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Features of Teaching General Education Subjects to Students with Limited English Proficiency

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Abstract

The objective of this study is to identify and systematize the structural features of teaching general education subjects to students with limited English proficiency in linguistically diverse classrooms. The research addresses the problem of persistent achievement gaps and the frequent overestimation of linguistic barriers in subject instruction. Despite extensive research on language scaffolding strategies, limited attention has been paid to the structural mechanisms through which language and disciplinary learning are coordinated across subject domains. The methodology is based on comparative analysis, source synthesis, and structural modeling of recent empirical studies in mathematics, science, civics, reading, and social studies education. Experimental research on linguistic task modification, cluster randomized trials on teacher professional development, and longitudinal analyses of literacy integration were examined to isolate mechanisms linking language and disciplinary learning. The results demonstrate that linguistic complexity alone produces modest performance effects when mathematical content is controlled, while teacher self-efficacy and integrated content-language planning significantly influence instructional precision. Evidence indicates that disciplinary literacy integration mitigates socio-economic and demographic disparities without reducing cognitive rigor. The conclusions emphasize that effective instruction for English learners depends on coordinated configurations: explicit articulation of language demands, preservation of subject complexity, iterative implementation cycles, and reflective recalibration of teacher beliefs. Structural transparency, rather than simplification, emerges as the defining feature of equitable subject instruction.

Keywords: English learners, language-responsive instruction, disciplinary literacy, teacher self-efficacy, content-language integration

1. Introduction

Contemporary general education classrooms are increasingly characterized by linguistic heterogeneity. Students with limited English proficiency participate in mathematics, science, social studies, and civics instruction delivered primarily through academic English. Persistent disparities in academic achievement raise questions about how subject instruction interacts with linguistic demands. While language has often been treated as a peripheral support variable, emerging research suggests that it constitutes a structural element of disciplinary reasoning.

The goal of this study is to substantiate a structural model of language-responsive instruction in general education

subjects that explains how language, disciplinary reasoning, and teacher belief systems interact in linguistically diverse classrooms. To achieve this goal, the study addresses the following objectives:

to examine how linguistic demands embedded in subject-specific tasks interact with disciplinary reasoning rather than independently determine performance;

to analyze the role of teacher self-efficacy and epistemic beliefs in shaping instructional configurations for English learners;

to synthesize cross-disciplinary empirical evidence in

order to identify recurring structural patterns of content–language integration. The scientific novelty of the study lies in its cross-disciplinary structural reconstruction of language-responsive instruction, shifting the analytical focus from isolated pedagogical strategies to coordinated instructional configurations operating across subject domains.

2. Methods and materials

To prepare this article, a comparative method, source analysis, interpretive synthesis, and structural modeling were used. The materials included empirical and theoretical studies examining language demands, teacher efficacy, disciplinary literacy, and instructional integration in multilingual classrooms.

Neumayer DePiper et al. (2021) investigated the impact of a professional development program (Visual Access to Mathematics) on teacher self-efficacy in supporting English learners in mathematics. Their cluster randomized trial demonstrated statistically significant gains in teacher confidence and highlighted the importance of iterative implementation and reflection. Ehmke et al. (2025) conducted an experimental study systematically varying the linguistic demands of reality-based mathematical tasks while holding mathematical complexity constant. Their findings revealed a discrepancy between teachers' expectations (effect sizes $0.73 < d < 1.67$) and actual student performance ($d = 0.12$). Jang et al. (2024) examined longitudinal data from kindergarten through Grade 5 and demonstrated that language and literacy skills significantly predict science achievement while mitigating socio-economic and demographic disparities. Mcewin et al. (2025) explored science and mathematics instruction for emergent bilinguals through children's literature, emphasizing narrative scaffolding as a bridge to abstract reasoning. Gallagher et al. (2023) conducted a multiple case study of multilingual learners' reading competence, identifying vocabulary routines, dialogic instruction, and text-structure support as mechanisms improving comprehension and motivation. Savage and Ikoma (2025) analyzed access to civics content in U.S. schools, showing

that evidence-based instructional approaches and explicit discourse norms influence civic participation. Son (2024) examined pre-service teachers' culturally sustaining social studies units, demonstrating how integrated language and content objectives enhance unit coherence for emergent bilinguals. Yang et al. (2023) studied teachers' beliefs about gifted English learners in mathematics and showed how epistemic stance toward bilingualism affects differentiation and task complexity. Renn et al. (2024) investigated educator buy-in regarding literacy integration in science classrooms, identifying professional culture and discourse alignment as determinants of implementation stability. Ní Ríordáin et al. (2024) analyzed language-responsive mathematics teaching within a CLIL context, emphasizing alignment between language objectives and mathematical reasoning for diverse learners.

