adapted versions of the model may be more suitable for writing instruction. The framework introduced by Qin and Karabacak [4] is of particular relevance to the current study. This framework consists of claim, data, counterargument claim, counterargument data, rebuttal claim, and rebuttal data. This adapted framework turns abstract argumentative principles into more distinct components that students can recognize, rehearse, and implement in their writing. However, although Toulmin-based instruction has been shown to support argumentative structure, evidence use, and counterargument treatment in L2/EFL writing contexts [25], [26], previous studies have paid limited attention to how such instruction can be integrated with self-regulated instruction and feedback-supported revision in a coherent module.

Effective argumentative writing instruction also requires timely support for feedback and revision. The use of AWE in writing instruction has expanded as it enables learners to receive timely formative feedback and engage in repeated revision. However, its pedagogical value becomes more evident when automated feedback is combined with teacher support rather than used in isolation [27]–[30]. Since AWE typically performs better at identifying surface-level errors than at addressing deeper rhetorical features like argument strength, evidence quality, and rebuttal. Consequently, it is best used as a supportive feedback tool rather than an independent teaching solution. Nevertheless, previous AWE research has focused mainly on feedback functions, learner perceptions, and writing outcomes, while less attention has been paid to how automated feedback can be pedagogically embedded within a broader self-regulated writing module.

Taken together, existing research has yet to fully explore how to systematically combine SRSD, adapted Toulmin-based instruction, and AWE feedback into a single, classroom-ready module for tertiary EFL argumentative writing. This lack of integration is problematic not only as a research gap, but also as a practical limitation for classroom instruction. When strategy instruction, argument structure, and feedback mechanisms are treated separately, learners may receive fragmented support, while teachers may need to piece together different instructional resources on their own. Therefore, this study responds to both a theoretical and practical gap by developing a context-sensitive SRLM for tertiary EFL argumentative writing. It offers a systematic design-and-development pathway for integrating SRSD, adapted Toulmin model, and AWE-supported revision in one pedagogically aligned module. The study addressed the following questions:

- What learner needs informed the design of the SRLM for English argumentative writing in a Chinese EFL context?
- How was the SRLM designed by integrating SRL, SRSD, the adapted Toulmin model, and AWE?
- How was the SRLM developed and refined through expert review?

2. METHOD

This section outlines the methodological approach adopted to examine the design and development of the SRLM for English argumentative writing in a Chinese EFL context. It describes the research design, context, participants, data sources, procedures, data collection instruments, data analysis, and ethical considerations. These methodological elements clarify how multiple sources of design-based evidence were used to support the development and refinement of the module.

2.1. Research design

A design and development research (DDR) approach was employed to support the systematic development of an SRLM for English argumentative writing in a Chinese EFL context. This approach was appropriate because the study sought to design, develop, and refine an instructional module through theoretical guidance and contextual evidence [31]. To operationalize the DDR process, the study adopted the ADDIE framework as an instructional design guide. ADDIE was selected because it provided an organized pathway from identifying learner needs to designing instructional features and developing module materials [32]. DDR established the methodological orientation of the study, whereas ADDIE served as the practical framework for organizing the module development procedures.

Importantly, this study was positioned as a development-focused design and development study rather than an effectiveness study. Its primary purpose was to design, develop, and refine an instructional module based on learner needs, theoretical foundations, design artifacts, and two rounds of expert review. Therefore, the study sought to generate design-based evidence regarding the relevance, coherence, feasibility, and pedagogical value of the module, rather than to test its causal effects on students' writing performance or SRL development. Accordingly, the present article is limited to the development-oriented phases of the study, covering needs analysis, instructional design, module development, and expert-informed refinement.

2.2. Context, participants, and data sources

This study was conducted in the context of tertiary EFL education in Sichuan Province, China, and targeted undergraduate students majoring in English. The needs analysis consisted of 364 valid questionnaire responses and five focus group discussions with 28 students. These data were used to identify students' argumentative writing difficulties, SRL strategy use, AWE-related perceptions, and instructional support needs.

Student participants were selected through purposive sampling because the study aimed to develop an instructional module for a clearly defined learner group. Eligible participants were English-major undergraduates who had prior experience in English writing or argumentative writing courses and were therefore able to provide relevant information for the needs analysis. Students outside this target learner group were excluded from the valid sample. Focus group participants were selected from the same learner population to further explain the questionnaire findings.

