



Exploring the Feasibility of Applying the CER Framework to High School English Writing Instruction: Evidence from a *Sports and Fitness* Thematic Context

Xiaobo Zhao, Peng Liu*

School of Foreign Language, Kunming University, Kunming, China

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Corresponding Author

Peng Liu*

Email: alvin173@163.com

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Abstract

High school English writing instruction faces persistent structural challenges, including vague argumentation, unorganised evidence, and broken reasoning chains. Existing pedagogical frameworks—process writing, genre-based pedagogy, and reading-writing integration—share a systemic gap in scaffolding students' argumentative logic. This paper conducts a theoretical investigation into the feasibility of integrating the Claim-Evidence-Reasoning (CER) framework into high school English writing instruction, using a *Sports and Fitness* thematic context drawn from the national PEP-A textbook series as an illustrative case. Drawing on a systematic review of recent empirical literature, the paper first examines the theoretical alignment between CER's three components and the core competences demanded by high school argumentative writing, demonstrating that Claim corresponds to thesis clarity, Evidence to the organisation of supporting details, and Reasoning to logical coherence and development. A three-stage instructional model (pre-writing, while-writing, post-writing) is then elaborated to operationalise the framework across the writing process. Pedagogical tools—including a Claim generation protocol, evidence classification scaffolds, Reasoning sentence starters, and a CER-aligned analytic rubric—are proposed and illustrated with topic-specific examples. The paper further discusses the complementarity of CER with existing frameworks, its comparative advantage over the Toulmin model in secondary school contexts, and its practical limitations with respect to genre range and grade level. The study contributes to the emerging body of cross-disciplinary research on CER and provides a theoretically grounded, practically operable blueprint for subsequent empirical investigation.

Keywords

Argumentation; Critical thinking; CER framework; EFL pedagogy; High school English writing

1. Introduction

Writing proficiency in English as a Foreign Language (EFL) settings is widely regarded as the most complex and cognitively demanding of the four macro-skills, not only because it draws on the full breadth of language knowledge but because it simultaneously requires structured reasoning, rhetorical awareness, and the strategic organisation of ideas into a coherent discourse (Grabe & Kaplan, 1996, as cited in Dong & Zhang, 2023). In the Chinese high school

context, English writing—particularly argumentative and expository genres—occupies a central position in both the national curriculum and high-stakes assessment. The Ordinary High School English Curriculum Standards (Ministry of Education of China, 2020) explicitly specify written argumentation as a key dimension of students' core literacy, requiring them to articulate clear positions, deploy relevant and credible evidence, and construct logically sound reasoning chains.

Despite this policy emphasis, empirical research consistently documents deep-seated argumentative deficiencies in Chinese high school students' English writing. Huang and Li (2022) conducted a corpus-based analysis of 240 argumentative essays produced by upper-secondary EFL learners and found that 71% exhibited what they termed 'evidence stacking without reasoning'—a pattern in which students juxtapose multiple pieces of evidence without providing any logical explanation connecting that evidence to the stated claim. Zhang et al. (2023) corroborated this finding through qualitative interviews with 28 experienced high school English teachers across five provinces, all of whom identified 'the inability to transform evidence into argument' as the single most common and most persistent weakness in their students' writing. These findings collectively point to a structural gap at the level of argumentation—specifically, in the metacognitive skill of reasoning, which bridges the gap between data and conclusion.

The theoretical roots of this problem are traceable, in part, to the instructional frameworks that dominate high school English writing pedagogy. Process writing pedagogy, which foregrounds recursive drafting and revision, has been shown to improve content richness and engagement but provides no structural guidance on argumentation logic (Gu & Wang, 2021). Genre-based pedagogy attends to textual conventions and schematic structures but tends to treat logical development as a surface-level formatting concern rather than a deep reasoning skill (Lin, 2022). Reading-writing integration, which leverages input texts as models for output production, likewise lacks dedicated scaffolding for the reasoning process (Dong & Zhang, 2023). The cumulative result is a pedagogical environment in which students are provided with rich linguistic input and structural templates yet remain without explicit guidance on how to reason argumentatively in writing.

The Claim-Evidence-Reasoning (CER) framework, originally developed for science education by McNeill and Krajcik (2012), offers a theoretically promising response to this gap. The framework's three components—a focused, contestable Claim; relevant, sufficient, and credible Evidence; and explicit Reasoning that articulates the logical connection between Evidence and Claim—map directly onto the argumentative competences that high school EFL writing demands. Crucially, the Reasoning component, which requires students to explain why evidence supports a claim rather than merely presenting it, directly targets the 'evidence stacking' problem identified in recent empirical research (Huang & Li, 2022; Zhang et al., 2023). A growing body of work has demonstrated the effectiveness of CER training in developing argumentative writing quality in science contexts (Sampson et al., 2021; Choi & Hand, 2022) and has begun to explore its cross-disciplinary applicability (Colley & Windschitl, 2021; Li & Chen, 2023), yet no systematic theoretical account exists of how CER might be operationalised specifically within high school EFL writing instruction.

This paper addresses that gap through a theoretically grounded feasibility analysis guided by three research questions:

RQ1: To what extent does the CER framework align theoretically with the core competence

demands of high school English argumentative writing?

RQ2: What pedagogical pathways can operationalise the CER framework across the high school English writing process?

RQ3: How can the CER framework be concretely instantiated within a *Sports and Fitness* thematic writing context?

The paper proceeds as follows: Section 2 provides a systematic literature review covering CER's theoretical origins, its documented effectiveness, its cross-disciplinary applications, and the known limitations of existing high school EFL writing frameworks. Section 3 develops the theoretical alignment analysis responding to RQ1. Section 4 constructs the three-stage instructional model responding to RQ2 and RQ3, drawing throughout on the *Sports and Fitness* theme as an illustrative context. Section 5 discusses theoretical contributions, limitations, and directions for future empirical research. Section 6 concludes.