The methodological approach combined comparative synthesis of findings, cross-domain thematic coding, and structural analysis to identify recurring instructional configurations. Thus, the materials and methods allowed for a comprehensive analytical reconstruction of language-responsive features in general education instruction.

3. Results

Instructional configurations in general education classrooms serving students with limited English proficiency display a structural shift from content transmission toward language-mediated meaning construction. Across mathematics, science, civics, reading, and social studies, instructional effectiveness is closely tied to how explicitly teachers recognize and operationalize the linguistic architecture embedded within subject tasks. The data topology emerging from the analyzed corpus reveals three interdependent trajectories: recalibration of teacher efficacy, redefinition of linguistic demand in content tasks, and integration of disciplinary literacy into general education instruction. The systematization of instructional trajectories is presented below (Table 1).

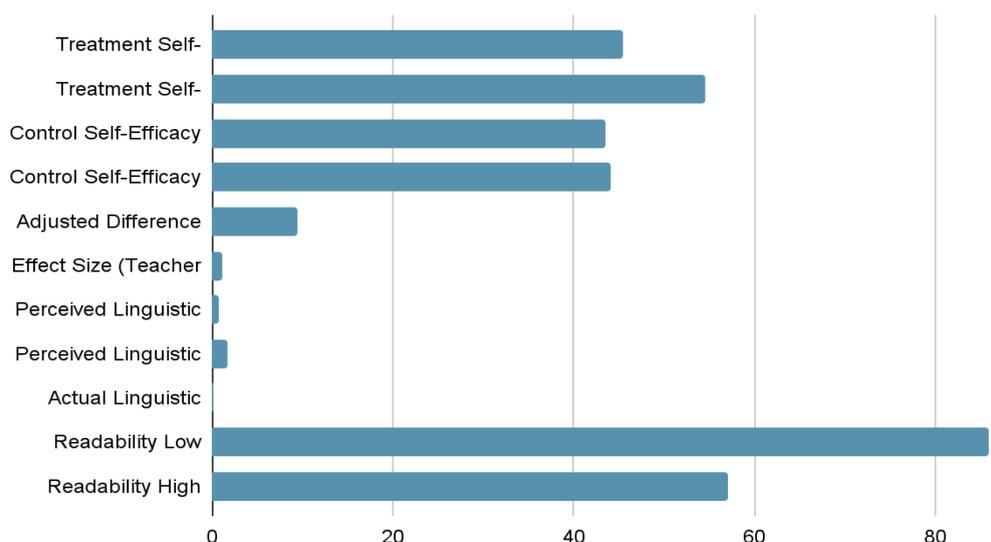
Table 1. Structural Trajectories in Teaching General Education Subjects to Students with Limited English Proficiency (compiled by the author based on Neumayer DePiper et al., 2021; Ehmke et al., 2025; Jang et al., 2024; Gallagher et al., 2023)

Trajectory	Core Focus	Mechanism of Influence	Pedagogical Implication
Recalibration of Teacher Efficacy	Professional self-perception	Iterative implementation and reflection	Increased instructional precision
Redefinition of Linguistic Demand	Task architecture	Separation of linguistic and mathematical complexity	Avoidance of oversimplification
Integration of Disciplinary Literacy	Subject-language coupling	Explicit articulation of discourse norms	Reduction of achievement disparities
Alignment of Belief Systems	Epistemic stance toward bilingualism	Reframing deficit assumptions	Expansion of cognitive challenge
Institutional Coordination	School-level culture	Collaborative planning cycles	Sustainability of language-responsive practice

A pronounced transformation appears in the domain of teacher self-efficacy when professional learning environments explicitly address language-responsive instruction. In a cluster randomized trial including 101 teachers from 47 schools, mean self-efficacy scores increased from 45.4 to 54.6 points in the intervention group, while the control group demonstrated only a 0.6-

point growth (43.6 to 44.2) (Neumayer DePiper et al., 2021). The adjusted difference between groups reached 9.5 points ($p < 0.001$) with an effect size of Hedges' $g = 1.14$, indicating a substantial institutional impact on teachers' perceived capacity to support English learners in mathematics (Neumayer DePiper et al., 2021). The distribution of quantitative indicators is presented below (Figure 1).

