



**INTEGRATING CLIL WITHIN ENGLISH-MEDIUM
INSTRUCTION: STUDENT PERCEPTIONS OF LEARNING,
ACADEMIC COMMUNICATION, AND READINESS IN A
MULTILINGUAL HIGHER EDUCATION CONTEXT**

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Abstract:

With the rapid expansion of English-medium instruction (EMI) across Asian higher education, increasing attention has been directed toward pedagogically grounded course design rather than reliance on language exposure alone. This action-based case study examines Vietnamese biotechnology undergraduates' perceived learning gains, language development, and challenges in a CLIL-informed cross-cultural communication course at a university in northern Taiwan. Drawing on Coyle's 4Cs framework—Content, Communication, Cognition, and Culture—the course integrated intercultural communication concepts with structured academic interaction, collaborative analysis, and milestone-based assessment. Data were collected through a course-specific questionnaire combining Likert-scale and open-ended items (n = 17). Descriptive and thematic analyses indicate that students perceived meaningful gains in conceptual understanding and academic readiness for future English-medium study in the United States. Participants also reported improvement across English skills, particularly increased confidence and participation in discussions and presentations. While language-related challenges—especially vocabulary limitations and difficulty expressing complex ideas—remained evident, these were generally framed as manageable through self-regulated strategies and instructional support. The findings suggest that CLIL-informed scaffolding, interaction-rich tasks, and staged assessment design may enhance EMI learning experiences and promote more equitable academic participation for international students in multilingual higher education contexts.

Keywords: English-medium instruction (EMI); CLIL; international students; cross-cultural communication; academic readiness; action-based case study

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1. Introduction

The internationalization of higher education has significantly reshaped language policies and instructional practices worldwide. English-medium instruction (EMI), defined as the use of English to teach academic subjects in contexts where English is not the majority language, has become a central mechanism through which universities pursue global engagement and academic competitiveness (Coleman, 2006; Rose & McKinley, 2023). Across Europe and Asia, EMI programs have expanded rapidly, often framed as pathways toward international mobility and global employability.

Despite this expansion, EMI research has repeatedly documented tensions between policy aspirations and classroom realities. While students frequently express positive attitudes toward EMI and acknowledge its perceived value for future careers, they also report difficulties in lecture comprehension, academic expression, and classroom participation (Chang, 2010; Huang, 2012, 2015; Macaro et al., 2018). These challenges are particularly pronounced for learners with limited prior EMI exposure or lower self-perceived English proficiency.

In Taiwan, EMI has gained renewed policy momentum under the 2030 bilingual nation initiative (Huang, 2024). Universities increasingly offer EMI courses not only to local students but also to international cohorts. However, previous Taiwanese EMI studies suggest that without explicit pedagogical scaffolding, language demands may restrict full participation and equitable access to disciplinary knowledge (Wu, 2006; Huang, 2012).

Scholars have therefore argued that EMI success depends not solely on English exposure but on pedagogically informed course design. Content and Language Integrated Learning (CLIL) provides one influential framework for integrating content and language objectives within the same instructional space (Coyle, 2007). Rather than treating language development as incidental, CLIL emphasizes intentional alignment across four interrelated dimensions: Content, Communication, Cognition, and Culture.

The present study examines how CLIL principles were operationalized within an EMI cross-cultural communication course designed for Vietnamese biotechnology undergraduates in Taiwan. These students are enrolled in an international program and are expected to transfer to English-medium universities in the United States during their junior or senior years. For them, EMI functions not only as a classroom medium but as preparation for future academic participation in English-dominant environments.

Guided by an action research orientation (Burns, 2009), this study investigates students' perceptions of learning outcomes, language development, and challenges within this CLIL-informed EMI course. It addresses the following research questions:

- 1) How do Vietnamese biotechnology majors perceive their gains in content learning and academic readiness in a CLIL-oriented EMI cross-cultural communication course?
- 2) How do they perceive their English development, particularly academic communication skills, as a result of this course?

- 3) What challenges and coping strategies do they report when learning cross-cultural content through EMI in preparation for future English-medium study?

By focusing on a specific international student cohort and providing detailed course-level analysis, this study contributes to the growing body of research advocating pedagogically grounded EMI implementation in multilingual higher education contexts.

2. Literature Review

2.1 English-Medium Instruction in Higher Education

English-medium instruction (EMI) has become a central strategy for internationalization in higher education. Universities increasingly adopt EMI to enhance institutional visibility, attract international students, and improve graduates' global competitiveness (Rose & McKinley, 2023). However, research has shown that EMI implementation often advances policy goals more rapidly than pedagogical reform.

A systematic review by Macaro et al. (2018) reported inconclusive evidence regarding the impact of EMI on content learning and only partial support for language development claims. While receptive skills may improve through exposure, gains in productive skills and classroom participation are less consistent. Students frequently report difficulties with lecture comprehension, disciplinary vocabulary, and expressing complex ideas in English, particularly in courses lacking explicit language support.

Such challenges have been documented in Asian contexts, including Taiwan (Chang, 2010; Huang, 2015), where EMI expansion has at times outpaced curriculum redesign and teacher preparation. These findings suggest that EMI effectiveness cannot be understood solely in terms of language proficiency; rather, course design and instructional practices play a critical role.

Recent scholarship therefore calls for closer examination of how EMI is operationalized at the classroom level, particularly for international students navigating multilingual learning environments (Gilanyi et al., 2023). A design-oriented perspective shifts attention from broad policy debates to the pedagogical structures shaping learner experience.