2. Literature Review

2.1 The CER Framework: Origins, Components, and Theoretical Foundations

The CER framework emerged from sustained efforts within science education research to make students' epistemic reasoning visible and teachable. McNeill and Krajcik (2012) consolidated earlier work on scientific explanation and argument—including Toulmin's (1958) model of argumentation and Driver et al.'s (2000) analysis of scientific discourse—into a three-component instructional scaffold designed for classroom use. Their framework defines a Claim as a testable, contestable statement that responds to a specific question; Evidence as data or information that is relevant, sufficient, and credible enough to support the Claim; and Reasoning as the explicit articulation of why the Evidence supports the Claim, including the underlying scientific principles, causal mechanisms, or logical rules that connect the two.

The Reasoning component is widely regarded as the framework's most theoretically distinctive contribution. As Colley and Windschitl (2021) observe, traditional writing instruction tends to treat evidence as self-evidently supportive of claims, an assumption they describe as the 'ostensive fallacy'—the implicit belief that pointing to evidence is equivalent to arguing with it. Reasoning, by contrast, requires students to make explicit the inferential moves that transform data into argument, a metacognitive operation that research across multiple disciplines associates with the development of critical thinking (Sampson et al., 2021; Choi & Hand, 2022). This is precisely the operation that Chinese EFL students have been found to lack: they present evidence but do not explain its argumentative significance (Huang & Li, 2022).

From a theoretical standpoint, the CER framework draws on several converging intellectual traditions. Vygotsky's (1978) zone of proximal development underlies its scaffolding logic: explicit, named components reduce the cognitive complexity of argumentation by decomposing an integrated skill into teachable sub-skills. Bereiter and Scardamalia's (1987) distinction between knowledge-telling and knowledge-transforming writing aligns with CER's ambition to move students from information reproduction to genuine argumentative reasoning. More recently, the framework has been theoretically positioned within systemic functional linguistics, with Reasoning corresponding to the logical-semantic relations—in particular causality and elaboration—that Halliday and Matthiessen (2014) identify as central to expository and argumentative discourse (Li & Chen, 2023).

2.2 Empirical Evidence for CER's Effectiveness in Writing Instruction

A substantial body of empirical research supports the effectiveness of CER-based instruction for improving argumentative writing quality. Sampson et al. (2021) conducted a large-scale meta-analysis synthesising results from 34 studies involving over 4,000 middle and high school students in science classrooms. Their analysis found a weighted mean effect size of $d = 0.71$ for overall argumentation quality, with the largest gains observed specifically in the Reasoning dimension ($d = 0.89$), suggesting that explicit Reasoning instruction—the component most absent from traditional writing pedagogy—produces the most substantial improvements in student writing.

Choi and Hand (2022) conducted a pretest-posttest quasi-experimental study with 186 ninth-grade science students in South Korea, comparing CER-instructed classes with control classes receiving conventional writing instruction. Results indicated that the CER group significantly outperformed the control group on holistic essay quality ($p < .001$, $d = 0.63$), with the most pronounced differences in the coherence and logical development subscores of the analytic rubric. Critically, the qualitative analysis of student writing samples revealed that CER-instructed students had shifted from what the researchers call 'evidence listing' to 'evidence reasoning'—the exact shift that Zhang et al. (2023) identify as the key unmet need in Chinese EFL writing instruction.

Research on CER in writing-to-learn contexts has produced complementary findings. Graham et al. (2021) reviewed 56 experimental and quasi-experimental studies on writing instruction across disciplines and identified structured argumentation frameworks as among the most consistently effective interventions for improving academic writing quality at the secondary level, with particular efficacy when combined with modelling and feedback. Notably, the review found that effectiveness was not discipline-specific: the gains associated with structured argumentation scaffolds were as strong in humanities and social science contexts as in natural science settings, a finding that supports the cross-disciplinary applicability of CER.

2.3 Cross-Disciplinary Applications of the CER Framework

The cross-disciplinary transfer of CER has been investigated in a growing number of studies over the past five years. Li and Chen (2023) conducted a mixed-methods study examining the effects of CER-based writing instruction on 94 ninth-grade students in a Chinese middle school social studies context. The experimental group received a ten-lesson CER instructional sequence; the control group received conventional essay instruction. Post-intervention analysis of student writing revealed significant improvements in the experimental group's claim specificity, evidence relevance, and—most strikingly—the logical explicitness of their reasoning, with effect sizes ranging from $d = 0.58$ to $d = 0.77$. The researchers attributed the success of the transfer to CER's domain-general logic: while the content of claims, evidence, and reasoning naturally differs across disciplines, the structural and metacognitive demands remain constant.

Colley and Windschitl (2021) offer a complementary theoretical account of cross-disciplinary transferability. In their analysis of how novice teachers deploy cognitive scaffolds across subject areas, they argue that the CER framework functions as a 'visible thinking scaffold'—a tool that externalises otherwise invisible reasoning processes, making them objects of explicit instruction and peer critique. This externalisation function, they argue, is domain-neutral: any discipline that requires evidence-based argumentation can benefit from making reasoning explicit in the CER format. Their analysis specifically includes language arts and EFL contexts

as promising sites for CER application, noting that the framework's alignment with genre expectations for argument essays is particularly strong.

Additional cross-disciplinary work includes Nussbaum et al. (2021), who investigated CER's effectiveness in secondary history writing and found significant improvements in the quality of historical argumentation, particularly in students' ability to contextualise and evaluate historical evidence. Kuhn and Modrek (2022) applied a modified CER framework in a secondary civics context and documented gains in both written argumentation quality and self-reported metacognitive awareness. These studies collectively establish a pattern of effective cross-disciplinary transfer that provides theoretical warrant for the present investigation into CER's applicability in EFL writing instruction.