Figure 1. Quantitative Indicators of Linguistic Demand and Teacher Self-Efficacy Effects (compiled by the author based on Neumayer DePiper et al., 2021; Ehmke et al., 2025)



Approximately 22% of variance in post-intervention scores was located at the school level and 78% at the individual level, suggesting that organizational context interacts with teacher-level adaptation (Neumayer DePiper et al., 2021). The moderation effect—where pretest gains translated into 0.77 posttest points in the control condition but only 0.33 in the intervention condition—signals a leveling mechanism: professional development disproportionately benefits teachers with initially lower confidence.

This recalibration of teacher belief structures intersects with evidence that teachers systematically overestimate the linguistic barriers embedded in mathematical problem-solving. When 72 teachers estimated the influence of linguistic modification on solution rates, expected effect sizes ranged from $0.73 < d < 1.67$; yet actual student performance across 1,346 learners yielded an effect size of $d = 0.12$ (Ehmke et al., 2025). The discrepancy between anticipated and observed difficulty reframes the interpretive frame of language demands. Linguistic simplification, while not irrelevant, does not uniformly determine performance outcomes in reality-based tasks. Instead, mathematical structure, prior knowledge, and problem-solving strategies appear to exert stronger constraints.

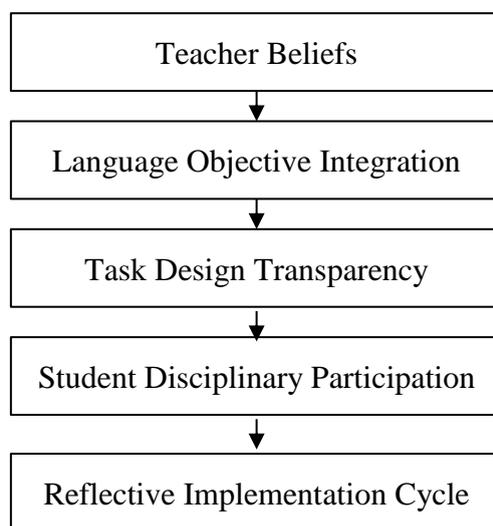
The evidentiary signal emerging from this contrast destabilizes deficit-oriented assumptions. If teachers assume linguistic complexity to be the primary barrier, they may inadvertently reduce cognitive rigor. Yet the modest performance shift ($d = 0.12$) under controlled linguistic

variation indicates that language operates as a conditional rather than dominant constraint (Ehmke et al., 2025). Students with lower proficiency do not uniformly fail under higher linguistic load; rather, the interaction between language proficiency and task design shapes differential outcomes.

Experimental manipulation of linguistic variables further clarifies this dynamic. In a sample of 1,346 students (49.4% female; 34% with immigrant background; mean age 14.0), five linear-function tasks were presented in low, medium, and high linguistic variants. Readability indices for a representative task differed markedly (Flesch scores: 86 for low demand; 57 for high demand), confirming substantial surface variation (Ehmke et al., 2025). Yet conceptual equivalence across versions ensured that mathematical requirements remained constant. The absence of large performance gaps under these manipulations suggests that comprehension difficulties arise less from isolated lexical complexity than from broader processes of constructing a situation model.

The cognitive mechanism underpinning success in such tasks aligns with the requirement to decode textual information, translate worldly parameters into symbolic form, and maintain coherence across modeling phases. Students must identify fixed and variable quantities within linear relations; the linguistic cueing of intercept and slope becomes critical only insofar as it facilitates model construction. Language, here, functions as a mediating instrument rather than an endpoint. The interaction of instructional components is presented below (Figure 2).

Figure 2. Interaction Scheme of Language-Responsive Instruction in General Education Subjects (compiled by the author based on Neumayer DePiper et al., 2021; Renn et al., 2024; Son, 2024)



A parallel configuration emerges in science instruction. Longitudinal analyses tracking kindergarten through Grade 5 demonstrate that language and literacy skills significantly predict science achievement while mitigating gender, racial, and socio-economic disparities (Jang et al., 2024). The structural implication is clear: scientific reasoning is inseparable from domain-specific language practices. Literacy does not operate as a peripheral support but reorganizes access to conceptual understanding. When vocabulary precision and syntactic clarity are systematically embedded, performance disparities contract rather than widen.