Expert review was conducted in two stages to evaluate and refine the emerging module. Eight experts participated in the design-phase review, and 10 experts participated in the development-phase review. They were purposively selected according to their expertise in EFL writing instruction, curriculum and pedagogy, instructional design, educational technology, or educational measurement. All expert reviewers had more than 15 years of teaching, research, or professional experience.

2.3. Procedure

The development of the SRLM followed three processes: needs analysis, instructional design, and development. The needs analysis provided the empirical basis for the module by identifying learners' argumentative writing challenges, SRL strategy use, and instructional support needs. These findings were subsequently transformed into design requirements for the SRLM [31]. In accordance with the ADDIE framework, the analysis stage identified the target learners, defined their writing-related challenges, and translated these needs into pedagogical priorities and design requirements for the module [32], [33].

Second, the design stage established the conceptual framework and instructional blueprint of the SRLM. The needs analysis findings, together with the theoretical foundations of SRSD, the adapted Toulmin model, and AWE, were used to define the module's objectives, instructional components, learning activities, scaffolds, and feedback procedures. Expert comments on the initial blueprint then guided further revision.

Third, the development stage transformed the revised blueprint into a concrete SRLM prototype consisting of instructional materials, learner supports, and learning activities. Expert feedback was used formatively to refine the prototype by enhancing its clarity, pedagogical coherence, and appropriateness for the target learners. Pilot activities were also undertaken to examine the clarity and feasibility of the instruments and preliminary materials.

2.4. Data collection instruments

The study used three types of data collection instruments: a needs analysis questionnaire, a semi-structured focus group discussion protocol, and two expert review forms. The needs analysis questionnaire was used to examine students' learning needs related to English argumentative writing, SRL strategy use, and readiness to use AWE. It consisted of four sections: background information (11 items), argumentative writing (13 items), SRL strategies (35 items), and AWE tool usage (3 items). The argumentative writing section measured three constructs: content development, structural organization, and language use. The SRL strategies section was adapted from Teng's [34] writing-related SRL framework and covered nine constructs: text processing, knowledge rehearsal, idea planning, goal-oriented monitoring, peer learning, feedback processing, interest enhancement, motivational self-talk, and emotion regulation. The AWE tool usage section examined students' previous experience with and willingness to use AWE tools. The questionnaire used five-point response scales to capture students' perceived writing difficulties and reported strategy use.

The semi-structured focus group discussion protocol was used to obtain more detailed explanations of the questionnaire findings. It consisted of 14 guiding questions covering students' experiences with English argumentative writing, perceived writing difficulties, SRL practices, feedback experiences, perceptions of AWE tools, and expectations for instructional support. Five focus group discussions were conducted with 28 students, and each session lasted approximately 45 to 60 minutes. Two expert review forms were used to evaluate and refine the SRLM in the design and development phases. Both forms included five-point Likert-scale items, together with open-ended comment sections for formative feedback. The design-phase expert review form evaluated four dimensions: completeness of module design, appropriateness and necessity of the design components, alignment and coherence among components, and feasibility of the proposed design. The development-phase expert review form evaluated five dimensions: content design, integration of SRSD and the adapted Toulmin model, SRL integration, practicality and pedagogical value, and clarity and presentation.

Several procedures were adopted to strengthen instrument validity and procedural clarity. The student questionnaire was translated into Chinese and reviewed by two experienced English teachers to ensure linguistic clarity, cultural appropriateness, and contextual alignment. The questionnaire items and expert review criteria were developed or adapted based on the study objectives, relevant literature, and the conceptual framework of the SRLM. Pilot activities were also conducted before formal data collection to examine item clarity, comprehension, and procedural feasibility.

2.5. Data analysis

Quantitative data from the needs analysis questionnaire and expert review forms were analyzed using descriptive statistics. For the needs analysis questionnaire, means, standard deviations, and percentages were used to identify students' perceived argumentative writing difficulties, SRL strategy use, AWE-related experience, and willingness to use AWE tools. For the expert review forms, mean scores were used to summarize experts' judgements of the module design and developed prototype across the relevant evaluation dimensions. As part of instrument checking, the reliability and construct validity of the questionnaire were examined using Cronbach's alpha and exploratory factor analysis, including KMO and Bartlett's tests. The needs analysis questionnaire demonstrated high internal consistency, with Cronbach's alpha values of .919 for the argumentative writing section and .939 for the SRL section.