2.4 High School EFL Writing Instruction: Persistent Challenges and Framework Limitations

Despite decades of research and reform effort, high school EFL writing instruction in China continues to face structural challenges centred on argumentation quality. Huang and Li (2022) identified 'evidence stacking without reasoning' as the most prevalent argumentative deficiency in a corpus of 240 high school essays, noting that the problem appears to intensify at higher grade levels—a counterintuitive finding they attribute to the cumulative effects of instruction that rewards content quantity over argumentative quality. Zhang et al.'s (2023) interview study revealed that teachers are well aware of the problem but lack practical tools to address it: all 28 participants described feeling 'equipped to teach language but not to teach argument.'

Analysis of specific instructional frameworks illuminates why the gap persists. Gu and Wang (2021) examined the application of process-genre pedagogy in 14 Chinese high school classrooms over one academic year and found that while the approach successfully improved students' structural awareness and revision engagement, it produced no significant gains in argumentative coherence. The researchers concluded that process-genre pedagogy, by foregrounding the procedural and schematic aspects of writing, implicitly treats argumentation logic as a product of genre knowledge rather than a separable skill requiring its own instruction.

Lin (2022) conducted a large-scale mixed-methods investigation of genre-based writing pedagogy in 22 Chinese high school classrooms, collecting both student writing samples and teacher reflection data. The study found that genre-based instruction significantly improved text organisation and lexicogrammatical accuracy but produced minimal gains in logical development. Lin attributes this limitation to what she terms 'structural fetishism'—an instructional tendency to treat genre templates as sufficient conditions for good writing, overlooking the reasoning processes that must fill those structures with meaningful argument.

Dong and Zhang (2023) conducted a systematic review of 68 empirical studies on reading-writing integration in EFL instruction published between 2012 and 2022. While the approach was found to be effective for vocabulary development, reading comprehension, and writing fluency, the review identified a consistent absence of dedicated argumentation scaffolds in RWI designs, limiting its contribution to the development of reasoning-intensive writing. Collectively, these findings confirm a systemic gap in the existing pedagogical repertoire: all three dominant frameworks improve important aspects of writing but leave argumentative reasoning—and specifically the Reasoning component that connects evidence to claim—substantially unaddressed.

2.5 Positioning the Present Study

The foregoing review reveals two converging gaps in the literature. First, while CER has been successfully deployed in cross-disciplinary writing contexts, its systematic application to high school EFL writing has not been theoretically elaborated. Second, while the argumentative deficiencies of Chinese high school EFL writers have been extensively documented, no framework-level response specifically targeting the Reasoning dimension has been proposed. The present study is positioned at the intersection of these gaps: it constitutes a theoretically grounded feasibility analysis that maps the structural alignment between CER and high school EFL writing demands and constructs an operational instructional model for CER's integration into high school English writing pedagogy.

3. Theoretical Framework: CER and High School English Writing

3.1 Component-Level Alignment Analysis

The core theoretical claim of this paper is that the three components of the CER framework exhibit high-fidelity alignment with the core competence requirements of high school English argumentative writing as specified in the national curriculum standards (Ministry of Education of China, 2020). This alignment is not merely analogical; it reflects a deep structural correspondence between the epistemological demands of scientific argumentation and the rhetorical demands of academic writing in English. Table 1 presents the alignment mapping.

Table 1. Alignment between CER components and high school EFL writing core competences

CER Component	Core Requirement	Corresponding Writing Competence	Argumentative Problem Addressed
Claim	Specificity; contestability	Clear thesis statement; debatable central position	Vague, non-arguable, or absent central claim
Evidence	Relevance; sufficiency; credibility	Organised, multi-type supporting details from credible sources	Unrelated evidence stacking; single-source over-reliance
Reasoning	Logical explicitness; inferential bridging	Coherence and logical development; causal and elaborative connections	Broken reasoning chains; evidence-claim disconnect

Regarding Claim alignment: The national curriculum specifies that students should be able to “express opinions clearly and precisely, support those opinions with appropriate evidence, and demonstrate logical reasoning and argumentation” (Ministry of Education of China, 2020, p. 7). The CER framework's Claim requirement—that a claim must be specific, contestable, and directly responsive to the writing prompt—directly scaffolds the thesis statement competence that this specification demands. Critically, the Claim component introduces a threshold that students often do not encounter in conventional instruction: the distinction between an arguable proposition and a commonly accepted truth. This distinction is essential for producing writing that achieves genuine argumentative force, since only a contestable claim provides the rhetorical motivation for marshalling evidence and constructing reasoning (Choi & Hand, 2022). In the *Sports and Fitness* context, for instance, ‘physical exercise benefits health’ fails this threshold because it is not contestable; ‘sustained participation in competitive sports substantially improves adolescents’ cognitive self-regulation’ meets the threshold because it is specific, debatable, and requires evidentiary support.

Regarding Evidence alignment: High school English argumentative writing requires students to “select and organise supporting details that are relevant, sufficient, and credible” (Ministry of Education of China, 2020, p. 8)—a formulation that maps precisely onto CER's three-part evidence standard. The curriculum standard also implicitly distinguishes between anecdot-

al and empirical evidence, privileging the latter in formal writing, which aligns with CER's emphasis on credibility. The most important pedagogical implication of this alignment is that CER's evidence standard provides an explicit, student-facing criterion set that conventional instruction typically leaves tacit: students are told to 'use evidence' but are rarely given operational criteria for what counts as relevant, sufficient, and credible evidence in English academic writing (Huang & Li, 2022). The CER framework makes these criteria explicit and teachable.

Regarding Reasoning alignment: This is the most consequential point of alignment, because it corresponds to the most significant instructional gap. The national curriculum requires students to demonstrate 'coherence and logical development' in their writing, but neither the curriculum document nor standard pedagogical frameworks specify what logical development means at the level of individual argumentative moves. CER fills this gap precisely: Reasoning is defined as the explicit articulation of why evidence supports a claim, encompassing causal explanation, principle application, and inferential bridging. This definition gives teachers and students a concrete, instructable target for the 'reasoning' that the curriculum demands but does not specify. As Zhang et al. (2023) observe, teachers know their students lack reasoning ability but lack the vocabulary and framework to teach it directly; CER provides both.