The coordination rhythm between language and content becomes especially visible in integrated mathematics–literature approaches. Instruction for emergent bilinguals that incorporates children’s literature as an entry point into science and mathematics repositions narrative structure as a scaffold for abstract reasoning (McEwin et al., 2025). Conceptual density is distributed across storytelling sequences, reducing initial linguistic intimidation while preserving disciplinary rigor. This reconstruction does not dilute mathematics; it reorders cognitive sequencing so that comprehension precedes formalization.

Reading competence further mediates general education outcomes. A multiple case study of multilingual learners documents that explicit vocabulary routines, dialogic questioning, and text-structure instruction correlate with gains in comprehension and motivational stability (Gallagher et al., 2023). Students exposed to such routines display improved metacognitive awareness and sustained engagement. The interaction pattern indicates that motivation and linguistic clarity are co-constitutive rather than independent variables.

Civics instruction reveals another layer of structural tension. Access to civic content in U.S. schools depends heavily on evidence-based instructional practices that foreground disciplinary discourse norms (Savage and Ikoma, 2025). Where language scaffolds are absent, participation in civic reasoning declines; where structured academic discussion and textual analysis are embedded, engagement increases. Civic literacy thus hinges on the transparency of argumentative language.

The architectural constraint extends into social studies planning. Pre-service teachers designing culturally sustaining units for emergent bilinguals demonstrate that

content–language integration reshapes unit coherence (Son, 2024). When social studies objectives are articulated alongside language targets, historical reasoning tasks become more navigable. Cultural references cease to function as opaque barriers and instead become resources for comparative analysis.

Within mathematics classrooms serving gifted English learners, belief systems of teachers influence instructional differentiation (Yang et al., 2023). When educators assume linguistic limitations to overshadow mathematical aptitude, advanced reasoning opportunities contract. Conversely, when teachers conceptualize bilingualism as cognitive capital, tasks expand in complexity and representation. Instructional ambition is therefore conditioned by epistemic stance.

Science classrooms exhibit similar patterns of educator buy-in. Professional communities that internalize the inseparability of language and scientific inquiry demonstrate greater willingness to incorporate literacy strategies into laboratory work (Renn et al., 2024). Resistance often stems from disciplinary identity concerns rather than empirical evidence. Once educators witness how structured discussion protocols enhance conceptual articulation, implementation stabilizes.

Across subject domains, a recurring friction emerges: language demands are real but unevenly distributed in their impact. Experimental simplification studies in mathematics show effect sizes ranging from $d = 0.05$ to $d = 0.17$ for certain subgroups, with no consistent universal gains (Ehmke et al., 2025). These modest shifts challenge the assumption that linguistic complexity alone explains achievement gaps. Instead, background variables—prior knowledge, strategy use, socio-economic status—mediate the relationship between text complexity and performance.

The institutional arrangement that most consistently alters outcomes involves iterative cycles of planning, implementation, and reflection. In professional development contexts, 174 link statements connected specific instructional components to growth in teacher efficacy, with 79 statements (45%) attributing gains to classroom implementation and reflection; 49 (28%) to lesson planning; 32 (18%) to analysis of student work; and 14 (8%) to learner-mode strategy immersion (Neumayer DePiper et al., 2021). Notably, 17 responses referenced

interaction between components, suggesting that isolated interventions are less influential than integrated cycles.

Implementation appears to operate as the mastery condition: teachers who applied language strategies in real classrooms reported heightened confidence. The mechanism resembles a feedback loop—anticipated linguistic obstacles are tested against actual student performance, and exaggerated assumptions often dissolve. This aligns with the earlier discrepancy between perceived ($0.73 < d < 1.67$) and actual ($d = 0.12$) linguistic effects (Ehmke et al., 2025). Experience recalibrates expectation.

The verification regime across disciplines thus converges on several empirically grounded findings. First, linguistic responsiveness enhances teacher efficacy and institutional readiness. Second, the measurable impact of linguistic simplification on task performance remains modest when mathematical structure is controlled. Third, literacy integration within science, mathematics, civics, and social studies narrows inequities by rendering disciplinary discourse explicit. Fourth, teacher belief systems mediate access to advanced content for English learners.

A boundary condition persists. Language cannot be abstracted from content, yet neither can it be treated as the singular explanatory variable. The data topology suggests that the most productive configurations arise when language objectives are co-articulated with disciplinary goals, when teachers interrogate rather than assume linguistic barriers, and when instructional cycles allow empirical observation of student reasoning.

The configuration that emerges is not a simplified curriculum for learners with limited English proficiency but a structurally transparent one. Listening precedes articulation; comprehension scaffolds modeling; discourse precedes formal proof. In this restructured environment, language operates simultaneously as a communicative medium and a cognitive instrument.