2.2 CLIL as a Pedagogical Orientation within EMI

Content and Language Integrated Learning (CLIL) offers a framework for addressing design challenges in EMI. Rather than treating language development as incidental, CLIL emphasizes the deliberate integration of disciplinary content and language use. Coyle's (2007) 4Cs framework—Content, Communication, Cognition, and Culture—conceptualizes learning as a multidimensional process in which conceptual understanding and academic language development are interdependent.

In higher education, CLIL typically functions as a pedagogical orientation guiding task sequencing, interaction design, and assessment alignment. Research suggests that EMI courses informed by CLIL principles—such as structured discussion routines, guided output tasks, and explicit attention to academic language—can mitigate

comprehension difficulties and support student engagement (Hidalgo & Ortega-Sánchez, 2023).

CLIL research also highlights the role of multilingual mediation. Rather than enforcing rigid English-only policies, CLIL-informed EMI may allow strategic translanguaging during collaborative meaning-making while maintaining English as the language of formal academic output (Tai et al., 2025). Such flexibility acknowledges learners' linguistic resources while preserving the academic goals of EMI.

Although CLIL has been widely examined in school contexts, fewer studies provide detailed accounts of its operationalization in higher education EMI courses serving international students. This gap underscores the need for course-level investigations.

2.3 Sociocultural Theory and Learning in EMI Contexts

Sociocultural theory offers a complementary lens for understanding learning in EMI classrooms. From this perspective, knowledge and language are co-constructed through social interaction and mediated activity (Vygotsky, 1978). The concept of the zone of proximal development suggests that learners can perform beyond their independent ability through guided participation with peers and instructors.

In EMI settings, collaborative tasks and structured discussion function as mediational spaces supporting both conceptual understanding and academic language use. This interactional dimension is particularly relevant in multilingual classrooms, where learners may draw upon diverse linguistic resources during meaning negotiation. Sociocultural theory also aligns with action research approaches (Burns, 2009), which emphasize iterative refinement of instructional practices in response to learners' needs. This perspective informs the present study's classroom-based design.

2.4 Cross-Cultural Communication and Academic Readiness

For students preparing to study abroad, academic readiness extends beyond language proficiency. Effective participation in English-medium universities requires awareness of intercultural communication norms, participation expectations, and differences in academic discourse (Hall, 1976; Ma & Lucietto, 2024).

Courses that integrate cross-cultural communication frameworks with academic English practice can serve as preparatory spaces for overseas study. By combining conceptual exploration with structured discussion and presentation tasks, such courses allow students to rehearse both cognitive and communicative dimensions of future academic participation.

However, empirical research documenting students' perceptions of these integrated EMI courses remains limited. The present study addresses this gap by examining a CLIL-informed cross-cultural communication course designed to support Vietnamese biotechnology students' learning and academic readiness in Taiwan.

3. Methodology

3.1 Context and Participants

The study was conducted in an international biotechnology program at a private university in northern Taiwan. Within this program, Vietnamese students complete part of their undergraduate training in Taiwan before transferring to partner universities abroad, where English serves as the primary medium of instruction. As a result, students are required to engage with disciplinary content through English while simultaneously preparing for future academic study in English-dominant higher education contexts.

Seventeen Vietnamese undergraduate biotechnology majors (10 female, 7 male) enrolled in a required English-medium cross-cultural communication course participated in the study. Participants were in their second or third year of study and had prior experience learning English as a foreign language in Vietnam, followed by exposure to English-medium instruction (EMI) courses after matriculating in Taiwan.

Given that the instructor also served as the researcher, steps were taken to reduce potential social desirability bias. The questionnaire was anonymous, participation was voluntary, and students were informed that their responses would not affect their grades. Data were collected only after final grades had been submitted. These procedures were implemented to encourage honest and independent responses.

Based on institutional background records and available standardized test information, participants demonstrated a relatively consistent intermediate to upper-intermediate English proficiency profile. Eight students reported recent IELTS scores ranging from 5.0 to 6.5, while nine reported TOEIC scores between 650 and 780. These scores correspond approximately to CEFR levels B1 to B2+, with the majority clustering at the B2 level. Students' self-ratings of English ability were largely aligned with these records, as most identified themselves as "intermediate" or "upper-intermediate."

Collectively, this proficiency distribution suggests that students possessed functional academic reading and listening skills necessary for engaging with EMI coursework. However, extended academic speaking, disciplinary discussion, and analytical writing in English remained developmental areas, particularly when students were required to articulate abstract theoretical concepts in real time.

All participants provided informed consent prior to data collection, and pseudonyms were used to ensure confidentiality.

3.2 Course Design and CLIL Operationalization

The Cross-Cultural Communication course was explicitly designed and implemented as an EMI course informed by Content and Language Integrated Learning (CLIL) principles. Coyle's (2007) 4Cs framework—Content, Communication, Cognition, and Culture—served as the guiding structure for curriculum alignment.

With respect to **Content**, the course introduced key intercultural communication concepts, including Big C and small c culture, collectivism–individualism, power

distance, communication styles, and academic interaction norms. These conceptual frameworks formed the disciplinary foundation of the course.

In terms of **Communication**, instructional activities were structured to require active use of English for academic purposes. Weekly lessons incorporated guided discussion prompts, pair and group interaction tasks, and presentation activities that required students to articulate conceptual understanding, compare cultural patterns, and respond to peers' perspectives. English served as the primary language for formal reporting and presentation.

Regarding **Cognition**, tasks were sequenced progressively, moving from foundational comprehension of intercultural concepts to analytical comparison and applied research. Students were encouraged to interpret cultural phenomena using theoretical frameworks and to justify their interpretations through structured argumentation.