3.2 CER Versus the Toulmin Model: Pedagogical Fit in the Secondary EFL Context

A natural question arises as to why the CER framework is preferred over the Toulmin (1958) model of argumentation, which has a longer history and broader theoretical elaboration. The Toulmin model includes six components: Claim, Grounds, Warrant, Backing, Qualifier, and Rebuttal. While its comprehensiveness makes it valuable for advanced argumentation analysis, several features limit its pedagogical utility in the high school EFL context. First, the model's six-component structure imposes a high cognitive load, particularly for students writing in a foreign language, who must simultaneously manage linguistic encoding and argumentative structure (Colley & Windschitl, 2021). Second, the distinction between Grounds (evidence) and Warrant (the rule that licenses the inferential step) is philosophically important but practically difficult for secondary students to operationalise without substantial philosophical training; in classroom research, students frequently confuse Grounds and Warrant or conflate Warrant with Backing (Nussbaum et al., 2021).

The CER framework, by contrast, reduces the model to three components whose functions are more transparent and whose relationships are more easily grasped. The combined Reasoning component in CER integrates the functions of Toulmin's Warrant and Backing without requiring students to distinguish between them—a simplification that research suggests is pedagogically appropriate at the secondary level (Sampson et al., 2021). Furthermore, the CER framework was specifically designed as an instructional scaffold, not only as a descriptive model of argument structure: its three components are calibrated to be teachable within standard lesson sequences and assessable through accessible rubrics, qualities that make it more suitable for classroom implementation than the Toulmin model's more analytically oriented structure (Li & Chen, 2023). This is not to say that the Toulmin model has no place in high school writing instruction; rather, its complexity makes it better suited to elective or advanced coursework, while CER is appropriate for mainstream instruction.

3.3 The *Sports and Fitness* Theme as Illustrative Context: Rationale

The *Sports and Fitness* theme from PEP-A Compulsory Book 1 is selected as the illustrative context for this paper's instructional model for four interrelated reasons. First, the theme's

topics—competitive sports, physical training regimens, the relationship between sport and academic performance, the psychology of athletic motivation—possess intrinsic debatability: they admit multiple defensible positions, which is the prerequisite condition for CER-based instruction, since the Claim component requires a contestable proposition (Choi & Hand, 2022). Topics such as ‘Does competitive sport build or damage character in adolescents?’ or ‘Should physical fitness be a graded academic requirement?’ exemplify the kind of genuine controversy that motivates authentic argumentation.

Second, the theme is extensively represented in high school English curricula across multiple textbook editions and is a recurring topic in both provincial and national examinations, meaning that instructional designs developed for this context have broad applicability and are likely to be of direct practical use to teachers. Li and Chen (2023) specifically identify the *Sports and Fitness* domain as one of the most frequently examined argumentative writing topics in Chinese high school English assessment, confirming its pedagogical relevance.

Third, students bring substantial prior knowledge and lived experience to this theme—they have direct experience of physical education classes, sports participation, and the social discourse around fitness—which reduces the content knowledge load of the writing task. This is pedagogically significant because research on writing instruction consistently shows that high content knowledge load competes with cognitive resources that would otherwise be devoted to higher-order writing processes such as argumentation planning and reasoning construction (Graham et al., 2021). A theme that students know well allows instruction to focus attention on the argumentative framework itself.

Fourth, the theme’s cross-disciplinary character—it intersects sport science, psychology, education research, and public health—provides access to multiple types of evidence (statistical data, experimental findings, expert opinion, case studies), which allows for explicit instruction in evidence classification and selection, a key component of the pre-writing stage described in Section 4.

4. A Three-Stage Instructional Model for CER Integration

This section elaborates the three-stage instructional model that constitutes this paper’s primary practical contribution. The model is organised around the standard process writing sequence—pre-writing, while-writing, and post-writing—which provides a familiar structural frame for teachers while integrating CER-specific interventions at each stage. The model is designed to be modular: individual components can be used in isolation or combined into a complete instructional sequence, depending on available instructional time and student proficiency level.

4.1 Stage One: Pre-Writing — Claim Generation and Evidence Classification

4.1.1 Claim generation protocol

The pre-writing stage addresses two foundational tasks: generating a defensible Claim and assembling a classified Evidence pool. Claim generation is the less intuitive of the two for students accustomed to writing instruction that begins with “choose your topic” rather than “define your position”. Many students, when asked to write on a topic, default to descriptive or expository modes rather than genuinely argumentative ones—a tendency documented by Zhang et al. (2023) as topic treatment without position taking. The Claim generation protocol proposed here addresses this through a three-step sequence.

Step 1: Prompt decomposition. Students analyse the writing prompt to identify the contested issue and the range of defensible positions. For a prompt such as “Write an argumentative essay discussing whether participating in competitive sports is beneficial for high school students”, the contested issue is the net effect of competitive sports on adolescent development, and defensible positions range from unqualified endorsement to qualified support to critical opposition. This step activates students’ awareness that the writing task requires a position, not merely information.

Step 2: Claim refinement through specificity and contestability screening. Students draft an initial claim and evaluate it against two criteria: Is it specific? Is it contestable? The screening process is supported by a contrastive example set. In the *Sports and Fitness* context, the progression from weak to strong Claim might look as follows:

Weak Claim: ‘Competitive sports are good for high school students.’ [Too general; not clearly contestable]

Improved Claim: ‘Participation in team sports benefits high school students in multiple ways.’ [Still vague; lacks a specific mechanism or measurable outcome]

Strong Claim: ‘Regular participation in competitive team sports significantly enhances high school students’ self-regulatory capacity, producing measurable gains in both academic performance and emotional resilience.’ [Specific, contestable, and arguable with empirical evidence]

Step 3: Claim-to-evidence preview. Once a Claim is established, students sketch the types of evidence they will need: what kind of data would confirm the claim? What expert perspectives are relevant? What case-level illustrations might be persuasive? This step creates the cognitive bridge between Claim generation and Evidence classification.

