e-TEALS no.16 | 2024
An **e**-journal of **T**eacher **E**ducation
and **A**pplied **L**anguage **S**tudies

Exploring interdisciplinary collaboration: Mixed methods insights from a higher education institution study

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Abstract

This article presents a mixed-method study exploring interdisciplinary collaboration at Castelo Branco Polytechnic University during the 2022-2023 academic year. The collaboration involves an English for Specific Purposes (ESP) teacher and a content teacher, examining receptiveness to collaboration and the impact of Integrated Content and Language in Higher Education (ICLHE). The study focuses on first-year undergraduate students in the fashion and textile design course, utilising questionnaires developed with Social Cognitive Theory (SCT) and Expectancy-Value Theory (EVT) for validity and reliability. The study provides a broad context based on research on interdisciplinary collaboration and ICLHE. Preliminary qualitative and quantitative analyses reveal significant challenges for students in technical language, underscoring the need for targeted support. The findings indicate a generally positive attitude towards ICLHE and collaborative teaching methods. Additionally, the study highlights how students' self-efficacy, expectancy beliefs, and task values influence their receptiveness and learning outcomes in interdisciplinary settings. The results emphasise the importance of clear learning objectives, active engagement, and adequate resources, suggesting that effective interdisciplinary collaboration can enhance technical language learning and overall educational experiences. These insights offer actionable recommendations for improving teaching practices and fostering successful interdisciplinary initiatives in higher education.

Keywords: Interdisciplinary collaboration, student receptiveness, ICLHE, Social Cognitive Theory, Expectancy-Value Theory

1. Introduction

In Higher Education Institutions (HEIs), student feedback primarily assesses course quality and learning outcomes, with limited research on students' receptiveness to different teaching methods. To address this gap, this study draws on existing research. It incorporates specific criteria to evaluate first-year undergraduate students' perspectives on interdisciplinary collaboration and Content and Language Integrated Learning (CLIL) in the fashion and textile design course. This article outlines the development of questionnaires, the initial analysis, and early findings from an ongoing study at Castelo Branco Polytechnic University, part of a PhD project at Porto University. The study focuses on interdisciplinary collaboration between an English for Specific Purposes (ESP) teacher and three content teachers, addressing challenges and opportunities in collaborative teaching. Given the study's extensive scope, this article specifically examines the responses of first-year undergraduate students to provide a detailed analysis of their perspectives on interdisciplinary collaboration within fashion and textile design.

Criteria for data collection methods are defined to assess interdisciplinary collaboration comprehensively. These criteria establish a research framework for teachers adapting to the evolving demands of globalisation. The subsequent sections will review pertinent literature, outline the research objectives, and detail the methodology, including criteria, data collection, and analysis techniques.

2. Literature Review

2.1 Collaborative teaching

Collaborative interdisciplinary endeavours within HEIs involve integrating diverse disciplines to address intricate challenges and advance research and education. Researchers (Axelrod, 2014; Hargreaves, 2019; Jortveit & Kovač, 2022; Marouli et al., 2017) emphasise the myriad benefits of interdisciplinary collaboration in higher education, such as fostering innovation, holistic understanding, and professional

development by merging diverse perspectives and expertise. Despite its significant real-world impact in addressing complex problems and benefiting communities (Alhassan et al., 2022; Jortveit & Kovač, 2022; Marouli et al., 2017), interdisciplinary collaboration faces challenges such as "difficulties in coordination," "unequal participation," "time constraints" (Jortveit & Kovač, 2022, p. 287), and "resistance to change" within disciplines (Marouli et al., 2017, p. 4820). However, these challenges can be overcome with careful planning and communication, leading to the realisation of the benefits of interdisciplinary collaboration (Chaovanapricha & Chaturongakul, 2020).

2.2 Integrating Content and Language in Higher Education

Integrating Content and Language in Higher Education (ICLHE) merges education and language through Content and Language Integrated Learning (CLIL), which combines language instruction with subject matter delivery (Coyle et al., 2010).

CLIL's effectiveness for language development, acknowledged by Lorenzo et al. (2011), aligns with the global focus of higher education, fostering motivation for foreign language acquisition. The impact of ICLHE on linguistic skills is evident in bilingual training programs, with ongoing discussions in higher education (Bamond et al., 2014; D'Alessio & Hardie, 2019b; Gabillon, 2020; Gil & Dueñas, 2023; McDougald, 2015; Vilkancienė & Rozgienė, 2017). showing that combining content and language enhances linguistic competence and academic knowledge, aiding language proficiency vital for academic and professional success.