Qualitative data from the focus group discussions and open-ended expert comments were analyzed thematically. The focus group discussions were audio-recorded, transcribed, and repeatedly reviewed to identify recurring patterns. The thematic analysis moved from meaningful excerpts to initial codes, categories, subthemes, and final themes. For the needs analysis focus groups, themes were generated around students' perceived importance of argumentative writing, writing difficulties, existing SRL practices, barriers to self-regulated writing, perceptions of AWE, and expectations for instructional support. Open-ended expert comments were analyzed to identify suggestions and revision points.

To enhance trustworthiness, the thematic analysis was conducted through a coder-checking process. The first author initially coded the qualitative data, and a second coder independently reviewed a sample of the coded data and emerging themes. Any discrepancies were discussed and resolved through refinement of the code labels, categories, and theme descriptions. The coding process was further strengthened through repeated review of transcripts, comparison of coded excerpts, and review of categories and themes. Credibility was strengthened by comparing patterns across focus groups and triangulating qualitative findings with questionnaire results. Dependability was supported through an audit trail documenting the progression from data collection and transcription to coding, categorization, theme development, interpretation, and design implications.

Questionnaire and focus group findings were triangulated to identify convergence, complementarity, and expansion across data sources. These integrated findings were then interpreted as design requirements.

Expert review findings were also analyzed formatively to refine the objectives, modeling procedures, assessment design, scaffolding tools, task instructions, and AWE-supported revision procedures.

2.6. Ethical considerations

This study involved human participants and was conducted in accordance with ethical standards for educational research. Participation in the questionnaire survey, focus group discussions, and expert review activities was voluntary, with informed consent obtained prior to data collection. Participants were informed of the study purpose, procedures, and their right to refuse or withdraw from participation at any stage without penalty. To protect privacy, confidentiality and anonymity were maintained throughout the study, and the collected data were used solely for academic purposes.

3. RESULTS AND DISCUSSION

This section presents the results and discussion of the design and development of the SRLM. It reports the needs analysis findings, explains the integrated design of the module, describes its development as an instructional prototype, and discusses how expert review supported its refinement. Together, these findings show how learner needs, theoretical foundations, design decisions, and expert feedback shaped the final module.

3.1. Needs analysis and implications for module design

This section reports the needs analysis findings that informed the design of the SRLM. Drawing on questionnaire and focus group data, it identifies students' major challenges in argumentative writing, their uneven use of SRL strategies, their perceptions of AWE-supported feedback, and their preferred instructional conditions. These findings are interpreted in relation to the design decisions made in the subsequent module development.

3.1.1. Argumentative writing difficulties

The questionnaire findings showed that students experienced a moderate level of difficulty across content development, structural organization, and language use. Since the argumentative writing section used a five-point scale from 1=very difficult to 5=not difficult at all, lower mean scores indicated greater perceived difficulty. Among the three dimensions, structural organization (M=3.106) recorded the lowest mean score, followed by content development (M=3.220), whereas language use (M=3.256) was perceived as slightly less difficult. This suggests that students' writing difficulties were not limited to sentence-level language problems, but were closely related to organizing ideas, developing content, and constructing coherent argumentative texts [35], [36].

The focus group findings further clarified the nature of these difficulties. Students reported problems in claim construction, evidence use, logical organization, and academic expression. Some students could state a general position but found it difficult to make the claim specific, deep, or persuasive. Others struggled to select convincing evidence or connect examples clearly to the main argument. These findings indicate that argumentative writing requires not only linguistic accuracy but also rhetorical judgement, logical reasoning, and strategic control [37]. Therefore, the SRLM needed to provide explicit and scaffolded support for argumentative writing, especially through instruction on claims, data, reasoning, counterarguments, and rebuttals. This justified the use of the adapted Toulmin framework as a structural basis for making argumentative elements more visible and teachable.

3.1.2. Uneven use of SRL strategies

The needs analysis also revealed an uneven pattern of students' SRL strategy use. The questionnaire results showed that feedback processing (M=4.060) was the strongest reported SRL behavior, followed by motivational self-talk and idea-planning strategies. In contrast, goal-oriented monitoring (M=3.180) recorded the lowest mean score, followed by peer learning and knowledge rehearsal. This indicates that students were relatively more capable of responding to feedback and maintaining motivation than of monitoring and regulating their writing systematically during the writing process [34], [38].