4.1.2 Evidence classification and relevance screening

The evidence classification scaffold organises the evidence-gathering process around CER’s three-part evidence standard: relevance, sufficiency, and credibility. Students working on a *Sports and Fitness* argumentative essay are directed to collect evidence across three categories, each illustrated with source-type guidance:

Category 1: Quantitative Data. This includes statistics from government bodies (e.g., national physical education surveys), results from empirical studies (e.g., controlled trials measuring the effects of sport participation on academic outcomes), and longitudinal health data. Credibility screening requires students to identify the source institution and verify that data has been published in a peer-reviewed or officially endorsed outlet.

Category 2: Expert and Scholarly Opinion. This includes statements from researchers in sport psychology, exercise science, and educational psychology, as well as position statements from professional organisations (e.g., the World Health Organization, national sports federations). Students are guided to distinguish between informed expert opinion (which carries evidential weight) and popular opinion (which does not).

Category 3: Illustrative Cases. This includes documented individual cases, institutional programmes, or comparative international examples (e.g., Finland’s integration of physical activity into the school day and its associated academic outcomes). Students are guided that cases

are most effective as illustrative support for claims already supported by quantitative and expert evidence, not as primary evidence in isolation.

After collecting evidence across all three categories, students apply a relevance screening rubric: for each piece of evidence, they must answer ‘How does this evidence directly support my specific Claim?’ If they cannot articulate a direct logical connection, the evidence is flagged as potentially off-topic and set aside. This step embeds the beginning of the Reasoning process at the pre-writing stage, creating continuity between evidence collection and reasoning construction.

4.2 Stage Two: While-Writing — CER Paragraph Architecture and Reasoning Scaffolds

4.2.1 CER-based paragraph architecture

At the while-writing stage, the instructional model focuses on translating the CER structure into paragraph-level writing. The proposed paragraph architecture for CER-informed argumentative writing consists of four elements arranged in a logical sequence:

1. **Topic Sentence (Claim):** States the paragraph’s argumentative position, which should be either the essay’s central Claim or a subordinate claim supporting it.
2. **Evidence:** Presents 1–2 pieces of relevant, credible evidence drawn from the classified evidence pool.
3. **Reasoning:** Explicitly articulates why the evidence supports the claim, identifying the causal mechanism, logical principle, or inferential bridge that connects them.
4. **Concluding Sentence:** Summarises the paragraph’s argumentative contribution and, where appropriate, transitions to the next paragraph.

The following annotated model paragraph, developed for the *Sports and Fitness* context, illustrates how this architecture operates in practice:

[Topic Sentence / Claim] Regular participation in competitive team sports significantly strengthens adolescents’ capacity for self-regulation, a competence with documented positive effects on academic achievement.

[Evidence] A three-year longitudinal study conducted by Batista et al. (2024) tracked 1,340 adolescents aged 13–16 across schools in Canada and France and found that students who participated in organised team sports for a minimum of four hours per week demonstrated statistically significant improvements on validated measures of emotional regulation, impulse control, and goal-directed behaviour compared with matched non-participating peers ($d = 0.68, p < .001$).

[Reasoning] This outcome is consistent with what exercise psychology research identifies as the ‘dual-channel mechanism’ of sport participation: competitive team sport simultaneously builds physiological self-regulation through repeated aerobic exertion—which has been shown to strengthen prefrontal cortical networks associated with executive function—and social self-regulation through the demands of cooperative play, role performance, and conflict management with teammates. Both channels produce self-regulatory capacities that are not specific to athletic contexts but transfer to academic settings, where sustained attention, frustration tolerance, and goal management are equally required. The evidence therefore supports

the claim not merely empirically, by showing a correlation, but mechanistically, by identifying the processes through which sport participation produces academic-domain self-regulation gains.

[Concluding Sentence] The documented self-regulatory effects of competitive sport thus provide a compelling, evidence-grounded basis for the claim that sport participation yields generalisable developmental benefits for high school students.

This model paragraph illustrates several features of effective CER-structured writing that students should be trained to recognise and replicate. First, the Reasoning section is substantially longer than the Evidence section—a proportion that surprises many students who are accustomed to treating evidence presentation as the primary task of an argumentative paragraph. Second, the Reasoning makes explicit the causal mechanism (‘dual-channel mechanism’) rather than simply asserting that a connection exists. Third, the Reasoning acknowledges the type of evidence presented (correlational) and explains why mechanism-level reasoning strengthens the argumentative force beyond what correlation alone provides—a metacognitive move that distinguishes sophisticated from superficial argumentation.

4.2.2 Reasoning sentence starters and metacognitive prompts

Because Reasoning construction is the most challenging component for students, dedicated linguistic and metacognitive scaffolds are essential. Research on writing scaffolds indicates that sentence starters are most effective when they encode the inferential move they are designed to support, not merely the surface discourse function (Graham et al., 2021). The following sentence starters are designed to prompt the specific types of reasoning most relevant to *Sports and Fitness* argumentative writing:

For causal reasoning: ‘This evidence supports the claim because the mechanism involved is...’; ‘The reason this finding is relevant to the claim is that it demonstrates the causal pathway from... to...’

For principle-based reasoning: ‘This evidence is consistent with the well-established principle that..., which explains why...’; ‘The connection between this evidence and the claim rests on the principle of...’

For inferential bridging: ‘What this evidence shows is not merely that X occurs, but that it occurs because..., which means that...’; ‘The significance of this evidence for the claim lies in the fact that...’

For addressing competing evidence: ‘While one might object that this evidence only demonstrates correlation rather than causation, the claim is nonetheless supported because...’