2.3 ICLHE in Portugal

The internationalisation of Portuguese HEIs is a prominent focus in the evolving higher education landscape. Guided by EU directives and the strategic efforts of the Portuguese government, HEIs have established robust internationalisation policies (Coelho & Arau Ribeiro, 2018). As underscored in these policies, English's significance necessitates a balanced perspective. The importance of language instructional approaches, such as ESP, English Medium of Instruction (EMI), and ICLHE, becomes evident within this context.

In Portugal, ICLHE usage is uncommon despite interest from language and content teachers (Morgado et al., 2015). The 'CLIL-ReCLes.pt project' facilitated collaboration among language specialists and researchers from member institutions of the Association of Language Centres in Higher Education in Portugal (ReCLes.pt). It provided valuable insights into content teachers' and students' specific needs and challenges (Morgado et al., 2015). Subsequent studies have further emphasised the need for increased support for content teachers in Portuguese HEIs (Ellison et al., 2017).

In ICLHE courses, language specialists can collaborate with content experts to align language and subject matter objectives, providing crucial language support through workshops or dedicated courses. Their involvement varies based on institutional policies, program specifics, and language-related guidelines. Language specialists actively participate in most instances, working with content experts to merge language and subject matter in ICLHE courses (Fürstenberg et al., 2022; Kletzenbauer et al., 2022; Lyster, 2017), ensuring the "synchronisation of learning objectives and aiding students in developing language skills within subject-specific concepts" (Fürstenberg et al., 2022, p. 309).

2.4 Interdisciplinary Collaboration with English

Collaboration between English language teachers and content teachers in higher education is considered crucial for student success across contexts like EMI, ESP, and ICLHE (Alhassan et al., 2022; Chaovanapricha & Chaturongakul, 2020; Gustafsson et al., 2011; Zappa-Hollman, 2018). Research increasingly examines teachers' views on collaboration using the ICLHE approach, as seen in Ruiz de Zarobe and Cenoz's (2015) study on Spanish university-level teachers. The findings reveal that teachers perceive collaboration positively, recognising its value in enhancing teaching and supporting students' language learning needs, leading to improved student engagement and motivation.

Recent interdisciplinary collaboration studies (Chaovanapricha & Chaturongakul, 2020; Lasagabaster, 2018; Tiongson, 2019) have delved into various projects between English language and content teachers to enhance student outcomes and foster teacher

collaboration skills. Examples include research on CLIL in English as Foreign Language contexts, spanning technology-mediated collaboration (Arnó-Macià, 2014), policy development for collaboration and ICLHE practices (D'Alessio & Hardie, 2019a) collaboration in EMI contexts (Kletzenbauer et al., 2022), and the use of online forums and videoconferencing in the INCOLLAB Project (2018). These diverse approaches underscore the potential benefits for student learning and teacher professional development.

Student responses to collaborative teaching in ICLHE are consistently positive. Studies reveal that students enjoy simultaneously acquiring subject matter and language skills (Arnó-Macià et al., 2020; Mestre-Segarra & Ruiz-Garrido, 2022; Milcu, 2012). They value the support provided by English language teachers in grasping complex concepts and utilising subject-specific vocabulary. Furthermore, students appreciate the collaboration between content and English language teachers to understand subject matter and language proficiency development better (Ronfeldt et al., 2015; Swales, 1971; Zappa-Hollman, 2018). This collaborative approach enhances student engagement, motivation, and comprehension. In collaborative teaching settings, students report increased confidence in communicating in English, understanding subject-specific concepts, and expressing optimism about the interactive and engaging nature of the approach (Dugan & Letterman, 2008; Merino & Lasagabaster, 2018).

This study differs from previous research on interdisciplinary collaboration by focusing on Castelo Branco Polytechnic University and examining the receptiveness of its entire teaching staff in one scientific area. It offers an in-depth exploration across an entire semester of first-year undergraduate classes, extending to comparisons with third-year undergraduate and master's programs. This comprehensive approach provides a holistic understanding of interdisciplinary collaboration across academic levels. Additionally, the study highlights the proactive involvement of teachers in planning and monitoring student development and receptiveness throughout the semester, adding valuable insights into collaborative teaching dynamics.

3. METHODOLOGY

3.1 Objectives

The research instruments employed are deliberately aligned with specific objectives and questions, facilitating a detailed exploration of collaborative dynamics. The data is obtained from questionnaires administered to students at different stages of the study. These questionnaires provide an understanding of students' perspectives on interdisciplinary collaboration.

The research questions guiding the study are:

- What are the participants' perspectives on implementing interdisciplinary collaboration between ESP teachers and content teachers before and after the case study?
- To what extent does interdisciplinary collaboration enhance students' learning of the specific technical language of their content area?

The research uses questionnaires at two stages: initially to assess student receptiveness to interdisciplinary collaboration and later to gather feedback and reflections. The final stage is crucial for understanding the effectiveness of collaboration and its link to student receptiveness, providing insights for curricular improvements and teaching practices.