The focus group findings provided further explanation. Students reported using some SRL practices, such as setting smaller goals, outlining before writing, checking whether paragraphs supported the main point, searching for examples, and encouraging themselves during difficult tasks. However, these practices were often partial and unsystematic. Some students reported losing direction during writing even when they began with a plan, while others found it difficult to evaluate the quality of their own writing accurately. Emotional barriers, such as low scores, repeated mistakes, and comparison with peers, also affected their confidence and persistence [39]. These findings suggest that SRL should not be treated as a stable learner trait, but as a set of teachable writing practices that require explicit instructional support [34], [40].

Accordingly, the SRLM needed to include goal-setting forms, writing process checklists, reflection sheets, and guided revision tasks to support planning, monitoring, self-evaluation, and revision.

3.1.3. Perceptions of AWE and feedback needs

The questionnaire findings showed that students had some readiness for AWE-supported writing. Specifically, 56.0% of the respondents had previously used an AWE tool, whereas 44.0% had not, indicating that AWE integration would not be entirely unfamiliar to many students. In terms of willingness, 36.8% of the students reported being willing and 22.0% very willing to use an AWE tool, while 37.1% selected neutral. Only a small proportion reported being unwilling (3.8%) or very unwilling (3.0%). These findings suggest that students were generally open to AWE use, but the relatively large neutral group also indicates that their acceptance would likely depend on how the tool was introduced, guided, and integrated into classroom practice [41].

The focus group findings further showed that students viewed AWE as useful but limited. They appreciated its speed and convenience in identifying surface-level problems such as grammar, spelling, and punctuation. However, they also questioned its usefulness for higher-order aspects of argumentative writing, including logical progression, content development, argument quality, and intended meaning. This is consistent with previous research suggesting that AWE is more effective when used as formative support rather than as a complete substitute for teacher feedback [27], [42]. Therefore, AWE was positioned in the SRLM as a supplementary revision tool. The module needed to guide students to interpret automated feedback critically, prioritize revision issues, and combine AWE feedback with teacher and peer feedback. Overall, the needs analysis generated three major design requirements: explicit support for argumentative structure, scaffolded SRL support, and guided AWE-supported revision. Table 1 summarizes how these findings were translated into SRLM design decisions.

Table 1. Linkage between needs analysis findings and SRLM design decisions

Key finding	Interpretation	SRLM design decision
Students experienced difficulties in argumentative structure, claim construction, evidence use, logical organization, and academic expression.	Students needed explicit and scaffolded support for rhetorical structure and reasoning.	Adapted Toulmin-based instruction was included to support claims, data, counter arguments, rebuttals, evidence use, and logical organization.
Students' SRL strategy use was uneven, especially in monitoring, self-evaluation, and sustained regulation during writing.	SRL needed to be made more visible, systematic, and actionable.	Goal-setting forms, writing process checklists, reflection sheets, monitoring prompts, and guided revision tasks were developed.
Students were generally open to AWE but viewed it as limited for logic, content, and argument quality.	AWE needed to be pedagogically guided rather than used as a stand-alone evaluator.	AWE was integrated as a supplementary revision tool combined with teacher and peer feedback.

3.2. Integrated design of the SRLM

Building on the needs analysis findings, the design phase specified how the SRLM would support argumentative writing, SRL, and feedback-based revision. This section presents the integrated design of the module from three interrelated aspects: its theoretical and conceptual framework, its learning objectives and content framework, and its core instructional strategies and learning activities. Together, these aspects show how learner needs were translated into a coherent instructional design.

3.2.1. Theoretical and conceptual framework

At the theoretical level, the SRLM was grounded in SRL, social cognitive theory (SCT), and cognitive load theory (CLT). SRL served as the overarching learning orientation because argumentative writing requires learners to set goals, plan, monitor, revise, and evaluate their writing across recursive stages of composition [34], [43]. SCT informed the use of teacher modeling, guided practice, observational learning, and confidence-building support, as students need opportunities to observe writing strategies, practice them with scaffolding, and gradually strengthen self-efficacy [44], [45]. CLT informed the sequencing of tasks and materials so that complex argumentative writing skills could be introduced progressively and supported through manageable learning steps [46].