Where such integration is absent, inequities persist. Where it is present, effect sizes in teacher transformation reach 1.14, readability differences narrow performance gaps, and literacy competencies reshape science trajectories. The evidence does not support reducing conceptual challenge; it supports recalibrating how conceptual language is introduced, rehearsed, and reflected upon across general education subjects.

4. Discussion

The analytical reconstruction of instructional practices across mathematics, science, civics, reading, and social studies reveals a structural paradox. Language is indispensable for disciplinary participation, yet its quantitative effect on task performance, when isolated experimentally, remains comparatively modest. This duality unsettles simplified assumptions about limited differentiated proficiency as the primary explanatory factor behind achievement gaps. The evidence indicates that language operates less as an independent barrier and more as a mediating infrastructure embedded within task architecture, teacher belief systems, and institutional design.

The discrepancy between teacher expectations of linguistic burden and experimentally observed performance shifts requires particular scrutiny. When teachers anticipate large performance declines under increased linguistic demand but students demonstrate only marginal changes, instructional planning may drift toward protective simplification rather than calibrated scaffolding. Such drift can inadvertently reduce cognitive intensity. The problem is not the recognition of linguistic complexity; it is the disproportionate weighting assigned to it. Where teachers interpret language primarily as an obstacle, curricular compression follows. Where language is conceptualized as a cognitive instrument, disciplinary rigor remains intact while access routes diversify.

This tension becomes more complex when considered in relation to teacher self-efficacy. Substantial gains in instructional confidence under structured professional development conditions suggest that teachers' perceived capacity to integrate language strategies is malleable. The pronounced growth in self-efficacy scores signals that targeted, iterative, job-embedded professional learning reorganizes teacher agency. Yet the moderating effect observed—where those with initially lower confidence demonstrated proportionally greater growth—indicates that teacher readiness is unevenly distributed across schools. Institutional context mediates adaptation.

Confidence alone, however, does not guarantee precision. A teacher may feel more capable of supporting English learners while still overestimating the direct influence of surface-level linguistic complexity. The interaction between efficacy and calibration, therefore, becomes

central. When implementation cycles allow educators to observe actual student reasoning, expectation structures adjust. Experience functions as corrective feedback. Over time, exaggerated anticipations of linguistic collapse give way to more nuanced interpretations of where comprehension truly fractures: in the construction of situation models, in the translation between representations, or in strategic planning.

Across general education subjects, language-responsive teaching appears most effective when disciplinary discourse norms are made visible rather than diluted. In mathematics, identifying fixed and variable relationships requires not merely vocabulary substitution but explicit modeling of reasoning sequences. In science, explanatory structures—hypothesis formation, causal inference, validation—depend on academic syntax that cannot be replaced with an informal paraphrase without loss of epistemic clarity. In civics, argumentative participation requires structured engagement with textual evidence and counterclaim formulation. Simplification that removes discourse density may inadvertently remove the very cognitive tools students must acquire.

The evidence from literacy-infused science instruction reinforces this point. Language and content do not function as separable domains; they form a coupled system. Literacy practices embedded in experimental reasoning tasks reduce disparities not because they lower expectations, but because they render the logic of inquiry transparent. The same configuration appears in integrated mathematics–literature approaches, where narrative scaffolding precedes symbolic abstraction. Conceptual transfer emerges through structured sequencing rather than the reduction of complexity.

A further interpretive layer concerns the interaction between language proficiency and background variables. Socio-economic status, prior mathematical knowledge, and familiarity with school discourse patterns intersect with linguistic competence. When these dimensions are conflated, causal attribution becomes distorted. Experimental designs controlling for mathematical content demonstrate that linguistic modification alone rarely produces universal gains. Instead, certain subgroups benefit conditionally. This conditionality suggests that linguistic demands amplify existing disparities rather than generate them independently. Instructional responses must therefore address both structural inequities and

discursive access.

Teacher belief systems occupy a decisive position in this configuration. Where bilingualism is interpreted as a deficit, expectations narrow. Where it is interpreted as a cognitive resource, representation formats diversify, and challenge levels remain ambitious. The architecture of opportunity expands or contracts according to epistemic stance. Professional learning environments that confront implicit deficit assumptions appear to reorient classroom discourse toward student strengths, particularly when analysis of authentic student work reveals unexpected competence beneath surface hesitation.

