

# When Content Complexity Meets Language Demand: AI-Mediated Cognitive Decoupling in Bilingual Professional Education

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## Abstract

Bilingual professional courses occupy a structurally uncomfortable position in higher education: they demand that learners simultaneously operate at the cognitive frontier of a discipline and produce output in a language that most of them have not yet mastered. Rather than treating this as a sequencing problem to be resolved through curriculum design, this paper argues that the tension is structural and, in its conventional form, irresolvable without a deliberate mechanism that allows the two demands to be addressed independently. Drawing on cognitive load theory, Krashen's affective filter hypothesis, and Swain's output hypothesis, the paper develops the principle of cognitive decoupling, understood as the deliberate design of instructional conditions in which high-order disciplinary reasoning and structured second-language production are no longer required to compete for the same processing resources. It then argues that AI-mediated scaffolding, specifically large-language-model agents capable of differentiated real-time interaction, offers the first technically scalable mechanism through which this principle can be operationalized in resource-constrained teaching environments. Evidence from sustained action research in a bilingual International Business Negotiation course at a provincial Chinese university illustrates how each component of the decoupling framework functions in practice and what boundary conditions constrain its effectiveness. The paper closes with a set of transferable design principles for bilingual professional education in contexts where faculty capacity and student language backgrounds are heterogeneous.

## Keywords

bilingual higher education, cognitive load theory, affective filter, AI-mediated scaffolding, second-language output, task-based language teaching, professional competence

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## 1. Introduction

Professional education conducted bilingually presents a paradox that has received surprisingly little theoretical attention in the higher education literature. The intellectual demands of disciplinary mastery, specifically the kind of complex, contested, and contextually situated reasoning that professional courses are designed to cultivate, are highest precisely when students are most cognitively burdened by the requirement to produce output in a second language. This is not a coincidence of poor course design; it is a structural consequence of attempting to pursue two cognitively demanding goals simultaneously within the same

instructional episode. Yet the standard response to this paradox has been to dilute one objective in service of the other: either disciplinary depth is sacrificed to make the language load manageable, or the language requirement is quietly reduced to superficial vocabulary labelling while the real course content proceeds in the first language. Both compromises represent a failure to take the bilingual professional course's core ambition seriously.

International Business Negotiation, as a course that simultaneously demands strategic professional reasoning and authentic cross-cultural communication in a second language, exemplifies this tension with particular sharpness. Existing research on the teaching of international negotiation has tended to develop along two largely separate tracks. One strand focuses on the content and pedagogy of negotiation itself, including the design of role-play activities, the use of simulation-based learning, and the integration of cross-cultural competence [4, 11, 21]. A parallel strand, concentrated largely in Chinese higher education scholarship, has examined the curriculum design of bilingual business courses from the perspectives of ideological integration, competency orientation, and vocational relevance [2, 5, 9, 19, 22]. What is conspicuously absent from both strands is a theoretically grounded account of why bilingual professional instruction so frequently fails to produce the simultaneous disciplinary and linguistic outcomes it promises, as well as what structural design principles, rather than incremental curricular adjustments, would be required to resolve that failure.

The maturation of large-language-model (LLM) tools over the past several years introduces a genuinely new variable into this longstanding pedagogical dilemma. LLM agents are capable of generating differentiated, responsive, and contextually authentic interlocutors at essentially zero marginal cost per student interaction, and they can do so while providing real-time linguistic scaffolding calibrated to a learner's demonstrated proficiency. The potential of AI tools in negotiation pedagogy has begun to attract scholarly attention: Rottner [12] demonstrates that iterative practice with AI negotiation bots yields measurable improvements in student performance, while Kōkuti et al. [7] document the pedagogical value of structured AI interaction in business communication education, and Alkaabi [1] shows that digital simulation tools in professional courses enhance higher-order thinking and engagement. However, the prevailing framing positions AI as a supplement to existing instruction rather than as a structural mechanism capable of altering the fundamental relationship between disciplinary reasoning and language production. The present paper proposes a different framing. It argues that AI-mediated scaffolding, properly designed, can operationalize what the paper terms cognitive decoupling: an instructional architecture in which the demands of disciplinary reasoning and second-language production are deliberately separated in time, task type, and cognitive register, such that neither goal compromises the other. Drawing on evidence from sustained action research in International Business Negotiation at a provincial Chinese university, the paper develops the theoretical basis for this principle, illustrates its practical instantiation, and derives design implications for bilingual professional education in resource-constrained settings globally.