At the instructional level, the SRLM integrated SRSD, the adapted Toulmin model, and AWE. SRSD was adopted as the main instructional framework because it connects explicit strategy instruction with self-regulatory procedures such as goal setting, self-monitoring, self-instruction, and self-evaluation [13], [18]. The adapted Toulmin model proposed by Qin and Karabacak [4] provided the structural framework for argumentative writing by making claims, data, counterargument claims, counterargument data, rebuttal claims, and rebuttal data more visible and teachable. AWE was incorporated into the framework to provide

timely feedback during revision, particularly on language-related issues, while higher-order aspects of argument development continued to require human mediation [28].

Taken together, these elements formed the theoretical and conceptual framework of the SRLM. As shown in Figure 1, the framework positioned SRL, SCT, and CLT as the broader theoretical grounding of the module, while SRSD, the adapted Toulmin model, and AWE functioned as its principal instructional components. This figure also clarifies the functional distinction among the components: SRL, SCT, and CLT explain the broader learning and design rationale, whereas SRSD, the adapted Toulmin model, and AWE show how this rationale was operationalized in classroom instruction.

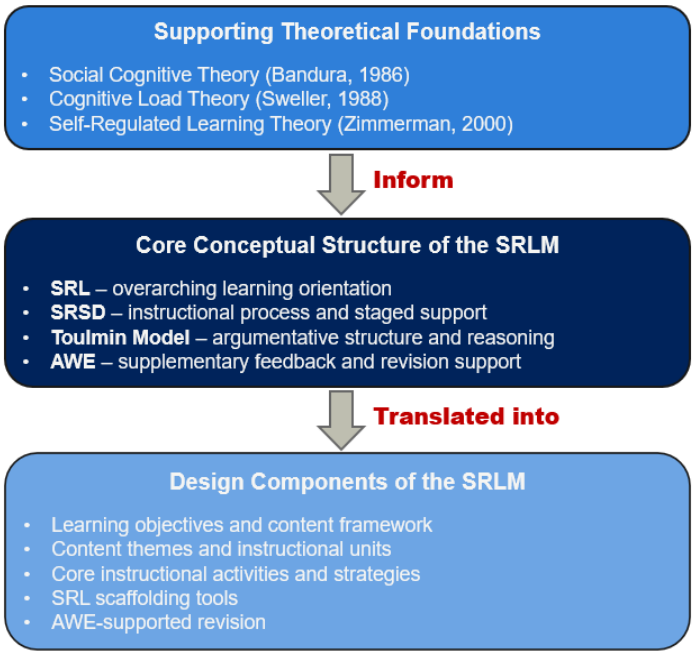


Figure 1. Theoretical and conceptual framework of the SRLM

3.2.2. Learning objectives and content framework

A second output of the design phase was the formulation of learning objectives and a structured content framework. The objectives were developed in response to the needs analysis findings, especially students' difficulties in argumentative structure, content development, SRL strategy use, and feedback-based revision. To make the objectives more closely connected to self-regulated writing, the design drew on Teng's framework [34] and organized the objectives around four dimensions: cognition, metacognition, social behavior, and motivational regulation [47].

At the cognitive level, the SRLM aimed to develop students' knowledge and skills in argumentative writing, including argumentative organization, claim construction, evidence use, counterarguments, rebuttals, logical reasoning, academic sentences, and rhetorical effectiveness. At the metacognitive level, it aimed to strengthen students' ability to plan before writing, monitor during drafting, and evaluate and revise after feedback. At the social behavior level, the module incorporated discussion, peer feedback, group tasks, and oral debate to support socially mediated learning. At the motivational regulation level, it sought to enhance students' confidence, persistence, and engagement through staged practice, meaningful tasks, and scaffolded participation.

The content framework was organized through 10 instructional units grouped under four broader themes: foundational orientation, global argument structure, argument development and reasoning, and language accuracy and rhetorical enhancement. Table 2 shows how the learning objectives were aligned with the four SRL dimensions, argumentative writing components, and corresponding design features of the SRLM. Table 3 presents the 10 instructional units organized under four broader themes, reflecting the progressive logic of the module design from initial orientation and macro-structure to more advanced work on reasoning, rebuttal, and rhetorical refinement. The framework also incorporated a learner-informed design decision by including an oral debate task as a culminating activity, reflecting students' interest in argument-focused oral engagement.