Implementation cycles constitute a recurrent structural solution. Planning that integrates language objectives, enactment in real classrooms, and reflective analysis of student artifacts creates a feedback loop that stabilizes innovation. Notably, teacher reflections frequently attribute efficacy growth to implementation rather than theoretical exposure alone. Abstract knowledge of strategies does not transform practice; iterative testing does. This suggests that language-responsive instruction in general education subjects cannot be disseminated through brief workshops or isolated modules. Sustained engagement, embedded within authentic teaching contexts, is necessary to shift both practice and perception.

A boundary condition remains visible in the modest effect sizes associated with linguistic simplification in controlled tasks. Simplifying syntax and vocabulary may ease initial comprehension, yet conceptual misunderstanding can persist when modeling processes are opaque. Comprehension difficulties often emerge during mathematization or interpretation phases rather than during literal reading. Language support that focuses exclusively on lexical transparency risks neglecting representational translation. Effective practice, therefore, requires mapping where within the problem-solving sequence breakdown occurs.

In science and social studies contexts, the pattern is analogous. Students may decode informational texts accurately yet struggle to internalize disciplinary argument structures. Structured discussion protocols, sentence frames, and co-constructed vocabulary banks facilitate articulation without eroding conceptual challenge. The operative principle is guided participation in disciplinary

discourse rather than protective shielding from complexity.

Institutional readiness introduces another dimension. Variability between schools in teacher self-efficacy growth suggests that professional culture shapes uptake. Where collaborative reflection is normalized and language integration is framed as collective responsibility, adoption accelerates. Where language instruction is compartmentalized as the domain of specialists, general education teachers may resist engagement. Organizational alignment thus influences the sustainability of language-responsive reforms.

An additional friction concerns assessment design. When large-scale testing instruments conflate mathematical and linguistic complexity, educators may struggle to interpret performance data accurately. Experimental manipulation demonstrates that disentangling these dimensions is methodologically feasible, yet classroom assessments often fail to replicate such clarity. Without transparent alignment between learning objectives and linguistic scaffolds, misinterpretation of student competence persists.

The cumulative evidence points toward a reframing of “features” in teaching general education subjects to students with limited English proficiency. Features are not isolated techniques—sentence starters, simplified texts, vocabulary lists—but coordinated configurations. These configurations integrate (1) explicit articulation of language demands, (2) preservation of disciplinary rigor, (3) iterative cycles of planning and reflection, (4) examination of student work as diagnostic evidence, and (5) recalibration of teacher belief systems through experiential verification.

The conceptual movement emerging from the analysis resists binary positioning. Language is neither negligible nor determinative. It is structural. When embedded deliberately within subject pedagogy, it amplifies access. When misinterpreted as the sole obstacle, it narrows ambition. The most durable instructional shifts occur where educators witness that linguistic scaffolding enhances, rather than substitutes for, conceptual reasoning.

A final interpretive tension concerns scalability. Experimental findings demonstrate measurable teacher transformation under structured professional development conditions, yet the transferability of such models across diverse educational systems remains contingent on institutional capacity. Cultural context, teacher preparation

frameworks, and assessment regimes mediate outcomes. Future inquiry must therefore explore how language-responsive configurations adapt across settings without losing coherence.

The discussion underscores that teaching general education subjects to students with limited English proficiency demands structural transparency rather than curricular reduction. Listening, reading, speaking, and writing function as intertwined cognitive pathways. Disciplinary knowledge emerges when these pathways are deliberately orchestrated. Instruction that recognizes this orchestration does not fragment language and content; it aligns them.

5. Conclusion

The study achieved its stated objectives. First, analysis of experimental evidence demonstrated that linguistic demands influence performance conditionally rather than deterministically. Teachers tend to overestimate the direct effect of linguistic complexity, whereas controlled studies reveal modest effect sizes when mathematical structure is held constant.

Second, examination of professional development research confirmed that teacher self-efficacy is significantly enhanced through structured, iterative implementation cycles. Growth in instructional confidence correlates with increased precision in integrating language strategies without reducing disciplinary rigor.

Third, cross-domain synthesis revealed that effective instruction for students with limited English proficiency is characterized by coordinated configurations: explicit articulation of language objectives, preservation of cognitive challenge, integration of disciplinary literacy, reflective analysis of student work, and recalibration of teacher belief systems.

The findings support the conclusion that teaching general education subjects to students with limited English proficiency requires structural transparency and content-language alignment rather than curricular simplification. Future research should empirically test the proposed structural configurations through mixed-methods classroom studies examining real-time discourse, task sequencing, and teacher decision-making.

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