## **2. Theoretical Framework: Why the Tension Is Structural**

The coexistence of high cognitive demand and high second-language anxiety in a bilingual professional classroom is not simply an unfortunate coincidence; it follows necessarily from the interaction of processes that cognitive and applied linguistic theory has described in considerable detail. Sweller's [17] cognitive load theory establishes that working memory capacity is finite and that the total cognitive demand experienced during a learning task, comprising the sum of intrinsic load generated by the material's inherent complexity and extraneous load introduced by the task's presentation and format, must not exceed this capacity if learning is to occur efficiently. In a bilingual professional course, the intrinsic load of acquiring domain-specific reasoning is already high, since negotiation strategy, cross-cultural commercial practice, and contract dynamics are areas of genuine conceptual difficulty for undergraduate learners. When second-language production is simultaneously required, it contributes an extraneous load that compounds rather than complements the intrinsic challenge, because managing lexical retrieval, syntactic formulation, and pragmatic appropriateness in a non-dominant language recruits the same limited cognitive resources needed for substantive professional reasoning. The consequence, consistent with what Sweller, van Merriënboer, and Paas [18] predict, is that neither learning objective is well served: disciplinary thinking is constrained by the processing overhead of language management, while language production remains hasty, formulaic, and insufficiently practised.

Krashen's [8] affective filter hypothesis adds a second, mutually reinforcing mechanism to this analysis. Even when students have received sufficient comprehensible input in the target language, output is suppressed whenever the affective filter, the motivational and anxiety-related screen through which input must pass before becoming available for use, is activated by conditions of threat or perceived inadequacy. In a bilingual professional classroom populated by students with heterogeneous proficiency, the conditions for chronic filter activation are structurally present: public oral performance in a language that many students associate with academic failure, combined with the evaluative pressure of a professional course in which disciplinary competence is simultaneously on display, creates precisely the high-anxiety environment that Krashen identified as the primary obstacle to productive language development. The silence that characterizes many such classrooms thus reflects not a lack of disciplinary comprehension but a rational self-protective response to an instructional design that makes participation cognitively and affectively costly. This dynamic has been implicitly acknowledged in the negotiation pedagogy literature: Germain-Thomas et al. [4] note that the artificiality of conventional simulation designs undermines student willingness to engage authentically, while McCarty and Wertheim [11] document persistent participation asymmetries in negotiation courses that track closely with students' perceived communicative competence.

The implication of these two analytical frameworks might seem to be that bilingual professional instruction is simply a bad idea, in that the cognitive and affective costs outweigh the benefits. This would be too hasty a conclusion, and Swain's (1985, 1995) output hypothesis provides the theoretical corrective [15, 16]. Swain's central claim is that learners do not acquire second-language competence solely through exposure to comprehensible input; they require occasions of pushed output, namely communicative events in which they are required to draw on their developing interlanguage and test its adequacy against a communicative purpose, in order to develop the syntactic precision and pragmatic fluency that characterize genuine proficiency. If bilingual professional instruction is the context in which students are most naturally motivated to produce purposeful professional communication in the second language, then reducing the language requirement to avoid cognitive overload removes the very condition most likely to generate productive acquisition. The challenge, therefore, is not to eliminate either demand but to find an instructional design that allows each to be pursued without the other functioning as a ceiling constraint.

Vygotsky's [20] concept of the zone of proximal development completes the theoretical scaffolding for the framework proposed here. Scaffolding, the temporary and calibrated support that enables learners to operate beyond what they could accomplish independently, is theoretically effective precisely because it allows developmental work to occur within the learner's zone of proximal development rather than either below it, in which case no growth occurs, or above it, in which case neither independent performance nor supported learning is possible. The pedagogical challenge in a heterogeneous bilingual classroom is that the zones of proximal development for second-language production are positioned at entirely different points along the proficiency continuum for different students, making teacher-delivered scaffolding structurally unable to serve the full cohort simultaneously. It is here that recent developments in AI-mediated instruction become theoretically significant. Rottner's [12] iterative AI-bot design demonstrates that repeated scaffolded interactions with an AI interlocutor can progressively shift student performance in negotiation tasks, a finding that is theoretically consistent with the ZPD account of how scaffolded practice generates developmental gain. The theoretical gap that remains, and that the present paper addresses, is the absence of a principled design framework for deploying AI scaffolding specifically to resolve the structural cognitive-linguistic tension in bilingual professional courses, rather than simply supplementing language or negotiation instruction at the margins.