Table 2. Alignment of SRL dimensions, learning objectives, and argumentative writing components

SRL dimension	Learning focus	Writing/argumentative focus	Corresponding module design features
Cognition	Develop argumentative writing knowledge and skills	Organization, claims, data, counter arguments, rebuttals, language accuracy, rhetorical effectiveness	Explicit instruction, adapted Toulmin-based tasks, unit progression
Metacognition	Plan, monitor, evaluate, and revise writing	Pre-writing, drafting, revising, feedback-based revision	Goal-setting forms, checklists, reflection sheets
Social behavior	Engage in peer interaction and collaborative meaning-making	Discussion, peer review, oral debate, feedback exchange	Group tasks, whole-class discussion, peer feedback
Motivational regulation	Sustain confidence, effort, and engagement	Persistence in revision, confidence building, constructive response to feedback	Scaffolded participation, meaningful tasks, oral debate, sequenced support

Table 3. Overview of content themes and instructional units in the SRLM

Themes	Units
Theme 1: Foundational orientation	Unit 1: Understanding the SRLM and the structure of argumentative writing
Theme 2: Global argument structure	Unit 2: Building strong introductions and conclusions
	Unit 3: Crafting effective claims
Theme 3: Argument development and reasoning	Unit 4: Supporting claims with data
	Unit 5: Using core argumentation methods
	Unit 6: Developing counterargument claims and data
	Unit 7: Constructing rebuttal claims and data
Theme 4: Language accuracy and rhetorical enhancement	Unit 8: Avoiding logical fallacies
	Unit 9: Writing effective and academic sentences
	Unit 10: Enhancing writing through figures of speech

3.2.3. Core instructional strategies and learning activities

The third output of the design phase was the formulation of core instructional strategies and learning activities. These included explicit knowledge explanation, teacher guidance and modeling, guided practice, varied writing tasks, visual and procedural scaffolds, goal-setting and reflection tools, and AWE-supported revision. Together, these strategies operationalized the theoretical and content framework of the SRLM in classroom practice.

Explicit knowledge explanation was included to clarify key argumentative concepts, writing procedures, and SRL strategies. Teacher modeling was used to demonstrate how claims are developed, evidence is selected, opposing views are addressed, and drafts are revised strategically [48]. Guided practice then supported students' gradual movement from teacher-supported learning to more independent writing through tasks such as analyzing model texts, revising weak claims, matching claims with evidence, identifying logical fallacies, developing counterarguments, and improving sentence clarity.

Varied task formats were also included to balance independent learning with selective collaboration. Individual planning, drafting, reflection, and revision tasks responded to students' preference for independent learning, while group discussion, peer feedback, whole-class activities, and oral debate provided opportunities for idea exchange and socially mediated regulation. Visual and procedural scaffolds, including graphic organizers, templates, checklists, goal-setting forms, and reflection sheets, were designed to make both argument structure and SRL processes more visible and manageable [43]. Finally, AWE-supported revision was incorporated into the feedback sequence to help students notice language problems and make draft-based revisions. Its use was connected to teacher and peer feedback so that automated suggestions could be interpreted within a broader writing improvement process. Table 4 summarizes the core instructional activities and strategies. In summary, these strategies ensured alignment among SRL development, SRSD-based instruction, adapted Toulmin-based argumentative writing, and guided AWE-supported revision.

3.3. Development of the SRLM as an instructional prototype

The development phase translated the integrated design into a classroom-ready prototype. Four main outputs were developed: sequenced instructional units, instructional and learner materials, SRL scaffolding tools, and AWE-integrated revision support. This development process reflected the ADDIE logic of converting design principles into usable instructional materials and support tools [31], [32].

3.3.1. Instructional units

The 10 instructional units translated the content framework into teachable classroom sequences. Each unit specified an instructional focus, task sequence, and expected output, allowing explanation, guided practice, writing tasks, and reflection to be organized progressively. The units moved from foundational

understanding of argumentative writing to more focused work on introductions, claims, evidence, reasoning, counterarguments, rebuttals, logical fallacies, academic sentences, and rhetorical enhancement.