The **Culture** dimension was addressed through explicit examination of differences in communication styles and academic participation norms between Asian and Western higher education contexts. This component was particularly relevant given students' anticipated transition to U.S. universities.

A major component of the course was a semester-long group research project focusing on a selected country or cultural context. Students were required to (a) conduct research using academic and credible online sources, (b) analyze cultural characteristics through course frameworks, (c) produce a structured written report in English, and (d) deliver an oral presentation to the class. Multiple feedback stages—including topic approval, draft review, and rehearsal presentations—were incorporated to support iterative refinement of both conceptual understanding and academic communication.

Assessment criteria emphasized clarity of ideas, application of theoretical concepts, and effectiveness of academic communication rather than grammatical accuracy alone.

3.3 Instruments and Data Analysis

Data were collected at the end of the semester through a course-specific questionnaire consisting of Likert-scale items and open-ended questions. The questionnaire was designed to capture students' perceptions of (a) content learning and academic readiness, (b) English language development, (c) classroom participation and communication confidence, and (d) perceived challenges and coping strategies in the EMI context.

Quantitative data were analyzed descriptively to identify overall response patterns. Qualitative responses were analyzed thematically to identify recurring themes related to learning experiences, linguistic challenges, and adaptive strategies. The integration of quantitative and qualitative data allowed for triangulation and facilitated alignment between empirical findings and the research questions guiding the study.

The Likert-scale section consisted of 18 items distributed across three constructs corresponding to the research questions. Internal consistency analysis yielded Cronbach's alpha coefficients ranging from .82 to .87, indicating acceptable reliability for exploratory classroom-based research.

4. Results

This chapter presents the findings of the study examining Vietnamese biotechnology majors' perceptions of a CLIL-informed EMI cross-cultural communication course in Taiwan. The results are organized according to the three research questions and integrate quantitative questionnaire data with qualitative responses to provide a comprehensive understanding of students' experiences.

Rather than presenting figures as isolated numerical summaries, this section interprets patterns across items and situates them within the broader instructional context.

4.1 Participant Background and EMI Context

Seventeen Vietnamese biotechnology majors participated in the study. Understanding their linguistic and educational background is essential for interpreting subsequent findings regarding perceived learning gains and challenges.

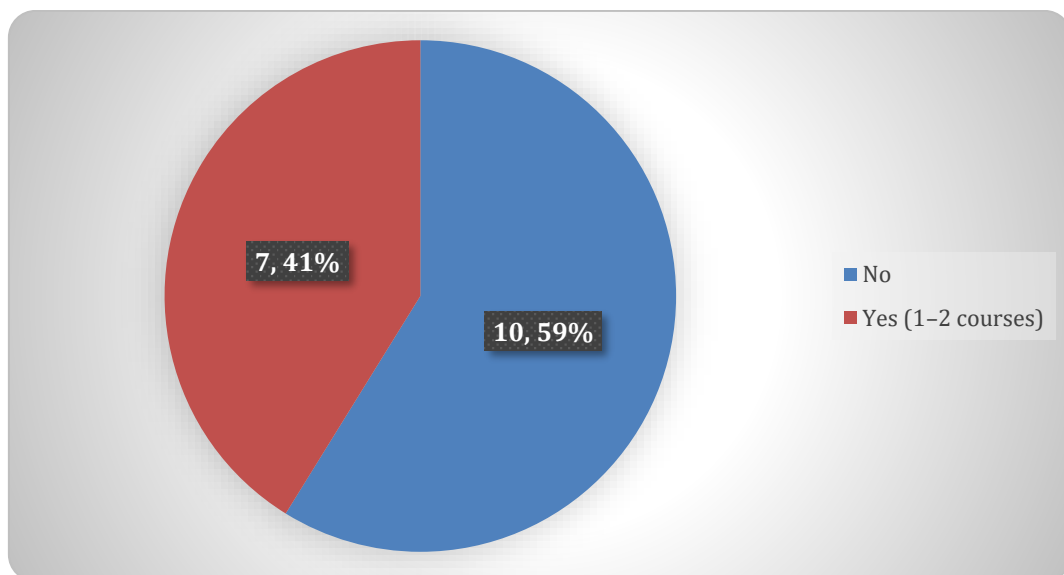


Figure 1: Prior EMI Experience

Figure 1 indicates that the majority of participants had little to no prior experience with English-medium instruction before enrolling in this course. For many students, this was their first sustained exposure to learning disciplinary content entirely through English.

This limited background is significant. Research has shown that students entering EMI environments without prior exposure often experience heightened cognitive demands during initial adaptation (Macaro et al., 2018). Therefore, any reported gains in confidence or academic readiness in this study must be understood within the context of relatively novice EMI learners.