### **3. The Structural Problem: Three Compounding Failures**

The theoretical analysis above describes mechanisms that operate across bilingual professional education in general; the specific conditions under which those mechanisms produce their most damaging effects are worth examining in detail, since they define the design targets that any effective intervention must address. Three structural failures, each compounding the others, characterize the contexts where the cognitive-linguistic tension is most acute.

The first is what might be called the faculty capacity paradox. In resource-constrained higher education, which encompasses the overwhelming majority of the world's universities, subject-matter expertise and

second-language instructional fluency are rarely co-present in the same instructor, because the developmental trajectories that produce one rarely intersect with those that produce the other. The result is a systematic distribution problem: the faculty most capable of delivering rigorous disciplinary content are typically those least equipped to model authentic second-language professional discourse, while those with strong foreign-language pedagogical skills frequently lack the domain depth needed to engage students in the complex professional reasoning that distinguishes a serious bilingual course from a language course with disciplinary vocabulary. This is not a resolvable problem at the level of individual faculty development; it is a structural condition that instructional design must work around. Tian and He [19] document this tension specifically in the context of applied undergraduate institutions in China, noting that faculty preparation programs seldom address the dual competence demands of bilingual professional instruction, and that institutional support for ongoing development is characteristically absent.

The second structural failure is learner polarization. Even when individual class sections are relatively homogeneous in their general academic profile, second-language proficiency within a cohort typically spans a range sufficient to make any single instructional pace either frustratingly slow for some students or inaccessibly rapid for others. Vygotsky's framework implies that this is not merely an inconvenience but a deep pedagogical problem, since a scaffold calibrated to one zone of proximal development simultaneously constitutes a ceiling for students below it and is trivially easy for students above it. Uniform pacing in a bilingual professional course thus reliably fails both extremes of the proficiency distribution while adequately serving only the students who happen to fall near the instructional midpoint. Zhang and Huang [22] identify this within-cohort heterogeneity as one of the central unresolved challenges in cross-cultural business instruction, arguing that the field has not yet developed systematic mechanisms for individualized differentiation at classroom scale.

The third failure, which follows mechanically from the first two, is the affective-cognitive double bind. When students whose language proficiency is insufficient for confident oral production are placed in a bilingual classroom where disciplinary content is also unfamiliar and cognitively demanding, the conditions for Krashen's affective filter activation are structurally present: the simultaneous management of content uncertainty and language anxiety pushes total cognitive and affective load beyond the threshold at which voluntary participation is a rational choice. The self-reinforcing quality of this dynamic is particularly damaging, since reduced output leads to reduced practice, which in turn retards proficiency development, which in subsequent sessions intensifies the anxiety that suppresses output. Wertheim et al. [21] observe a related phenomenon in single-language negotiation courses, noting that students with low initial confidence in their communicative ability systematically avoid the voluntary role-taking that is most developmentally valuable; in a bilingual context, the same mechanism operates with additional force because the language itself becomes a source of evaluative threat.

#### **4. Cognitive Decoupling Through AI Scaffolding: A Design Framework**

The three structural failures described above share a common underlying logic: they are all consequences of designing instruction as though disciplinary reasoning and second-language production must be pursued simultaneously, using the same cognitive resources, within the same unbroken instructional episode. Cognitive decoupling, as a design principle, challenges this assumption directly. It proposes that a bilingual professional course should be deliberately structured so that the conditions most favourable for high-order disciplinary reasoning are not the same conditions in which second-language production is required, thereby allowing each goal to be pursued with full cognitive and affective resources rather than in competition with the other. This principle has three operational implications, each of which addresses one of the structural failures identified above.