Table 4. Core instructional activities and strategies in the SRLM

Instructional component	Description	Intended SRL support	Intended writing support
Explicit knowledge explanation	Direct explanation of concepts, structures, and writing procedures	Builds awareness of strategies and process	Clarifies argumentative concepts and writing expectations
Teacher guidance and modeling	Demonstration of writing moves and strategy use	Supports observation and guided uptake	Shows practical application of Toulmin elements and writing procedures
Guided practice	Scaffolded tasks during pre-writing, drafting, and revising	Supports planning, monitoring, and adjustment	Develops step-by-step writing competence
Varied writing tasks	Individual, group-based, and whole-class activities	Encourages active engagement and socially mediated regulation	Repeated practice in argumentative writing
Visual and procedural scaffolds	Graphic organizers, templates, checklists	Supports planning, monitoring, and reflection	Helps structure ideas and improve coherence
Goal-setting and reflection tools	Forms for goal setting and self-reflection	Makes SRL more explicit	Strengthens revision and self-evaluation
AWE-supported revision	Use of automated feedback with teacher/peer support	Supports feedback processing and prioritization	Improves revision quality and language accuracy

3.3.2. Instructional and learner materials

The instructional and learner materials consisted of learner-facing explanations, guided worksheets, structured task instructions, writing activities, revision prompts, and examples related to argumentative writing. These materials clarified lesson purposes, task procedures, and expected outputs for both teachers and students. They also provided concrete support for students as they moved through planning, drafting, revising, and reflecting activities.

3.3.3. SRL scaffolding tools

The SRL scaffolding tools were developed to make planning, monitoring, reflection, and self-evaluation more visible during writing. At the whole-module level, a short-term goal-setting form helped students maintain broader learning direction. At the unit level, writing process checklists and learning goal and reflection forms supported students' regulation of specific writing tasks. To illustrate how SRL scaffolding was operationalized in the prototype, Table 5 presents an excerpt from the fixed core writing process checklist used across the instructional units.

Table 5. Example excerpt from the core writing process checklist

Writing stage	Checklist item	Intended SRL function
Planning	I understand the writing task and requirements.	Task understanding
Planning	I have set a clear goal for this writing task.	Goal setting
Drafting	Each paragraph has a clear purpose related to my main position.	Monitoring coherence
Drafting	I provide reasons or support for my position.	Argument development
Revising	I revise content and logic before focusing on grammar.	Strategic revision
Reflecting	I can identify the strongest part of my writing.	Self-evaluation

3.3.4. AWE-integrated revision support

Pigai was incorporated as a supplementary feedback tool to support students' draft revision. The AWE-integrated revision support included prompts that guided students to check automated suggestions, decide which feedback to accept, compare successive drafts, and identify issues requiring teacher or peer discussion. In this way, AWE use was developed as a guided revision procedure rather than a stand-alone tool-use activity.

3.4. Expert review and refinement

Expert review was conducted in two rounds to evaluate and refine the SRLM. The design-phase review examined the conceptual blueprint of the module, while the development-phase review examined the classroom-ready prototype. Expert judgement is often used to examine the quality, coherence, feasibility, and instructional value of an emerging educational product before classroom implementation [31], [33], [49].

3.4.1. Design-phase expert review

In the design phase, eight experts reviewed the proposed SRLM blueprint. The review focused on four dimensions: completeness of module design, appropriateness and necessity of the design components, alignment and coherence among components, and feasibility of the proposed design. The quantitative ratings indicated positive expert evaluation, with mean ratings across the four dimensions ranging from 4.13 to 4.88.

The experts recognized the relevance of the major design components, including the learning objectives, content themes, 10-unit structure, SRL strategies, SRSD stages, the adapted Toulmin model, AWE-supported feedback workflow, teaching and learning activities, assessment framework, and contextual adaptation for Chinese university EFL learners. They also identified several areas for refinement. These included making the unit structure more manageable, clarifying primary and auxiliary learning goals, strengthening the "Model It" component with demonstration paragraphs, making formative assessment more systematic, revising learning objectives with observable verbs, and specifying expected outputs for each unit.

3.4.2. Development-phase expert review

In the development phase, 10 experts reviewed the developed SRLM prototype. The review examined the instructional units, learner materials, SRL scaffolding tools, and AWE-integrated revision support. The quantitative ratings again indicated generally positive evaluation, with mean ratings across the evaluation dimensions ranging from 3.89 to 5.00.

The experts considered the developed prototype pedagogically promising and suitable for further implementation. They noted that the instructional units provided a clearer teaching sequence, the learner materials clarified task procedures, the SRL tools supported planning and reflection, and the AWE-integrated revision support offered a practical way to incorporate automated feedback into writing instruction. They also recommended clearer task instructions, simpler and better-aligned scaffolding tools, and more explicit guidance on how students use AWE feedback.