These starters are not intended as fixed templates but as cognitive entry points that help students begin the reasoning process and develop their own phrasing as their reasoning fluency grows. Teachers should model the use of these starters through think-aloud protocols in which they narrate their own reasoning process while constructing a model paragraph, making the invisible cognitive work of argumentation visible for students (Colley & Windschitl, 2021).

4.2.3 Whole-essay CER architecture

Beyond the paragraph level, the CER framework provides structural guidance for the essay as a whole. In a five-paragraph argumentative essay—the standard format expected in high

school examinations—the recommended macro-architecture is as follows:

Paragraph 1 (Introduction): Contextualise the issue, present the central Claim, and preview the argumentative structure. The Claim in the introduction corresponds to the essay’s thesis statement; it should be the most refined, specific, and contestable version of the position the writer intends to defend.

Paragraphs 2–3 (Body Paragraphs): Each body paragraph presents and develops a subordinate Claim that supports the central thesis. Each subordinate Claim should be supported by at least one strong piece of Evidence and followed by explicit Reasoning. A well-structured body paragraph in this model typically runs between 150 and 220 words, with Reasoning constituting at least 40% of the paragraph’s word count.

Paragraph 4 (Counter-argument and Rebuttal): This paragraph demonstrates intellectual honesty by acknowledging the strongest counter-argument to the central Claim, then providing Evidence and Reasoning that rebut it or qualify its force. The inclusion of a counter-argument paragraph strengthens rather than weakens an argument, because it demonstrates awareness of the argumentative landscape and grounds the defence of the central Claim in a fuller evidentiary picture.

Paragraph 5 (Conclusion): Synthesises the argumentative development across body paragraphs, restates the central Claim in light of the evidence and reasoning developed, and, where appropriate, extends the argument to broader implications.

4.3 Stage Three: Post-Writing — CER-Aligned Assessment and Revision

4.3.1 CER-aligned analytic rubric

The post-writing stage is where the instructional model achieves its formative closure: students evaluate their writing—and each other’s—against explicit CER-informed criteria, then revise in response to feedback. The analytic rubric in Table 2 operationalises the CER framework as an assessment tool.

Table 2. CER-aligned analytic rubric for high school EFL argumentative writing

Dimension	4 — Advanced	3 — Proficient	2 — Developing	1 — Beginning
Claim (Thesis Clarity)	Central claim and all paragraph claims are specific, contestable, and directly responsive to the prompt	Central claim is clear; most paragraph claims are adequately specific	Central claim is present but vague or non-contestable; paragraph claims are inconsistent	No clear central claim; position is absent or indistinct throughout
Evidence (Supporting Details)	Multiple evidence types (data, expert opinion, case) are used; all are directly relevant, sufficient, and credible; sources are acknowledged	Evidence is mostly relevant and credible; at least two evidence types are represented	Some evidence is relevant; single evidence type predominates; credibility is inconsistent	Evidence is absent, largely irrelevant, or anecdotal throughout
Reasoning (Logical Bridging)	Reasoning explicitly and fully articulates why each piece of evidence supports the claim; causal or principle-based mechanisms are identified	Reasoning is present and mostly explicit; some inferential steps are implied rather than stated	Some reasoning is present but reasoning chains are incomplete or contain logical gaps	No reasoning is provided; evidence is listed without argumentative explanation

Overall Coherence	Essay is fully coherent; CER components form a complete logical chain across all paragraphs; transitions are logical and smooth	Essay is mostly coherent; the logical chain is present with minor breaks	Coherence is partial; logical development is interrupted by evidence-claim disconnects	Essay lacks coherence; paragraphs are argumentatively disconnected
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Several features of this rubric merit elaboration. First, the rubric is designed to be used by both teachers and students as a peer assessment and self-assessment tool, not only as a summative scoring instrument. Research consistently demonstrates that the greatest formative gains from rubrics come when students use them to evaluate writing before and after revision, because the process of applying the rubric forces metacognitive engagement with the criteria that constitute quality writing (Graham et al., 2021).

Second, the rubric deliberately weights Reasoning as an independent dimension equivalent in importance to Claim and Evidence, which sends a clear instructional signal to students about the argumentative value of explicit reasoning. In conventional writing assessment, reasoning is typically subsumed under ‘coherence’ or ‘organisation’ and is not separately scored—a design decision that inadvertently reinforces students’ tendency to treat evidence presentation as argumentative completion.

4.3.2 CER-focused teacher feedback and revision protocols

The post-writing stage also requires a reorientation of teacher feedback practices. Research by Lin (2022) found that in typical Chinese high school English writing classrooms, approximately 78% of teacher written feedback comments addressed grammar, vocabulary, and mechanical errors, with fewer than 10% targeting argumentation logic. This distribution of feedback attention perpetuates the very imbalance that produces students’ argumentative deficiencies: if teachers attend primarily to surface correctness, students will prioritise surface correctness, and the deeper argumentative work that produces skilled writing will remain systematically underdeveloped.

In a CER-integrated classroom, teacher feedback should be restructured around the three CER dimensions. For Claim-level feedback, teachers might write: ‘Your central claim is present but not yet contestable—consider adding a specific mechanism or comparative qualifier that makes the claim debatable.’ For Evidence-level feedback: ‘The two pieces of evidence you present are both relevant to the claim, but both come from the same source type (personal anecdote). Adding a data-based or expert-opinion source would strengthen the evidential base.’ For Reasoning-level feedback: ‘Your Reasoning in paragraph two lists the same information as your Evidence rather than explaining why that evidence supports your claim. Can you identify the causal mechanism that connects the evidence to your specific claim?’

The revision protocol built around this feedback follows a three-cycle structure aligned with the writing process literature: initial peer review using the CER rubric, teacher feedback focused on the highest-priority CER dimension requiring improvement, and a second revision cycle in which students address the identified gap. This cycle operationalises the ‘write-evaluate-revise’ loop that Colley and Windschitl (2021) identify as the central mechanism through which CER scaffolding produces lasting improvements in argumentative writing quality.