3.2 Research design

This study uses a mixed methods design, combining qualitative and quantitative data to explore interdisciplinary collaboration at Castelo Branco Polytechnic University. Quantitative questionnaires provide numerical data for statistical analysis, while qualitative questions offer descriptive insights into participants' experiences with collaboration and CLIL strategies. The qualitative data enhances the numerical findings, ensuring a comprehensive understanding of attitudes and perceptions. This approach provides a holistic view of interdisciplinary collaboration, examining trends, diverse perspectives, and student learning outcomes.

3.3 Participants

Thirty-six undergraduate students participated in the study. All students willingly participated by providing consent for inclusion in the case study. However, not all students completed every questionnaire, and in some cases, some questions were left unanswered during the study. Table 1 offers a comprehensive overview of the questionnaire participation and completion rates, emphasising the first-year fashion and textile students in the graduate course. This focused analysis facilitated a deeper understanding of the engagement levels of these specific students across various stages of the study, contributing to a nuanced interpretation of data collection dynamics within the specified courses.

Course	Total Enrolled Students	Students participating	Completed Questionnaires						
			pre	1	2	3	4	5	6
				Post Class Questionnaires					
Fashion and Textile Design (Undergraduate)	53	36	35	34	31	16	24	18	24

Table 1 *Participation and Completion of Questionnaires*

3.4 Questionnaires

Copies of the questionnaires, consent forms, and a comprehensive data management protocol were submitted to the University of Porto's Data Protection Unit. Appendix A: Overview of Questionnaires and Evaluation Criteria details the specific evaluation criteria addressed by each questionnaire. Previous research and surveys informed the development of student questionnaires, with insights from studies in HEIs shaping their structure and content. Data on student experiences in university and interdisciplinary education was used to refine the questionnaires, ensuring they effectively captured students' perspectives. (Aguilar & Rodríguez, 2012; Mestre-Segarra

& Ruiz-Garrido, 2022; Urgal, 2019; Walker, 1973; Zhou et al., 2019). Specific criteria were devised to address concerns raised by researchers regarding the validity of student questionnaires (Zhang & Aryadoust, 2022; Klemenčič & Chirikov, 2015). These criteria guided the choice of question formats and ensured that surveys effectively capture students' perceptions, attitudes, and experiences.

To ensure the accuracy and relevance of the data, it is crucial to re-validate interpretations and data usage in the new context, as emphasised by Zhang and Aryadoust (2022). Developing criteria for this re-validation process is essential, as supported by prior research such as Arnó Macià et al. (2020) and Dugan and Letterman (2008), which enhances the validity and reliability of the data. The study emphasises methodological and empirical validation in developing questionnaires to measure students' receptiveness, drawing on Social Cognitive Theory (Bandura, 1986) (SCT) and Expectancy-Value Theory (EVT) (Wigfield, 1994). These established frameworks are frequently used in research within HEIs to understand and enhance student learning and motivation (Alalwan et al., 2019; Gaspard et al., 2018; Guo et al., 2017; Meyer et al., 2019; Mishra, 2020; van Dinther et al., 2011). They provide insights into how students' beliefs and expectations impact their engagement and success. The questionnaire design criteria were based on SCT's focus on self-efficacy and outcome expectations and EVT's emphasis on task importance and utility.

4. DATA ANALYSIS

The analysis employs quantitative and qualitative methods. Detailed criteria and themes ensure a systematic examination of student feedback. Integrating EVT and SCT, the analysis explores motivational aspects, such as students' expectations and the value of interdisciplinary activities, self-efficacy, observational learning, and environmental factors like teacher and peer support. This combined approach provides a comprehensive understanding of the factors influencing students' engagement and learning outcomes in interdisciplinary education.

4.1 Pre-class questionnaire

This questionnaire explored students' attitudes, expectations, and experiences with interdisciplinary methodologies, drawing on SCT and EVT. For a detailed breakdown of how each question corresponds to SCT and EVT components, please refer to Appendix B: Overview of Pre-Class Questionnaire Aligned with SCT and EVT. In this appendix, Table B provides a comprehensive organisation of the questions by their theoretical relevance, clarifying their roles in intervention planning and execution. The quantitative analysis of the questionnaire focuses on structured data from closed-ended questions, offering statistical insights into students' attitudes and expectations based on both theories.

4.2 Post-class questionnaire

The questionnaire design criteria are detailed in Table 2, which categorises and analyses feedback on students' experiences and perceptions. The criteria were developed based on previous research on student feedback and interdisciplinary education (Mestre-Segarra & Ruiz-Garrido, 2022; Urgal, 2019; Zhang & Aryadoust, 2022; Zhou et al., 2020). This approach ensured that the questions were designed to effectively capture students' attitudes, experiences, and perceptions in a manner consistent with these studies' findings and recommendations.