Taken together, the two rounds of expert review strengthened both the pedagogical coherence and practical usability of the SRLM. The design-phase review refined the conceptual blueprint, while the development-phase review improved the clarity and manageability of the classroom-ready prototype. Through expert-informed refinement, the module became clearer in its objectives, more coherent in its instructional sequence, more explicit in its modeling and assessment procedures, and more manageable in its scaffolding and AWE-supported revision. From an SRL perspective, students needed support for goal setting, planning, monitoring, revision, and reflection, indicating that they required help in regulating the whole writing process. From an SRSD perspective, students' difficulties with idea organization, strategy use, and revision highlighted the need for explicit strategy instruction, teacher modeling, scaffolded practice, and gradual transfer of responsibility. From the perspective of the adapted Toulmin model, weaknesses in claim development, evidence use, reasoning, and rebuttal showed the need for an argumentative framework that makes argument logic visible to learners. From an AWE perspective, students' conditional openness to automated feedback indicated that technology-supported feedback should be embedded within guided revision rather than used as an independent evaluator. These connections explain why the developed SRLM integrates SRL-oriented learning cycles, SRSD-based strategy instruction, adapted Toulmin-based argument planning, and AWE-supported revision within one coherent pedagogical design.

3.5. Theoretical contribution

This study contributes to the theoretical development of self-regulated writing instruction by integrating SRL, SRSD, the adapted Toulmin model, and AWE-supported feedback within a Chinese EFL argumentative writing context. It extends SRSD-informed writing instruction by showing how self-regulatory processes, including goal setting, strategic planning, monitoring, revision, and reflection, can be operationalized through a structured module. By incorporating the adapted Toulmin model, the study links self-regulation not only to writing processes but also to the development of argument quality. In addition, the use of AWE shows how technology-mediated feedback can support learners' monitoring and self-evaluation, thereby enriching SRL-based writing pedagogy.

4. CONCLUSION

This study provides a development-focused account of how an SRLM can be designed and refined to support English argumentative writing and SRL in a Chinese EFL context. Drawing on learner needs analysis, theoretical grounding, design artifacts, and two rounds of expert review, the study demonstrates how empirical needs, pedagogical theory, and expert-informed refinement can be combined to develop a classroom-ready instructional prototype. The findings indicate that the SRLM responds to learners' difficulties in argumentative writing and self-regulated writing. By combining SRL-oriented learning cycles,

SRSD-based strategy instruction, adapted Toulmin-based argument planning, and AWE-supported revision, the module provides a coherent instructional prototype for Chinese tertiary EFL writing contexts. Expert review further supported its pedagogical relevance and helped refine its clarity, coherence, feasibility, scaffolding, assessment, and feedback procedures.

Theoretically, the study contributes a conceptual pathway for connecting self-regulation, strategy instruction, argumentation support, and technology-mediated feedback in L2 argumentative writing. Practically, the SRLM offers structured lesson procedures, SRSD-based writing strategies, Toulmin-based argument planning, AWE-supported feedback use, revision activities, and reflective tasks that can be embedded into regular English writing courses. Teachers can implement the module through repeated writing cycles in which students set goals, plan arguments with Toulmin-based checklists, draft essays, interpret AWE feedback, revise their texts, and reflect on their strategy use. Institutions may also adopt the module in English writing courses, writing centers, or teacher training workshops, supported by shared lesson plans and technology-enhanced feedback resources.

This study also has methodological and contextual limitations. Methodologically, it was designed as a module development study. Therefore, the findings provide design-based evidence of the module's relevance, coherence, feasibility, and pedagogical value, but they do not demonstrate causal effects on students' argumentative writing performance, SRL strategies, motivation, or revision behavior. Contextually, the SRLM was developed with particular attention to Chinese EFL learners, especially English-major students in the Sichuan higher education context. Its applicability to other regions, non-English-major students, different proficiency levels, or other educational settings should therefore not be assumed without further investigation. Future studies should implement the SRLM in diverse classroom contexts and empirically test its effectiveness through classroom implementation, quasi-experimental designs, longitudinal studies, or mixed-method research.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

CONFLICT OF INTEREST STATEMENT

Authors state no conflict of interest.

INFORMED CONSENT

We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL

The research related to human use has been complied with all the relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration and has been approved by the authors' institutional review board or equivalent committee.

DATA AVAILABILITY

The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request. The data are not publicly available because they contain information that could compromise the privacy of research participants.

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