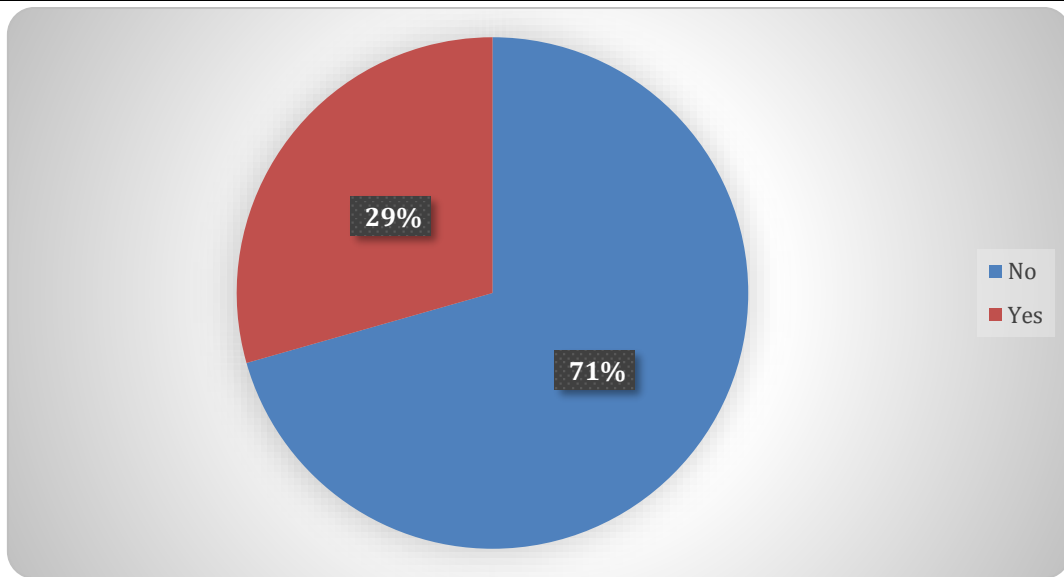


Figure 2: Study or Residence in English-Speaking Countries

Figure 2 shows that most participants had not studied or lived in an English-speaking country for longer than three months. This suggests that students’ adaptation to English-medium academic discourse occurred primarily within the Taiwanese institutional setting rather than through immersive overseas experiences.

The absence of extended immersion strengthens the interpretation that reported improvements are closely associated with the course design and instructional practices rather than external exposure.

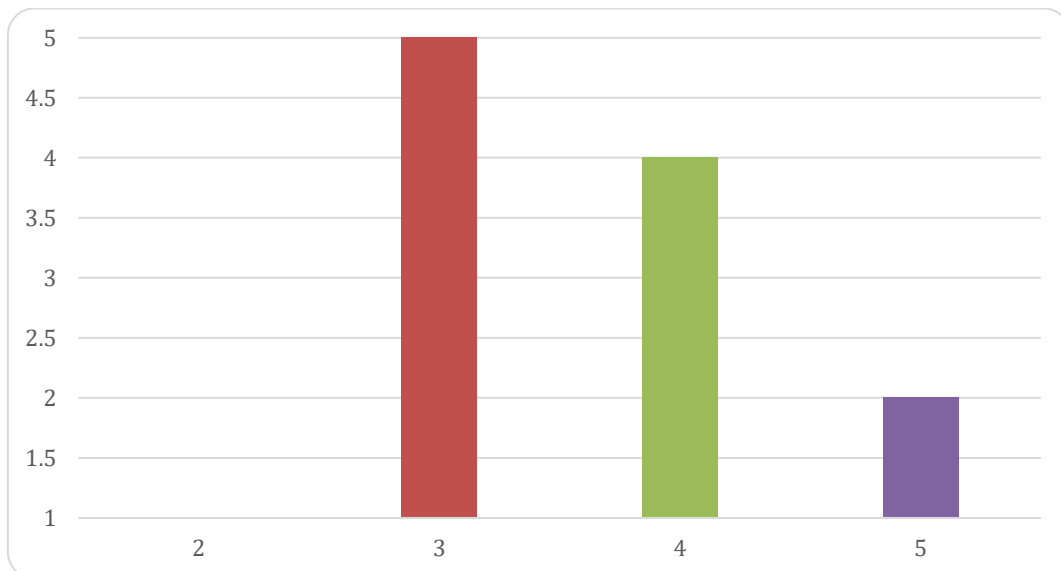


Figure 3: Self-Rated English Proficiency

As shown in Figure 3, most students self-identified as having intermediate English proficiency, with relatively few reporting high proficiency. The cohort, therefore, reflects a linguistically diverse but predominantly non-advanced group.

This baseline profile contextualizes later findings related to expressive difficulty and vocabulary limitations. It also highlights the importance of instructional scaffolding in enabling equitable participation within EMI classrooms.

4.2 RQ1: Perceived Gains in Content Learning and Academic Readiness

Research Question 1 examined students' perceptions of content learning and readiness for future English-medium study.

4.2.1 Quantitative Findings

Students reported high levels of agreement with statements indicating that EMI supported their understanding of cross-cultural communication concepts and enhanced their academic preparation. Mean scores across RQ1 items ranged from 4.12 to 4.53 on a 5-point Likert scale ($SD = .42-.61$), reflecting consistently positive evaluations of both conceptual learning and perceived readiness for future English-medium study.