Table 2

Framework for qualitative data analysis (post-class questionnaire): Categories and themes

Criteria for Coding	**Themes within Each Category**
1. Clarity of learning objectives	clear / unclear learning objectives
2. Integration of disciplines	Successful / limited integration
3. Active learning opportunities	frequent / infrequent active learning opportunities
4. Facilitation of interdisciplinary dialogue	encouraged / limited interdisciplinary discussions
5. Assessment methods	aligned / misaligned assessment methods

Criteria for Coding	Themes within Each Category
	no specific assessment mentioned
6. Faculty support and guidance	high / low satisfaction with faculty support
	no specific feedback
7. Resources and materials	adequate / inadequate resources and materials
	no specific feedback on resources and materials
8. Student feedback and reflection	positive aspects / challenges faced on the course
9. Overall satisfaction	high / low overall satisfaction

Additionally, SCT and EVT inform the design and analysis of the post-class questionnaire. The questionnaire comprises multiple qualitative questions, each addressing specific aspects. Appendix C with Table C provide a detailed alignment of each questionnaire item with the SCT and EVT.

5. RESULTS

The results reveal how interdisciplinary collaboration affects students' academic experiences and technical language skill development. Quantitative data measures engagement and satisfaction, while qualitative insights reveal benefits and challenges. Together, they offer a clear view of the effectiveness of interdisciplinary teaching and its effects on learning outcomes.

5.1 Pre-class questionnaire

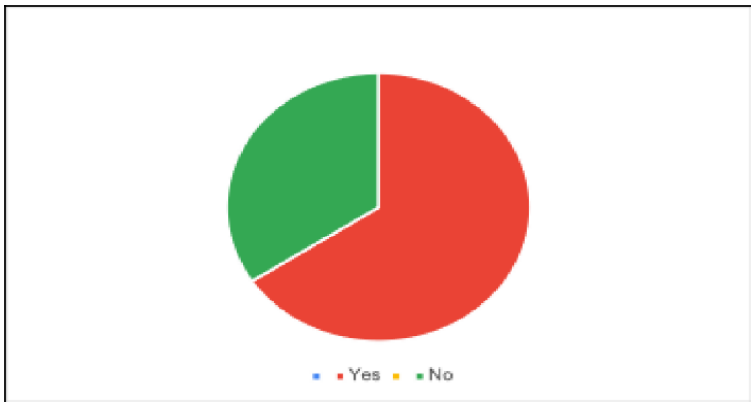
The pre-class questionnaire data indicates a positive receptiveness. Specifically, 15 students expressed a definite interest in collaboration by choosing "Yes," while 20 students indicated potential interest with a response of "Maybe." Notably, no responses indicated disinterest or an evident reluctance to participate ("No"). This initial data

suggests a favourable attitude, setting a promising foundation for interdisciplinary collaboration between ESP and content teachers.

Question 10 enquires about students' preferences regarding including English as a subject in their course. The data, as illustrated in Figure 1, shows that 23 out of 35 students strongly advocate for the addition of English to their course. The majority's receptiveness to this integration accentuates their positive attitude towards interdisciplinary collaboration, implying that aligning the curriculum with student preferences will enhance the success of the approach.

Figure 1

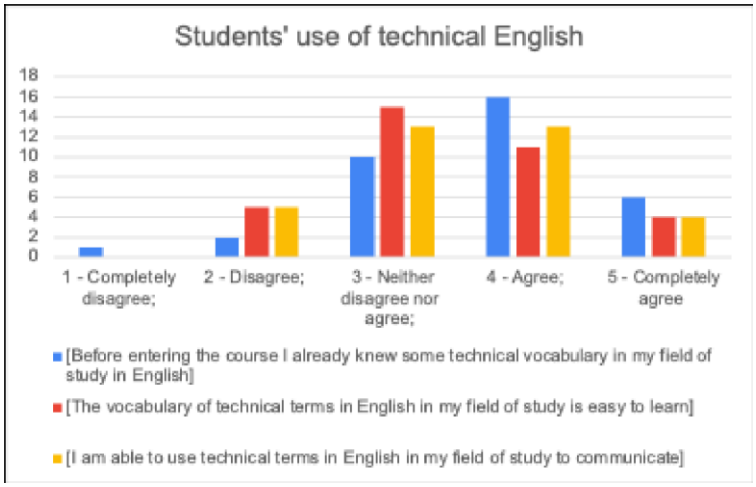
Student Preferences for English as a Curricular Subject: Pie Chart Analysis



Students assessed their familiarity with technical English vocabulary, focusing on prior knowledge, ease of learning, and use. This evaluation highlights their confidence and proficiency, crucial for determining readiness for interdisciplinary collaboration with an ESP teacher. Responses varied, with many reporting prior knowledge and confidence. These findings, illustrated in Figure 2, show varying comfort levels with technical vocabulary and inform the design of interdisciplinary collaborations.