##### **4.1 Structured First-Language Permission for High-Load Disciplinary Tasks**

Conventional bilingual instruction operates, implicitly or explicitly, on the assumption that maximizing second-language use at all times is necessary to maintain the course's bilingual character. Cognitive load theory provides no support for this assumption when the disciplinary tasks in question generate high intrinsic load. In conditions where students are required to construct complex strategic arguments, evaluate competing claims under uncertainty, or coordinate the interests of multiple negotiating parties, all of which are tasks

that characterize advanced professional reasoning, the simultaneous requirement to produce those arguments in a non-dominant language imposes an extraneous load that competes directly with the germane load that would otherwise drive the development of professional competence. A principled design response, therefore, is to identify the highest-cognitive-load tasks in the course and explicitly permit first-language use for those tasks, not as a remedial accommodation but as a cognitive load management strategy. In the course that informs this paper, small-group strategic deliberation during simulated negotiation sessions was conducted primarily in the first language, while the subsequent communicative phases, namely the exchange of offers, objections, and concessions with the AI interlocutor, required second-language production. This division ensured that the cognitive work of strategy formation was not compromised by language management overhead, while reserving the conditions of relative cognitive ease, occurring when the strategic position had already been established, for practised second-language output. Germain-Thomas et al. [4] offer a structurally analogous insight in their collaborative role-play design, observing that students produce more sophisticated negotiation behaviour when they have been given adequate deliberative preparation time before entering the simulation; the decoupling principle extends this observation by making explicit that the language of that preparation phase should be determined by cognitive need rather than by ideological commitment to target-language maximization.

## **4.2 AI-Mediated Differentiated Scaffolding at Cohort Scale**

The learner polarization problem cannot be resolved through uniform instructional design, as the theoretical analysis above establishes. It requires differentiated scaffolding calibrated to each student's zone of proximal development; however, individual calibration at the scale of a typical professional course cohort is, in practice, impossible to deliver through human instruction alone. AI-mediated scaffolding addresses this constraint directly, since LLM agents can generate arbitrarily many differentiated instructional interactions simultaneously, adjusting task complexity, vocabulary support density, and response latency to match the demonstrated proficiency of each individual learner without requiring additional instructor time. The pedagogical design implication is that AI tools should not be positioned as a single supplementary activity at the margins of an otherwise conventional bilingual course; they should serve as the primary mechanism through which the Vygotskian principle of zone-sensitive scaffolding is operationalized for the full proficiency range of the cohort. In the course examined here, students at higher proficiency levels engaged in full-immersion AI negotiation simulations with translation assistance disabled and adversarial interlocutor profiles selected for complexity; intermediate students worked through staged task sequences in which a complete negotiation was decomposed into scaffolded phases; and students with weaker foundations received pre-loaded scenario vocabulary and in-session linguistic support during initial interactions. Consistent with Swain's output hypothesis, this architecture ensured that all students were generating meaningful second-language output within their respective zones of proximal development. Alkaabi's [1] finding that business simulation games in online professional courses significantly enhance higher-order thinking and engagement is consistent with the mechanism proposed here, and suggests that the benefits of authentic AI simulation extend beyond language practice to the development of the strategic and analytical competencies that professional courses are primarily designed to build.

## **4.3 Professional Task Authenticity as the Scaffolding Medium**

A critical design feature of the framework is that AI-mediated scaffolding is embedded in authentic professional tasks rather than delivered as supplementary language instruction. This distinction matters theoretically because, as a substantial body of research in task-based language teaching has established, second-language production generated in the service of a communicative goal, particularly when the learner's attention is directed primarily at meaning and professional purpose rather than at linguistic form, produces qualitatively different developmental outcomes from production generated in explicitly language-focused exercises [3, 10]. In the bilingual professional course context, this implies that AI agents should simulate realistic professional interlocutors such as procurement negotiators, contract counterparties, and regulatory officials, rather than language tutors. The cognitive and affective consequence is that students direct their working memory resources toward solving a professional problem, and second-language production emerges instrumentally as the necessary medium of that problem-solving, rather than being an end in itself. This shift in attentional orientation reduces the affective filter activation that occurs when language production is evaluated as performance; students focused on achieving a commercial objective in a negotiation are

engaged in professional practice that happens to require language use, not in a language exercise evaluated by professional criteria. Kökütü et al. [7] make a related observation in their examination of AI-assisted business communication training, noting that students who perceived the AI interaction as professionally purposeful rather than pedagogically artificial demonstrated both higher engagement and qualitatively richer output.