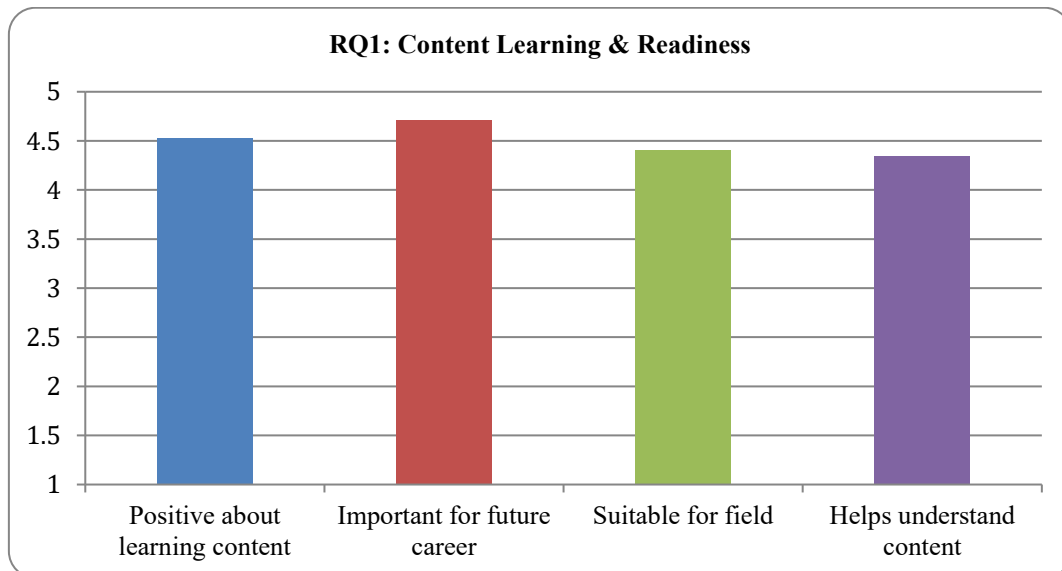


Figure 4: Content Learning and Academic Readiness

Figure 4 presents mean scores across items related to conceptual understanding, disciplinary relevance, and preparation for future overseas study. The consistently high ratings suggest that students experienced the EMI course as academically meaningful rather than linguistically obstructive.

Notably, items related to future academic and career relevance received particularly strong agreement. This indicates that students viewed EMI not merely as a language-learning context but as an investment in future participation in international academic communities.

4.2.2 Qualitative Findings

Open-ended responses reinforce these patterns. Several students emphasized that learning cross-cultural frameworks in English increased their familiarity with international academic discourse. One participant noted:

“Now I can use concepts like power distance to explain communication problems in research teams.”

This comment suggests movement beyond surface-level cultural awareness toward applied conceptual understanding within professional contexts. Others noted that the course helped them anticipate differences in communication styles and classroom expectations in U.S. universities.

Importantly, very few responses framed English as preventing conceptual comprehension. Instead, students described occasional difficulty with terminology but generally reported being able to grasp key ideas through discussion and clarification. This suggests that the integration of content input with structured interaction may have mitigated comprehension barriers commonly reported in earlier EMI research (Huang, 2015).

4.3 RQ2: Perceived English Development and Academic Communication

Research Question 2 focused on perceived English development, particularly academic communication skills.

4.3.1 Quantitative Findings

Students reported improvement across listening, speaking, reading, and writing.

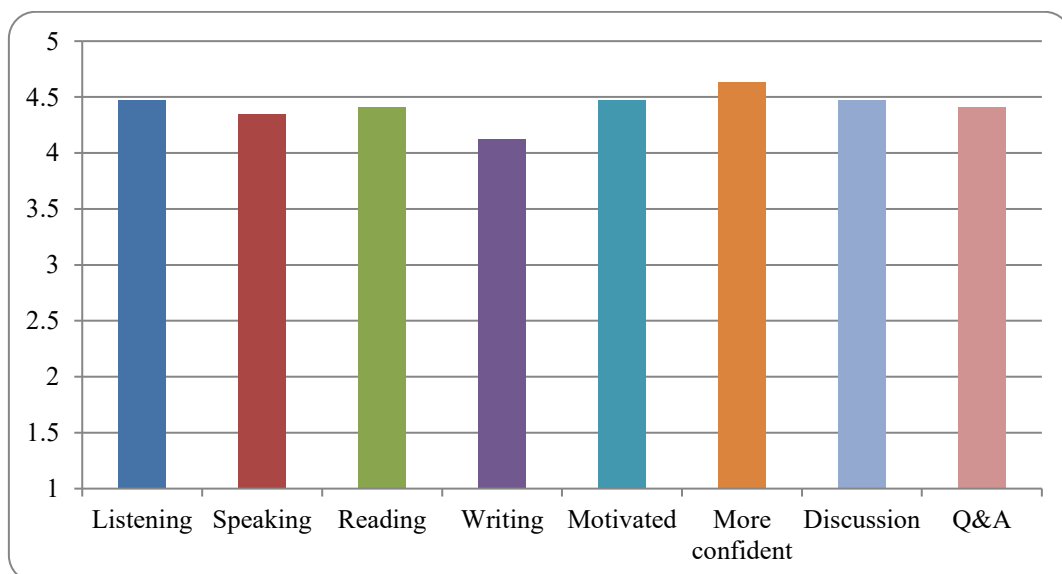


Figure 5: English Language Development and Communication Confidence

Figure 5 illustrates perceived gains across language skills. Mean ratings for receptive skills (listening and reading) exceeded 4.30, whereas speaking and writing ranged between 3.95 and 4.18 ($SD = .48-.67$), indicating positive but slightly more variable perceptions of productive skill development. The stronger gains reported for listening and reading are consistent with systematic EMI findings that receptive skills tend to develop more prominently than productive skills (Macaro et al., 2018). Nevertheless, the positive ratings for speaking and writing suggest that structured interaction within the course may have supported development beyond passive exposure.

Items related to confidence and participation opportunities were especially strong. Students agreed that they had sufficient chances to speak, ask questions, and express opinions during class.

4.3.2 Qualitative Findings

Qualitative responses highlight confidence as a central theme. Many students described initial hesitation when speaking English, but noted gradual improvement through repeated small-group discussions and presentation tasks. As one student reflected:

“At first I was afraid to speak in English, but after practicing in groups, I felt more confident sharing my ideas.”

Students frequently mentioned that rehearsing ideas with peers before presenting publicly reduced anxiety and allowed vocabulary clarification. Some also reported increased awareness of academic language structures, noting that they learned how to organize comparisons more clearly using expressions such as “in contrast” and “similarly.”