Figure 2

Student proficiency and comfort with technical vocabulary in English: Pre-class insights



The analysis shows that 75% of students support collaborative teaching between English and other subjects, and 65.7% want English included in their curriculum, highlighting its value. While 42% have some knowledge of technical English vocabulary, only 35.7% find these terms easy to learn, and 57.1% are neutral or disagree. Confidence in using technical English varies, with 42.9% expressing confidence. Question 14 is critical for gauging receptiveness to interdisciplinary methods, as familiarity with technical terms may indicate prior exposure or understanding of interdisciplinary benefits. However, it is not the sole determinant of receptiveness.

These findings suggest the need for tailored language support and interactive teaching strategies. The significant interest in collaborative teaching and the desire for English in the curriculum highlight opportunities for integrating English into students' fields of study. Addressing diverse perceptions of vocabulary learning ease and promoting communication skills can enhance the effectiveness of interdisciplinary collaboration between ESP and content teachers.

5.2 Post-class questionnaire

The analysis is framed within the theoretical perspectives of SCT and EVT. Table 3 below summarises key quantitative findings from the questionnaire. These findings are categorised to reflect how they align with SCT and EVT, offering insights into the

effectiveness of the interdisciplinary teaching approach. As the questionnaires were distributed after each class, analysis refers to the subject content, namely symbolism, urbanisation, sustainability, MOOD, TONE and Tecidoteca.

Table 3

Quantitative Analysis Aligned with SCT and EVT

Question	**Findings**	**SCT Alignment**	**EVT Alignment**
Clarity of learning objectives (Q 5)	clarity ranging from 44% to 86%.	Clear objectives: enhance self-efficacy clear expectations.	value, relevance, motivation
Integration of disciplines (Q7)	83.8% well integrated	Supports self-regulation and learning strategies.	practical value, motivation
Active learning opportunities (Q8)	95.1% frequent active engagement.	Fosters self-efficacy through mastery experiences and social modelling.	valuable, engagement, persistence
Facilitation of interdisciplinary dialogue (Q9)	99.3% encouraged to participate in interdisciplinary discussions	Encouragement supports social persuasion, boosting self-efficacy.	importance, utility, motivation
Assessment methods (Q10 & 11)	82.4% assessments were aligned with learning objectives	Aligned assessments: evaluate progress, enhancing self-efficacy.	value, motivation
Resources and materials (Q13)	87.32% resources were adequate	Adequate resources: effective learning strategies, self-regulation.	institutional support, value, engagement
Feedback and reflection (Q14 & 15)	Significant benefits include subject matter (97%) and practical application (36%);	Develop self-regulation skills, adjust learning strategies.	student expectations, motivation

Question	Findings	SCT Alignment	EVT Alignment
	challenges include language proficiency gaps.		
Overall satisfaction (Q16 & 17)	92.96% rated experience as 4 or 5	High satisfaction: positive mastery experiences, social persuasion, boosting self-efficacy.	perceived value, worthwhile

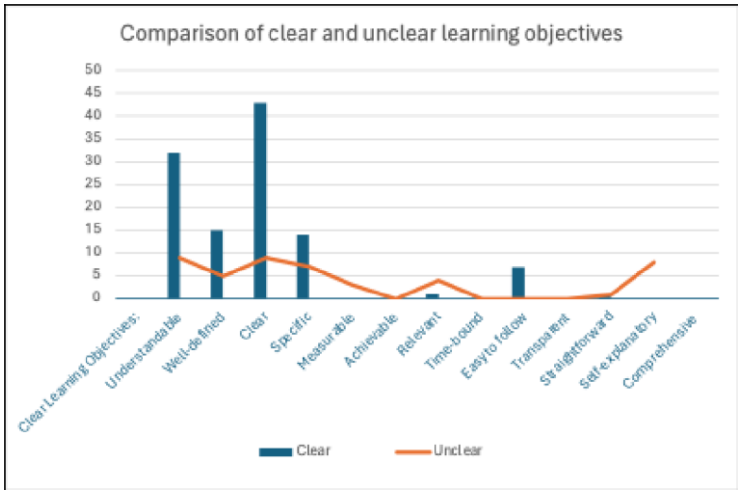
These findings suggest that clear, integrated, and engaging teaching practices positively influence students' self-efficacy and motivation. Addressing identified challenges, such as language proficiency gaps, is essential to enhancing the effectiveness of interdisciplinary teaching. These insights underscore the importance of tailored interventions and ongoing refinement to meet students' needs and expectations, fostering a supportive and effective learning environment.