The resource efficiency dimension of the framework deserves brief attention, since it bears directly on whether the approach can be replicated where the originating instructor's specific technical knowledge is unavailable. The teaching practice described here developed a modular resource architecture in which the course was decomposed into sixteen reusable instructional units, each providing pre-designed AI interaction prompts, tiered task specifications, and assessment anchors that an instructor could deploy with approximately two to three hours of familiarization per session, a substantial reduction from the eight to ten hours typically required to develop comparable AI-integrated materials from scratch. This reduction was achieved not by simplifying the instructional approach but by separating the pedagogical design logic from the specific content of each session, so that AI interaction templates could be populated with new professional scenarios without rebuilding the underlying scaffolding architecture. In resource-constrained settings where pedagogical innovation characteristically fails to diffuse because it depends on the idiosyncratic expertise of its originator, the capacity to package an instructional approach as a replicable modular system is a condition of institutional uptake rather than a secondary consideration.

## 5. Evidence from Practice: Classroom Observations and Teaching Reflections

The observations reported in this section arise from two full cycles of action research conducted in the bilingual International Business Negotiation course at a provincial Chinese university, spanning successive academic years and involving undergraduate cohorts drawn from the International Economics and Trade and Business Administration programs. Action research, as a methodology for pedagogical inquiry, is concerned not with generalisable causal inference but with the systematic description of how a theoretical framework functions when it encounters the complexity of a real teaching environment, described by Kemmis and McTaggart [6] as a spiral of planning, acting, observing, and reflecting. The evidence presented here is accordingly offered as grounded illustration of the mechanisms proposed in Section 4, with appropriate epistemic modesty about the scope of the claims it can support.

The most consistently observed consequence of introducing the dual-track L1 permission structure was the transformation of the group deliberation phase from a near-silent or formulaic exercise into a substantively engaged strategy session. In the conventional role-play format that preceded the redesign, small groups typically produced brief, undifferentiated position statements and moved to the simulation phase without having genuinely resolved the strategic question of how they intended to create value or manage concessions. Once L1 deliberation was explicitly structured into the pre-simulation phase, framed as a strategy preparation stage rather than as a remedial accommodation, the observable quality of student reasoning during that phase increased markedly. Groups could be heard developing specific BATNA constructions, anticipating counterparty objections, and preparing fallback positions: activities that the course's learning objectives require but that had been systematically crowded out by the language management overhead of conducting those discussions in English. These findings are consistent with the cognitive load analysis in Section 4.1. Removing second-language production from the strategy formation stage allows students to allocate their limited cognitive resources to professional reasoning rather than linguistic encoding. Deep engagement, as required by the course objectives, can thus be achieved. This result is in line with the conclusion of Wertheim et al. [21], who show that sufficient preparation time before negotiation role-plays has a greater impact on learning quality than the duration of the simulation itself.

The introduction of tiered AI negotiation simulations produced a second pattern of observation that illuminates the affective filter mechanism described in Section 2. In earlier iterations of the course, the AI simulation was offered as a single-difficulty environment accessible to all students simultaneously. Instructors observed that students with weaker English foundations typically engaged with a small number of sessions before disengaging, a pattern consistent with Krashen's prediction that persistent output failure suppresses the motivation to attempt further production. When the tiered scaffolding structure was introduced, with real-time vocabulary support available to lower-proficiency students and translation

assistance progressively withdrawn as performance improved, instructor observation records noted a sustained engagement pattern even among students who had previously disengaged earliest. The theoretical account of this change is straightforward: by ensuring that initial AI interactions were tractable for students near the lower end of the proficiency distribution, the redesign prevented the early filter activation that had previously foreclosed participation. Students who completed even a modest number of successful simulated interactions developed what instructors described as a willingness to attempt more challenging scenarios, a progression consistent with what the affective filter literature predicts when anxiety is reduced through accumulated successful output experience. McCarty and Wertheim's [11] comparative finding that structured simulation environments with scaffolded entry points produce more equitable participation distributions than open-ended role-play formats is consistent with this mechanism and reinforces the case for differentiating the AI interaction environment by proficiency level.