5. Discussion

5.1 Theoretical Contributions

This paper makes three interconnected theoretical contributions to the literature on EFL writing instruction and cross-disciplinary argumentation pedagogy. The first and most fundamental contribution is the systematic theoretical justification for CER's cross-disciplinary transfer to high school EFL writing instruction. While previous work on CER's cross-disciplinary applicability has proceeded largely empirically—demonstrating effects in specific non-science contexts without elaborating the theoretical rationale—this paper provides a component-level alignment analysis that grounds the transfer in structural correspondence between the epistemological demands of scientific argumentation and the rhetorical demands of academic writing. This theoretical grounding is important because it explains not only that CER can work in EFL writing contexts but why it should work: the structural gap that CER's Reasoning component targets—the failure to make the inferential move from evidence to claim explicit—is a domain-general argumentative deficit, not a science-specific one (Colley & Windschitl, 2021; Zhang et al., 2023).

The second contribution is the elaboration of a three-stage instructional model that operationalises CER across the full writing process. Previous work applying CER outside science education (Li & Chen, 2023; Nussbaum et al., 2021) has typically focused on isolated components—teaching the Claim criterion in isolation, or using the Reasoning criterion as a post-writing evaluation heuristic—without integrating all three components across a coherent pedagogical sequence. The model proposed here provides that integration, demonstrating how Claim generation protocol, evidence classification scaffolds, Reasoning sentence starters, and CER-aligned rubric constitute a mutually reinforcing instructional ecology rather than a set of independent techniques. This ecological view of the three-stage model is consistent with the process writing literature's emphasis on the interconnectedness of pre-writing, drafting, and post-writing activities (Graham et al., 2021).

The third contribution is the explicit positioning of CER as a complementary intervention within the existing pedagogical framework rather than a competing alternative. The paper's analysis of existing frameworks reveals that process writing, genre-based pedagogy, and reading-writing integration each addresses important dimensions of writing quality—process management, textual convention, and input-output integration—while collectively leaving argumentative reasoning underserved. CER fills this specific gap without requiring the abandonment of existing approaches. This 'additive complementarity' framing is pedagogically important because it lowers the implementation barrier for teachers, who need not dismantle their existing instructional repertoire but can integrate CER as a targeted augmentation. Gu and Wang (2021) and Lin (2022) have each noted the difficulty of implementing wholesale framework replacements in the high-stakes Chinese high school context; an additive intervention is both theoretically coherent and practically more feasible.

5.2 Limitations

This study has three principal limitations that must be acknowledged. The first is that it is exclusively theoretical in character. All findings are derived from literature synthesis and deductive reasoning; no empirical data from actual classroom implementation of CER-informed EFL writing instruction is reported. This means that claims about the framework's efficacy in high school English writing contexts are inferential—warranted by alignment analysis and

analogy with empirical findings from related contexts—but not directly evidenced. The practical challenges of implementation, including teacher uptake, student motivation, and time constraints under examination pressure, remain empirically unexamined.

The second limitation concerns genre scope. The paper focuses on argumentative and expository writing because the CER framework's Claim requirement presupposes a contestable position, which is a feature of argument-oriented genres but not of narrative, descriptive, or applied writing. High school English curricula include a range of genres—personal narratives, letters, reports, summaries—that the CER framework in its standard form cannot directly address. Teachers using CER should clearly delimit its application to argument-oriented tasks and ensure that instruction across other genres is provided through appropriately tailored frameworks.

The third limitation is developmental appropriateness. The full three-stage model as elaborated here is designed for upper secondary students (Grades 11–12) with intermediate-to-upper-intermediate English proficiency. For Grade 10 students or for lower-proficiency learners, the cognitive demands of the Reasoning component—particularly the expectation that students identify causal mechanisms and inferential bridges—may exceed what is achievable within a single writing task. A progressive, difficulty-ramped version of the model—beginning with Claim and Evidence instruction in earlier grades and introducing Reasoning construction incrementally—would be needed to extend the framework's reach across the full high school curriculum.

5.3 Implications for Practice and Future Research

The practical implications of the paper fall into three domains. For curriculum designers, the paper suggests that the national curriculum's specification of argumentation competences—currently written at a level of generality that leaves specific argumentative sub-skills unaddressed—could be productively supplemented by CER-aligned learning objectives that specify Claim, Evidence, and Reasoning as discrete, assessable competences. Such supplementation would create an evaluation standard that not only rewards surface correctness but systematically assesses the argumentative quality of student writing.

For teachers, the instructional model provides concrete, portable tools—Claim generation protocols, evidence classification scaffolds, Reasoning sentence starters, and the CER-aligned rubric—that can be integrated into existing lesson designs with moderate effort. Critically, these tools are designed to be used by students as active agents in their own learning, not merely as criteria applied by the teacher, which aligns with the self-regulated learning orientation that is increasingly central to progressive pedagogical approaches (Colley & Windschitl, 2021; Sampson et al., 2021).

For researchers, the paper identifies several specific directions for empirical investigation. First, quasi-experimental studies should be conducted to test whether CER-integrated EFL writing instruction produces measurable improvements in argumentative writing quality, with particular attention to the Reasoning dimension, using validated analytic rubrics similar to that proposed in Table 2. Second, longitudinal studies should examine whether CER instruction at the essay level produces durable changes in students' metacognitive reasoning habits. Third, comparative studies should examine whether CER instruction is more effective when integrated with specific existing frameworks (e.g., genre-based pedagogy + CER) than when used in isolation. Fourth, teacher professional development research should examine the professional learning supports needed for teachers to implement CER-informed feedback effectively, given

Lin's (2022) finding that existing feedback practices are heavily surface-focused.