5.2.2 Qualitative Analysis

As relates do Question 6, in the Symbolism class, 29 objectives were clear, and 28 were unclear, with feedback noting that clear objectives were well-defined and easy to follow, while unclear ones were vague and complex. The Urbanisation class received positive feedback but had some complex objectives. The Sustainability class had no unclear objectives but concerns about specificity. The MOOD and TONE classes received positive feedback but had fewer responses, suggesting potential engagement or time issues. The Tecidoteca class also had positive feedback but concerns about relevance.

Figure 3

Comparison of clear and unclear learning objectives

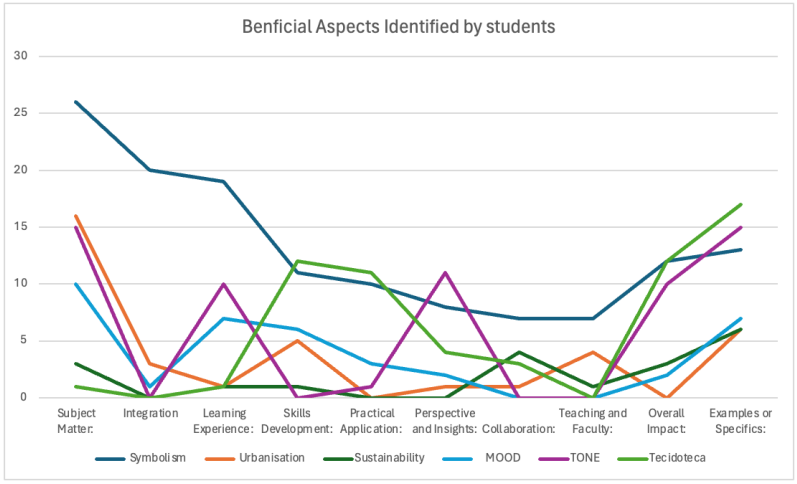


The feedback aligns with SCT's emphasis on self-efficacy and environmental influences. Clear learning objectives enhance students' confidence and understanding, which is crucial for effective learning and engagement. The varied feedback across classes illustrates how different environments and instructional practices impact students' self-efficacy and perceived effectiveness. With regards to EVT, the analysis reflects students' expectations and the perceived value of clear learning objectives. Positive perceptions of clear objectives align with the theory's focus on the importance of well-defined goals in motivating and engaging students. Addressing concerns about clarity and relevance aligns with enhancing the perceived value of the learning experience.

In relation to Question 14, the findings, illustrated in Figure 4, reveal distinct class features. The analysis reveals distinct patterns across classes. The Symbolism class is noted for its high recognition of concept integration, reflecting deep student engagement.

Figure 4

Beneficial aspects identified by students



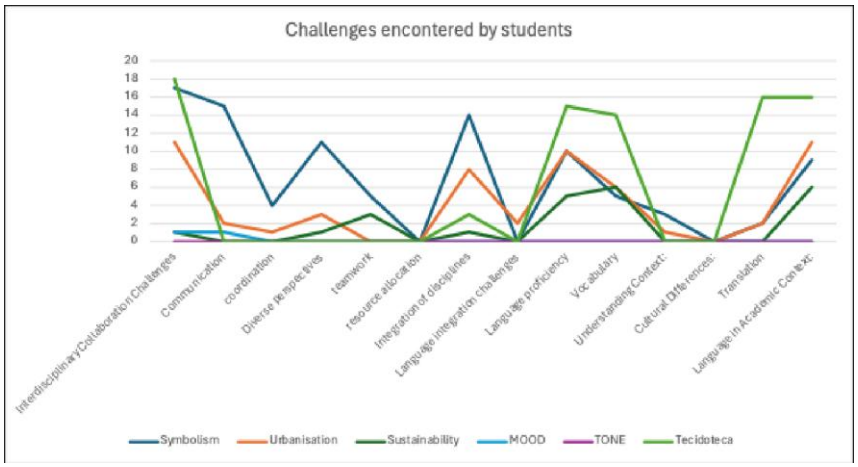
Urbanisation has strong positive perceptions and content appreciation, indicating high student interest. Sustainability is distinguished by its emphasis on collaboration and shared learning experiences. MOOD receives positive feedback for creating a satisfying and engaging learning environment. TONE is recognised for exploring diverse perspectives and enriching students' viewpoints, while Tecidoteca is celebrated for its focus on practical skill development and hands-on learning. These findings align with SCT, as positive feedback on clear benefits enhances students' self-efficacy and engagement, which are crucial for effective learning. Additionally, the EVT is reflected in the high appreciation of content and practical skills, underscoring the role of perceived benefits in motivating students.