However, the original framework did not fully anticipate one condition. Students with extremely limited vocabulary struggle to process even the simplest AI prompts. For these students, tiered scaffolding does not function in the same way as for other learners. Instructor observations clearly indicate that these students remain dependent on in-class translation support after multiple sessions and do not reduce their reliance over time. The scaffolding prevented withdrawal from tasks but did not generate the necessary developmental struggle. According to Swain's output hypothesis, this challenging but manageable effort is where actual language acquisition occurs. This observation implies a design refinement: for students below a certain vocabulary threshold, more intensive pre-task preparation, including schema activation, scenario vocabulary pre-loading, and practised formulaic phrase rehearsal, is necessary before the main AI interaction phase can function as a developmental rather than merely a participatory experience. The implication is not that the decoupling principle should be abandoned for weaker students; rather, the scaffolding must reach further back into the instructional sequence to ensure that the proficiency floor required for productive participation is established before the communicative task commences.

The qualitative shift in negotiation behaviour that instructors observed across the two action research cycles provides perhaps the most theoretically significant illustration. In the first cycle, student simulation transcripts predominantly exhibited what negotiation scholars describe as positional bargaining: students restated their opening positions, made unilateral concessions under pressure, and rarely attempted to reframe the negotiation in terms of shared interests or multi-dimensional value creation. By the second cycle, following the introduction of the full dual-track design with L1 deliberation phases and progressively more demanding AI interlocutors, instructor observations and transcript analysis documented an emergent capacity for integrative strategy, as students were observed packaging offers across price, delivery timeline, and warranty terms rather than treating price as the sole negotiable variable, a strategy that requires both professional knowledge of how to create joint value and the L2 fluency to communicate it under communicative pressure. This transition from positional to integrative patterns is consistent with the cumulative argument of the theoretical framework: the L1 deliberation phases appear to have provided the cognitive space in which students could develop and rehearse the underlying strategic reasoning, while the repeated AI simulation sessions provided the pushed output practice through which that reasoning became expressible in the second language with sufficient fluency to deploy strategically under real-time communicative pressure. Germain-Thomas et al. [4] identify the development of integrative versus distributive awareness as a key marker of progression in negotiation education, and the trajectory observed here, moving from distributive defaults to integrative capacity, maps directly onto that developmental account.

## **6. Design Principles for Bilingual Professional Education**

The theoretical argument and practice observations developed above support a set of design principles applicable to bilingual professional education in contexts beyond the specific course and institutional setting examined here. These principles are offered as transferable starting points for instructors and curriculum designers working in any discipline and any country where the structural tension between disciplinary reasoning and second-language production characterizes the instructional environment.

The first principle is to map the cognitive architecture of the course before assigning language requirements. Not all professional learning tasks generate equivalent cognitive load, and the design decision

about when and how to require second-language production should be calibrated to this variation. Tasks that require complex strategic reasoning, evaluation of competing claims, or collaborative problem-solving under uncertainty should, wherever possible, be designed to allow first-language deliberation, reserving second-language production for the communicative output phase that follows. This is not a concession to students' language limitations; it is a recognition that the bilingual professional course's primary purpose is to develop professional competence, and that this goal is not served by allowing language management overhead to crowd out the substantive cognitive work on which professional competence depends. As Zhang and Huang [22] argue, the persistent gap between negotiation instruction and real professional competence in cross-cultural contexts is often traceable not to insufficient content coverage but to instructional designs that subordinate strategic reasoning to surface-level language performance.

The second principle is to use AI tools to scale differentiated scaffolding, not to automate instruction. The design value of LLM agents in bilingual professional courses lies not in their ability to deliver pre-packaged content but in their capacity to provide calibrated, responsive, and endlessly patient interlocution that adjusts to individual learner need without requiring additional instructor time. Instructors who adopt this principle should expect their role to shift from content delivery toward scaffolding design: the intellectually demanding work moves from the preparation of lectures and exercises to the design of AI interaction environments that generate the kinds of pushed output experiences that Swain's hypothesis identifies as developmental. The instructor's comparative advantage lies in the high-inference judgments, encompassing strategic sophistication, cross-cultural sensitivity, and ideological and ethical reasoning, that current AI cannot reliably assess, while AI handles the high-volume, objectively scorable dimensions of formative feedback. Li [2] and Chen and Wu [9] both argue that the ideological and cultural dimensions of business negotiation instruction require human interpretive judgment that technology cannot substitute; the framework presented here is fully consistent with that position, since it reserves precisely those dimensions for instructor-led assessment.