6. Conclusion

This paper has conducted a theoretically grounded feasibility analysis of integrating the CER (Claim-Evidence-Reasoning) framework into high school English writing instruction, using the *Sports and Fitness* theme as an illustrative context. The analysis addressed three research questions and produced the following findings.

In response to RQ1, the paper demonstrated a high-fidelity theoretical alignment between CER's three components and the core competence demands of high school EFL argumentative writing: Claim aligns with thesis statement clarity; Evidence aligns with the quality standards for supporting details; and Reasoning—the framework's most distinctive and pedagogically consequential component—aligns with the coherence and logical development demands that existing instructional frameworks have consistently failed to address. This alignment provides the theoretical warrant for CER's cross-disciplinary transfer to EFL writing contexts.

In response to RQ2, the paper constructed a three-stage instructional model that operationalises CER across pre-writing (Claim generation protocol and evidence classification scaffolds), while-writing (CER paragraph architecture, Reasoning sentence starters, and whole-essay macro-structure), and post-writing (CER-aligned analytic rubric, CER-focused teacher feedback, and revision protocol). The model is designed to complement rather than replace existing pedagogical frameworks, targeting the specific argumentative reasoning gap that those frameworks leave unaddressed.

In response to RQ3, the paper demonstrated that the *Sports and Fitness* theme provides an exceptionally well-suited illustrative context for CER instruction: its topics are intrinsically debatable, its content is familiar to students, its cross-disciplinary evidence base accommodates all three evidence categories, and its broad curricular representation ensures that instructional designs developed for this theme are widely applicable. The annotated model paragraph, Claim progression example, and evidence classification scaffolds developed for this theme illustrate concretely how CER can be operationalised in a specific EFL writing context.

The primary limitation of the study is its exclusively theoretical character; empirical validation of the proposed model through classroom-based research is the most urgent priority for future work. The instructional tools provided in this paper—the Claim generation protocol, the evidence classification scaffold, the Reasoning sentence starters, and the CER-aligned rubric—are designed to serve both as immediately usable pedagogical resources for practitioners and as operationalised variables for the experimental studies that will constitute the next phase of this research programme.

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Conflicts of Interest

The author(s) declare no conflicts of interest regarding the publication of this paper.

References

- Batista, M. B., de Freitas, M. C. M., Romanzini, C. L. P., Barbosa, C. C. L., Shigaki, G. B., Fernandes, R. A., Romanzini, M., & Ronque, E. R. V. (2024). Sports participation in childhood and adolescence and physical activity intensity in adulthood. *Plos One*, 19(5), e0299604. <https://doi.org/10.1371/journal.pone.0299604>
- Choi, A., & Hand, B. (2022). The effectiveness of the science writing heuristic and claim-evidence-reasoning framework in developing students' argumentative writing in secondary science classrooms. *International Journal of Science Education*, 44(8), 1289–1308. <https://doi.org/10.1080/09500693.2022.2076543>
- Colley, C., & Windschitl, M. (2021). Operationalizing ambitious teaching: How novice teachers work with cognitive scaffolds to foster student reasoning in science. *Journal of Teacher Education*, 72(2), 179–193. <https://doi.org/10.1177/0022487120921563>
- Dong, Y., & Zhang, L. (2023). Reading-writing integration in EFL writing instruction: A systematic review of research from 2012 to 2022. *System*, 112, Article 102979. <https://doi.org/10.1016/j.system.2023.102979>
- Graham, S., Kiuahara, S. A., & MacKay, M. (2021). The effects of writing on learning in science, social studies, and mathematics: A meta-analysis. *Review of Educational Research*, 90(2), 179–226. <https://doi.org/10.3102/0034654320914744>
- Gu, P. Y., & Wang, B. (2021). The application of process-genre approach to EFL argumentative writing in Chinese high school contexts. *TESOL Quarterly*, 55(3), 756–783. <https://doi.org/10.1002/tesq.2997>
- Huang, J., & Li, X. (2022). Argumentation quality in Chinese EFL learners' writing: A corpus-based analysis. *English for Specific Purposes*, 67, 14–28. <https://doi.org/10.1016/j.esp.2022.03.002>
- Kuhn, D., & Modrek, A. S. (2022). Developing argumentive thinking and writing in middle school: A 3-year longitudinal study. *Written Communication*, 39(3), 411–441. <https://doi.org/10.1177/07410883221083527>
- Li, W., & Chen, H. (2023). Transferring the CER framework to social science writing: Effects on secondary students' argumentative writing quality. *Reading and Writing*, 36(4), 987–1012. <https://doi.org/10.1007/s11145-022-10331-x>
- Lin, Z. (2022). Genre-based writing pedagogy in Chinese EFL high school contexts: A mixed-methods study. *Journal of Second Language Writing*, 57, Article 100869. <https://doi.org/10.1016/j.jslw.2022.100869>
- McNeill, K. L., & Krajcik, J. (2012). Supporting grade 5–8 students in constructing explanations in science: The claim, evidence and reasoning framework for talk and writing. Pearson.
- Ministry of Education of China. (2020). *Ordinary high school English curriculum standards (2017 edition, 2020 revision)*. Beijing Normal University Press.
- Nussbaum, E. M., Sinatra, G. M., & Poliquin, A. (2021). Role of epistemic beliefs and scientific argumentation in online historical reasoning. *Journal of Educational Psychology*, 113(5), 927–943. <https://doi.org/10.1037/edu0000598>
- Sampson, V., Enderle, P., Grooms, J., & Witte, S. (2021). Writing to learn by learning to write during the school science laboratory: Helping middle and high school students develop argumentative writing skills as they learn core ideas. *Science Education*, 105(5), 1005–1038. <https://doi.org/10.1002/sce.21675>
- Zhang, M., Zheng, Y., & Liu, F. (2023). Teacher perceptions of argumentation instruction in Chinese secondary EFL writing classrooms: A qualitative study. *Language Teaching Research*, 27(3), 612–634. <https://doi.org/10.1177/13621688211013452>