Rather than focusing solely on grammar or accuracy, students emphasized communicative effectiveness and willingness to participate. This shift in orientation—from fear of error to engagement in meaning-making—represents a significant affective and functional development within EMI contexts.

4.4 RQ3: Challenges and Coping Strategies

Research Question 3 examined perceived challenges and strategies for managing EMI demands.

4.4.1 Quantitative Findings: Challenges

Figure 6 shows moderate agreement with statements indicating vocabulary limitations and difficulty fully expressing subject knowledge in English. Items related to vocabulary constraints yielded mean scores between 3.40 and 3.78, whereas anxiety-related items remained below 3.00. This pattern reinforces the distinction between cognitive-linguistic challenge and affective distress, suggesting that students experienced EMI as effortful but not emotionally overwhelming.

This pattern suggests that students distinguished between linguistic difficulty and emotional distress. English posed cognitive demands, but it did not generally produce overwhelming anxiety.

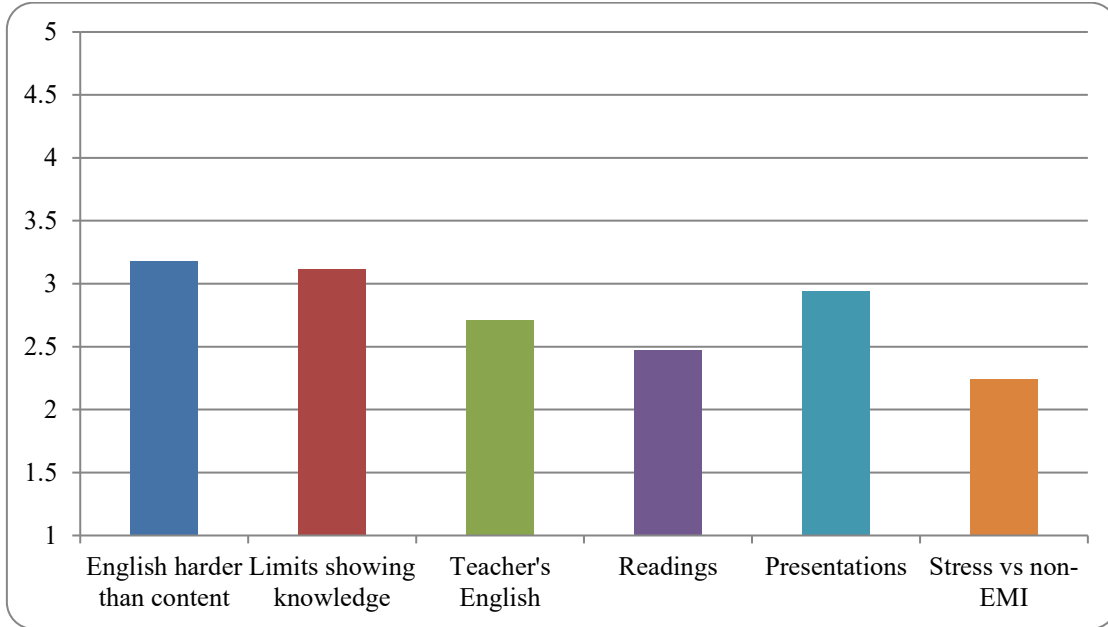


Figure 6: Challenges in EMI Learning

4.4.2 Quantitative Findings: Coping Strategies and Support

Figure 7 indicates frequent use of preview–review strategies, dictionary or translation tools, and instructor clarification. Students reported high levels of perceived teacher support.

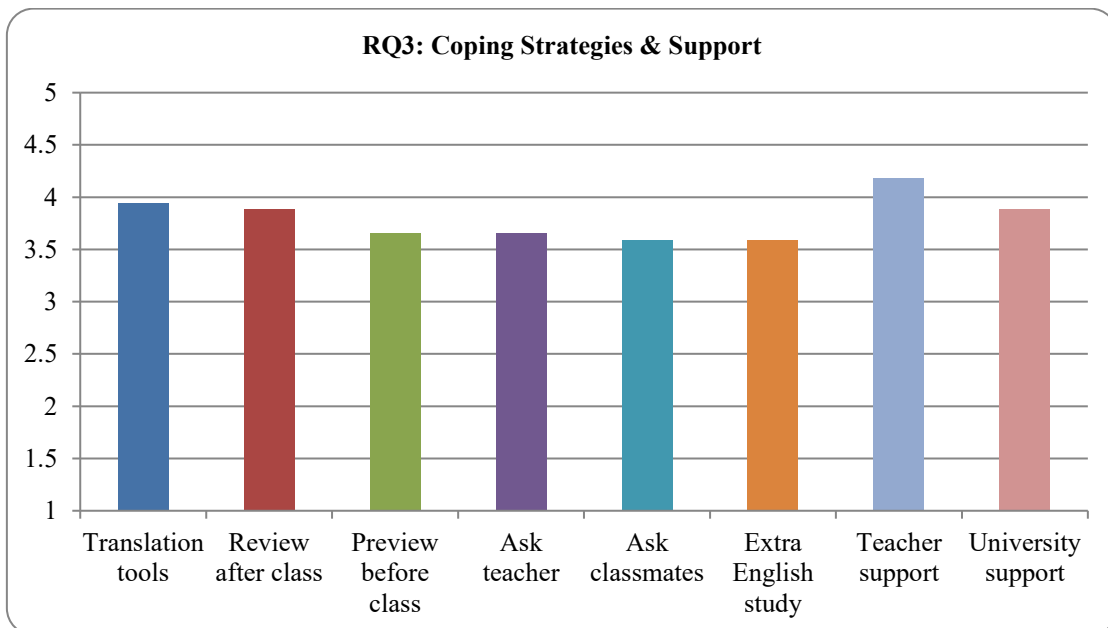


Figure 7: Coping Strategies and Perceived Support

The prevalence of self-regulated strategies demonstrates active adaptation rather than passive struggle. Students appeared to approach EMI as a manageable challenge requiring strategic effort.