In what purports to Question 15, the analysis of perceived challenges reveals that students in the Symbolism class faced communication and language issues, while those in Urbanisation needed help with language proficiency and academic context. Sustainability noted teamwork and language challenges, whereas MOOD and TONE reported minimal issues. Tecidoteca faced significant problems with language proficiency and translation. The sparse feedback from TONE and MOOD may indicate

fewer perceived challenges or reluctance to discuss them. These findings, consistent with SCT, highlight how challenges affect students' self-efficacy and engagement. They also align with EVT, as overcoming these challenges impacts students' motivation and expectations for interdisciplinary collaboration.

Figure 5

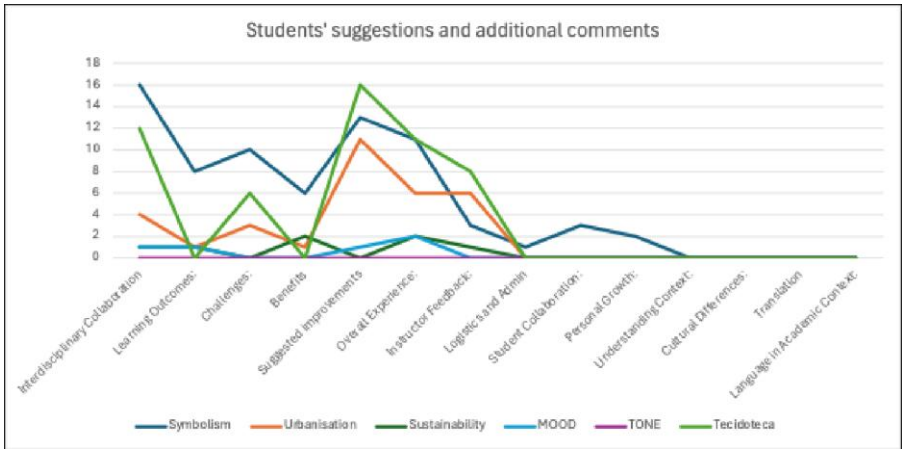
Challenges encountered by students.



In relation to Question 17, the analysis identifies several key themes across classes. In Symbolism, students highlighted "Interdisciplinary Collaboration" and suggested improvements. Urbanisation feedback focused on the need for better "Instructor Feedback" and areas for enhancement. The Sustainability class received positive comments on "Interdisciplinary Collaboration" and "Benefits," indicating a generally favourable experience. MOOD had positive sentiments about "Interdisciplinary Collaboration" and "Learning Outcomes," along with specific improvement suggestions. Tecidoteca feedback pointed out collaboration challenges and offered suggestions for improvement. These findings, illustrated in Figure 6, align with SCT and EVT, reflecting how students' experiences and feedback affect their self-efficacy, engagement, motivation, and expectations and guide future improvements in interdisciplinary teaching practices.

Figure 6

Students' suggestions and additional comments.



The challenges identified in interdisciplinary collaboration offer valuable insights for strategic recommendations. Consistent efforts to address language-related barriers, including proficiency, vocabulary, and academic context, are essential for effective communication and comprehension. Tailoring interventions to the unique needs of each class is crucial, acknowledging variations in challenges across interdisciplinary settings. Emphasising clear communication strategies, such as guidelines and collaborative tools, can mitigate communication difficulties.

6. CONCLUSIONS

The combined qualitative and quantitative findings underscore the importance of clarity, integration, active engagement, and collaborative dialogue in interdisciplinary teaching. Addressing language-related challenges and ensuring adequate resources and logistical support are critical for enhancing students' learning experiences. By aligning these insights with SCT and EVT, it becomes evident that fostering self-efficacy, providing clear objectives, and ensuring the perceived value of tasks are essential components of effective interdisciplinary education. The study's comprehensive approach supports the development of effective teaching strategies, as pointed out by

previous studies (Ellison et al., 2022; Morgado et al., 2015). It provides a foundation for ongoing refinement and adaptation, ensuring that interdisciplinary teaching continues to meet students' evolving needs and expectations, a factor that is seen as fundamental for students in other studies (Aguilar & Rodríguez, 2012; Arnó-Macià et al., 2020; Maiz-Arevalo & Domínguez Romero, 2013).

Integrating collaborative teaching plans and faculty support is crucial for the success of interdisciplinary initiatives. Continuous feedback from students is essential for refining these practices and enhancing their effectiveness, which other studies point out as student engagement and experiences (De las Heras et al., 2014; Marsh, 1984; van Dinther et al., 2011; Walker, 1973). This study suggests that adopting diverse pedagogical approaches to accommodate various learning styles can further boost engagement and outcomes.