The third principle is to treat task-based professional authenticity as a condition of second-language development rather than a motivational supplement. The task-based language teaching literature has established that learners develop more durable and transferable language competence when production is generated in the service of a genuinely communicative purpose than when it is produced in response to a linguistic exercise [3, 14]. The design implication is that AI agents in a bilingual professional course should be cast as professional interlocutors with their own interests, constraints, and communicative styles, rather than as language practice partners. The communicative pressure of managing a commercially adversarial AI counterpart creates the conditions that Swain identified as necessary for pushed output, in a context where the affective stakes are substantially lower than in a classroom performance. Salacuse [13], reflecting on decades of international negotiation pedagogy, similarly emphasizes that the simulation's credibility as a professional scenario, rather than its technical complexity, is the primary determinant of its developmental value.

The fourth principle concerns the replicability of the instructional design. In the higher education contexts where the structural tension documented here is most acute, pedagogical innovation that depends on any individual instructor's unique technical expertise or unusually high preparation investment will not scale beyond its originator. Designing for replicability from the outset, through modular resource architectures, explicitly documented AI interaction prompt libraries, and assessment frameworks that are transparent about the respective roles of AI-generated behavioral data and instructor judgment, is not a secondary concern but a condition of the innovation's institutional impact. An instructional design that works brilliantly for one teacher in one course is, in the language of the higher education literature on educational change, an innovation without an adoption mechanism. Tian and He [19] identify exactly this scalability deficit as the reason why isolated instances of successful bilingual course reform in applied undergraduate institutions have not generated systemic change, a diagnosis that the modular design philosophy of the present framework is directly intended to address.

## 7. Conclusion

Bilingual professional education has long been caught between two obligations it cannot simultaneously fulfill under conventional instructional design: the obligation to develop genuine disciplinary competence

and the obligation to develop authentic second-language communicative capacity. When these two demands are permitted to compete for the same cognitive resources within the same instructional episode, the result is predictably inadequate on both dimensions. The argument developed in this paper is that AI-mediated scaffolding offers the first technically scalable mechanism through which the structural tension between these demands can be resolved rather than merely managed, by creating instructional conditions in which high-order disciplinary reasoning and structured second-language production are pursued at different moments, in different cognitive registers, and with different forms of support.

The theoretical contribution of the paper is to name and ground this design principle of cognitive decoupling through AI scaffolding in the established theoretical architecture of cognitive load theory, the affective filter hypothesis, and the output hypothesis, and to show how these three frameworks, taken together, imply a specific set of design decisions rather than competing or merely coexisting. The practical contribution is to illustrate these design decisions through sustained action research and to extract from that experience a set of transferable principles that can guide curriculum designers working in any bilingual professional course in any institutional context where the structural conditions analyzed here are present. In doing so, the paper also responds to a recurring concern in the bilingual professional education literature, namely that innovative course designs remain trapped in the contexts of their origin, by making the modular replicability of the design a first-order pedagogical commitment rather than an afterthought.

Several limitations of the present account should be acknowledged honestly. The evidence base is drawn from a single institution and a single course, which constrains the transferability of specific observations even as the theoretical framework retains broader applicability. The boundary condition identified for very low-proficiency learners, specifically the observation that pre-task preparation must be more intensive than the current design provides, represents an unresolved design challenge that future iterations must address. Evidence on whether the behavioural shifts observed within a single course cycle persist and transfer to professional practice outside the course is entirely absent, and represents the most important gap in the current knowledge base. Future work should pursue systematic cross-institutional documentation of the framework's implementation across different disciplinary contexts, alongside more granular investigation of how the optimal L1-to-L2 task ratio varies across proficiency levels and professional domains. These are ultimately questions for iterative practitioner inquiry and, eventually, for formal comparative study; the present paper's contribution is to establish the theoretical terms on which such inquiry should proceed.

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## **Conflicts of Interest**

The authors declare no conflict of interest.

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