4.4.3 Qualitative Findings

Open-ended responses further clarify this pattern. Students often described vocabulary gaps as temporary obstacles that could be addressed through preparation or peer discussion. Several participants noted that discussing concepts with classmates before whole-class reporting helped clarify both meaning and wording.

Some students also reported strategically using Vietnamese during preparatory discussions to ensure conceptual understanding before presenting in English. As one participant explained:

“Sometimes we used Vietnamese to make sure we understood the idea correctly before explaining it in English.”

Such multilingual negotiation appeared to function as cognitive scaffolding rather than avoidance of English use. Students described first clarifying abstract concepts in their shared language and then reformulating them into English for formal presentation. Several students suggested additional vocabulary explanations or review sessions, indicating a desire for enhanced scaffolding rather than rejection of EMI itself. Overall, challenges were framed as effortful but surmountable within a supportive classroom environment.

4.5 Summary of Results

Across all three research questions, students generally perceived the CLIL-informed EMI course in positive and constructive terms. They reported meaningful gains in conceptual understanding of cross-cultural communication frameworks and indicated that the course enhanced their sense of academic readiness for future English-medium study. In addition to content-related development, students described improvement across English language skills, particularly in listening and reading, alongside noticeable growth in communicative confidence during discussions and presentations. Although vocabulary limitations and difficulty expressing complex ideas remained evident, these linguistic challenges were largely framed as manageable rather than discouraging. Taken together, the findings suggest that the integration of structured interaction, milestone-based assessment, and consistent instructional support played a central role in shaping students' overall learning experiences and perceived outcomes within the EMI context.

5. Discussion

This study examined Vietnamese biotechnology undergraduates' perceptions of learning gains, language development, and challenges in a CLIL-informed EMI cross-cultural

communication course. By organizing the discussion around the three research questions, this section interprets the findings in relation to EMI scholarship, CLIL pedagogy, and the specific multilingual context in which the course was situated.

5.1 RQ1: Content Learning and Academic Readiness in a CLIL-Informed EMI Course

Students in this study reported generally positive perceptions of content understanding and academic readiness. Importantly, despite limited prior EMI exposure, participants did not frame English as a barrier preventing conceptual learning. Instead, many described EMI as facilitating familiarity with academic terminology and international perspectives relevant to their future study in the United States.

This finding contrasts with earlier Taiwanese EMI research that documented substantial comprehension difficulties and reduced access to disciplinary content when courses relied heavily on lecture delivery without explicit scaffolding (Wu, 2006; Huang, 2012). In those contexts, language demands often overshadowed content engagement. By contrast, the present course incorporated guided discussion, collaborative analysis, and staged project work, aligning more closely with CLIL's emphasis on integrating Content and Cognition (Coyle, 2007).

The milestone-based country research project appears particularly significant. Rather than evaluating students through a single high-stakes assessment, the course distributed cognitive and linguistic demands across iterative stages, including topic selection, draft feedback, peer review, and rehearsal presentations. This structure likely reduced cognitive overload and supported deeper engagement with cross-cultural concepts. Consistent with Hidalgo and Ortega-Sánchez (2023), structured CLIL-informed tasks may enhance conceptual clarity by embedding language use within meaningful disciplinary problem-solving.

Moreover, students' references to "preparation" and "future study" suggest that the course functioned as a site of academic socialization. EMI here was not merely a medium of instruction but a rehearsal space for future participation in English-medium universities. This aligns with Rose and McKinley's (2023) argument that EMI, when pedagogically grounded, can facilitate students' integration into international academic communities rather than merely providing English exposure.

5.2 RQ2: English Development and Academic Communication

Consistent with systematic EMI reviews (Macaro et al., 2018; Curle et al., 2020), students reported particularly strong gains in receptive skills such as listening and reading. These findings are not surprising, as exposure to English lectures and materials typically enhances comprehension abilities. However, the relatively positive ratings for speaking and writing are noteworthy.

In many EMI contexts, productive skills lag behind receptive gains due to limited structured interaction opportunities (Macaro et al., 2018). In the present course, however, Communication was embedded explicitly within instructional design. Weekly small-group discussions, structured reporting tasks, and staged presentations required

students to articulate conceptual understanding actively. This design aligns with CLIL's emphasis on purposeful language use within disciplinary tasks (Coyle, 2007).

Students' qualitative comments frequently highlighted increased confidence rather than purely linguistic improvement. Confidence, or willingness to communicate, is often underemphasized in EMI research, yet it plays a crucial role in academic participation. Within this course, small-group rehearsal spaces appeared to function as lower-stakes environments where students could negotiate meaning, clarify vocabulary, and refine ideas before public presentation.

From a sociocultural perspective (Vygotsky, 1978), these collaborative interactions may have created mediational spaces that enabled learners to operate within their zones of proximal development. While English remained the primary medium of academic output, strategic multilingual negotiation during group work may have supported comprehension and expressive clarity. Such flexible mediation aligns with Tai et al.'s (2025) argument that multilingual resources can enhance rather than undermine CLIL-based EMI learning.