Student receptiveness to interdisciplinary collaboration is evident from high levels of engagement and positive feedback, particularly regarding the integration of content and language and the encouragement of interdisciplinary discussions. This favourable disposition highlights the effectiveness of collaborative teaching approaches.

However, communication difficulties and language proficiency gaps persist and must be addressed. Continuous student feedback, diverse pedagogical approaches, and institutional support are essential for enhancing teaching practices and ensuring successful interdisciplinary initiatives. This study provides a solid foundation for refining interdisciplinary education and sets the stage for future research into the factors influencing student engagement and effectiveness.

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Appendix A

Overview of Questionnaires and Evaluation Criteria

Table A:
Detailed Overview of Questionnaires and Evaluation Criteria

Questionnaire	Criteria
Pre-class	awareness of interdisciplinary collaboration, expectations and motivations, perceived benefits, prior experiences and exposure, language skills and proficiency, use of English in context, expectations of collaboration, concerns or reservations
Post-class	perceived impact on language skills, integration of interdisciplinary content, engagement and motivation, interdisciplinary thinking and skills, collaboration and teamwork, application of knowledge personal growth and development, suggestions for improvement, long-term impact

Appendix B

Overview of Pre-Class Questionnaire Aligned with SCT and Expectancy-Value Theory

Table B:
Alignment of Pre-Class Questionnaire Questions with SCT and Expectancy-Value Theory

Question Number	Purpose	SCT	Expectancy-Value Theory
6	Importance of learning a foreign language	Value	Value
7	Previous English experience	Self-Efficacy	Expectancy
8	English proficiency level	Self-Efficacy	Expectancy
9	Curricular English subject	Self-Efficacy	Expectancy
10	Interest in having an English subject	Value	Value
11	Technical vocabulary in English	Self-Efficacy	Expectancy
12	Familiarity with interdisciplinary teaching	-	Value
13	Participation in interdisciplinary teaching	-	Value
14	Interest in collaborative teaching format	Value	Value
15	Self-assessed level of English	Self-Efficacy	Expectancy
16	Frequency of English use in various contexts	Self-Efficacy and Environmental Influences	Value

Note: Self-Efficacy: Refers to students' beliefs about their ability to succeed in English-related tasks and interdisciplinary collaboration. Value: Refers to the perceived importance and utility of learning English and participating in interdisciplinary methods.

Appendix C

Overview of Post-Class Questionnaire Aligned with SCT and Expectancy-Value Theory

Table C:
Alignment of Pre-Class Questionnaire Questions with SCT and Expectancy-Value Theory

Question Number	Purpose	SCT	Expectancy-Value Theory	Details
5	Assess clarity of learning objectives		Expectation of success	Influence perceived ability to achieve them, affecting motivation and engagement.
6	Understand reasons for clarity or lack of clarity in learning objectives		Value	Importance of understanding objectives for perceived relevance and engagement.
7	Evaluate integration of content and language	Observational learning		Integration supports modeling and observational learning, enhancing comprehension and application of interdisciplinary content.
8	Measure frequency of active engagement with course content	Engagement and self-efficacy		Builds confidence and learning through practice, promoting self-efficacy.
9	Determine if students felt encouraged to participate in interdisciplinary discussions	Self-efficacy and peer influence		Encouragement boosts confidence and emphasizes the value of peer interaction, enhancing self-efficacy.
10	Assess alignment of assessment methods with learning objectives		Expectation of success	Affects perceived fairness and ability to meet objectives, influencing motivation and engagement.
12	Gauge satisfaction with support and guidance provided by instructors	Environmental factors		Enhances the learning environment and perceived capability, contributing to student engagement and confidence.
13	Evaluate adequacy of resources and materials used in the lesson		Value	Adequate resources increase perceived value and relevance of the course, supporting student engagement and motivation.

Question Number	Purpose	SCT	Expectancy-Value Theory	Details
14	Identify the most beneficial aspects of the interdisciplinary course for student learning	Value and self-efficacy	Value	Highlight valued components and confidence-building activities, informing future instructional strategies.
15	Understand specific challenges related to interdisciplinary collaboration or language integration	Environmental factors		Indicate areas where support was lacking, providing insights into improvements for future interdisciplinary courses.
16	Measure overall satisfaction with the interdisciplinary lesson		Value	Reflects perceived value and relevance of the experience, providing a comprehensive measure of student engagement and motivation.
17	Collect additional comments and suggestions for improvement	Comprehensive insights	Comprehensive insights	Provide detail on value and self-efficacy aspects, offering a holistic view of student experiences and potential areas for enhancement in interdisciplinary courses.

Note: SCT focuses on self-efficacy, observational learning, and environmental factors, while Expectancy-Value Theory examines students' expectations of success and their value to interdisciplinary activities.