Thus, students' reported English development appears closely tied to the interaction-rich and scaffolded nature of the course design rather than exposure alone.

5.3 RQ3: Challenges and Coping Strategies in EMI Learning

Consistent with prior EMI research in Taiwan and other Asian contexts (Chang, 2010; Huang, 2015), vocabulary limitations and difficulty expressing complex ideas emerged as the primary challenges. Students frequently noted that they understood concepts but struggled to articulate them fully in English.

However, unlike earlier studies reporting high levels of anxiety or avoidance behavior, participants in this study reported relatively low affective distress. This distinction between cognitive-linguistic difficulty and emotional burden is significant. Students appeared to interpret language challenges as expected aspects of EMI rather than insurmountable barriers.

Quantitative findings indicated frequent use of preview–review strategies, dictionary consultation, translation tools, and instructor clarification. These strategies reflect self-regulated learning behaviors and active adaptation. Pun and Thomas (2019) similarly found that students in EMI contexts perceive challenges as manageable when adequate instructional support and mediation are present.

Teacher support was rated highly, reinforcing the importance of responsive pedagogy. Rather than enforcing rigid English-only norms, the course allowed strategic multilingual negotiation during collaborative work while maintaining English for formal output. From a CLIL perspective, this reflects attention to the Culture dimension, acknowledging students' linguistic identities and promoting equitable participation.

Taken together, these findings suggest that linguistic challenges are not inherently detrimental in EMI contexts; their impact depends largely on instructional design, scaffolding, and classroom interaction norms.

6. Conclusion, Pedagogical Implications, and Future Directions

This study examined Vietnamese biotechnology undergraduates' perceptions of learning gains, language development, and challenges within a CLIL-informed EMI cross-cultural communication course in Taiwan. Situated within the broader expansion of EMI under Taiwan's bilingual policy (Huang, 2024), the course was intentionally designed to move beyond exposure-based EMI models by integrating conceptual instruction, structured academic communication, and staged assessment within a coherent pedagogical framework.

Across all three research questions, findings suggest that students perceived the course as supportive of both disciplinary understanding and preparation for future English-medium study. Despite limited prior EMI exposure and predominantly intermediate self-rated English proficiency, participants reported meaningful gains in conceptual clarity, participation confidence, and academic readiness. Importantly, English was not framed as an insurmountable barrier to content learning. Instead, students described EMI as a context in which they became more familiar with disciplinary terminology, academic discussion norms, and intercultural communication frameworks relevant to future study in the United States.

From a CLIL perspective (Coyle, 2007), the alignment of Content, Communication, Cognition, and Culture appears central to these outcomes. Conceptual instruction was consistently paired with structured discussion tasks and applied project work, enabling students to use English purposefully rather than passively receiving information. The staged country research project, incorporating feedback and rehearsal, distributed cognitive and linguistic demands across the semester. This design likely mitigated cognitive overload and allowed gradual development of both disciplinary understanding and communicative competence.

While vocabulary limitations and expressive precision emerged as persistent challenges—consistent with previous EMI research in Taiwan and Asia (Chang, 2010; Huang, 2015; Macaro et al., 2018)—these challenges were generally experienced as manageable rather than discouraging. Students actively employed preview–review strategies, translation tools, and help-seeking behaviors, and they reported high levels of perceived teacher support. This suggests that linguistic difficulty does not inevitably translate into high anxiety or disengagement; rather, its impact is mediated by instructional scaffolding and classroom interaction norms. In this respect, the findings reinforce arguments that EMI effectiveness depends as much on pedagogical design as on students' initial proficiency (Curle et al., 2020; Hidalgo & Ortega-Sánchez, 2023).

Several pedagogical implications emerge. First, EMI courses serving multilingual and international student cohorts should adopt structured interaction routines rather than relying predominantly on lecture-based delivery. Small-group discussion followed by guided reporting can provide lower-stakes rehearsal spaces that build communicative confidence and conceptual clarity. Second, milestone-based assessment design may reduce affective pressure and allow iterative refinement of both content knowledge and

language use. Third, strategic multilingual mediation during collaborative learning—while maintaining English for formal academic output—can enhance comprehension and participation without undermining EMI goals. Finally, cross-cultural communication courses embedded within disciplinary programs can function as transitional academic spaces, supporting both cognitive and affective readiness for study abroad.

This study is not without limitations. The small sample size and single-course context limit generalizability. Moreover, reliance on self-reported perception data means that findings reflect students' subjective experiences rather than objective measures of proficiency or academic achievement. Future research could incorporate longitudinal tracking of students after transfer to English-medium universities to examine whether perceived readiness translates into measurable academic success. Classroom observation and discourse analysis would also provide deeper insight into interactional dynamics within CLIL-informed EMI settings. Comparative research across disciplines and institutional contexts would further clarify how curriculum design interacts with learner backgrounds and proficiency profiles.

In conclusion, this action-based case study demonstrates that a CLIL-informed EMI course can support international students' perceived content learning, academic communication development, and readiness for future English-medium study when pedagogical design intentionally integrates content, language, cognition, and culture. As EMI continues to expand across Asian higher education (Rose & McKinley, 2023; Huang, 2024), careful attention to curriculum architecture will be essential for promoting equitable and meaningful participation in multilingual academic environments. Rather than viewing EMI primarily as a language policy initiative, institutions may benefit from reconceptualizing it as a pedagogical design challenge—one that requires structured scaffolding, interaction-rich tasks, and sustained alignment between disciplinary goals and communicative practice.

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Conflict of Interest Statement

The author declares no conflicts of interest.

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