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Soft CLIL in Electronics: Developing a Hybrid Unit for Practical Application

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Abstract

In higher education, integrating language development with technical instruction has become an increasingly important challenge, particularly in Algerian electronics education. Therefore, this paper demonstrates the development of a hybrid electronics learning unit for third-year students at El Oued University, designed according to the Integrated Content and Language (ICL) approach. More importantly, the unit focuses on the Analog-to-Digital Converter, aiming to establish a correlation between disciplinary knowledge and English language proficiency within a technological context. To achieve the objectives, the unit was structured using the 6Ts model, including Theme, Topic, Text, Task, Transition, and Thread. At the lesson level, activities were developed using the 5Es instructional framework, which involves: Engage, Explore, Explain, Elaborate, and Evaluate. Consequently, technical content and language objectives are aligned and mutually reinforced, thereby facilitating a holistic learning experience. In addition, the unit incorporates multimodal, scaffolded, and collaborative tasks, which enable students to engage with authentic technical discourse while simultaneously improving their English skills. In addition, the unit was used in a hybrid format, combining eighty percent campus-based instruction with twenty percent distance learning. This approach not only fosters learner autonomy but also accommodates different learning preferences and encourages positive interaction among students. Most importantly, the study emphasizes conceptual unit development rather than empirical implementation. As a result, it demonstrates how Soft CLIL principles can be adapted to the Algerian higher education context to advance language-enabling technical instruction. Furthermore, the study provides practical guidance for replicating English integration in technical units by highlighting the importance of teacher collaboration, purposeful task design, and longitudinal evaluation to ensure sustained learning outcomes. In conclusion, the proposed unit exemplifies how structured instructional frameworks, combined with hybrid delivery and scaffolded activities, can simultaneously support technical mastery and language development. Therefore, it offers a replicable model for bridging content and language in higher education and contributes to ongoing efforts to implement context-sensitive, language-enriched instruction in Algeria and comparable educational settings.

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Mots clés

Soft CLIL ; apprentissage hybride ; conception pédagogique ; enseignement de l'électronique ; L'Éducation Durable en Algérie

Résumé

Cette étude présente le développement d'une unité d'enseignement hybride en électronique destinée aux étudiants de troisième année à l'Université d'El Oued, en Algérie, fondée sur le cadre de l'Intégration du Contenu et de la Langue (ICL). Guidée par les principes du Soft CLIL, l'unité vise à établir un pont entre les connaissances disciplinaires et la maîtrise de l'anglais dans un contexte technique. Elle a été conçue selon le modèle des 6Ts (Thème, Sujet, Texte, Tâche, Transition, Fil conducteur) et structurée au niveau des leçons à travers le modèle des 5Es (Engager, Explorer, Expliquer, Élaborer, Évaluer). Axée sur le thème du convertisseur analogique-numérique (ADC), la conception intègre le contenu technique et le développement linguistique au moyen d'activités collaboratives, étayées et multimodales. Proposée sous un format hybride (80 % en présentiel et 20 % en ligne), elle favorise l'autonomie et l'engagement des apprenants tout en tenant compte de la diversité des styles d'apprentissage. L'étude met l'accent sur la conception conceptuelle plutôt que sur la mise en œuvre empirique, illustrant comment le Soft CLIL peut être adapté à l'enseignement supérieur algérien pour promouvoir un apprentissage des STEM appuyé par la langue. Dans l'ensemble, cette approche offre un modèle transférable pour intégrer l'anglais à l'enseignement technique, tout en formulant des recommandations concernant la collaboration entre enseignants, la conception des tâches et les futures évaluations longitudinales.

1. Introduction

CLIL (Content and Language Integrated Learning) has been proven to be an effective way of teaching language skills and subject matter simultaneously; this allows students to learn their language skills as well as content learning in a specific subject (Coyle, Hood, & Marsh, 2010; Coyle, 2021; Aguirre-Muñoz et al.,2024). In tertiary education, students, for instance, can be particularly helped by this twin emphasis on teaching in that they need to learn technical vocabulary and complicated concepts. For instance, the students in the study of Electronics need to learn very sophisticated concepts as well as technical vocabularies so that they can perform well in class as well as in their profession.

Another argument is that combined language and content contribute to better retention of complex concepts because language may serve as a means for further cognitive processing (Dalton-Puffer, 2011; Mehisto, 2012; Jantassova et al., 2024). All these findings provide reasons to believe that CLIL might improve comprehension and critical thinking, especially in specialized fields. This paper will discuss that Soft CLIL principles can be adapted to the Algerian setting through a hybrid delivery mode, with 80% face-to-face instruction and 20% online sessions.

The approach aims at meeting both the language and technical needs of electronics students at Eloued University in such a way as to take into consideration the diversity in learning styles while ensuring appropriate integration of content and language. This model satisfies not only the current academic needs of students but also prepares them

for increasingly global and English-oriented professional environments.

The aim of this research is to bridge the gap between language acquisition and technical knowledge in applying Soft CLIL a more focused language support at no major curricular overhaul. In doing so, it enhances both the level of English, deepening understanding of electronics among students and contributing substantially to their general academic/professional development. In this respect, the research indicates how context-specific adaptations of CLIL may enrich the educational experience for students in Algeria and open ways to a more effective integration of language and content in technical education.

2. Literature Review

The research literature on CLIL today acknowledges its flexibility and success in varied educational contexts, particularly in tertiary education (Ball, Kelly, & Clegg, 2015; Bower, Coyle, Cross, & Chambers, 2020; Zayas-Martínez et al.,2024). CLIL is a highly adaptable approach that integration can take place in various ways, including Soft CLIL and Hard CLIL. In fact, Soft CLIL has been mainly useful in those contexts where more radical curriculum change is not feasible (Marsh, 2002; Hemmi & Banegas, 2021). This approach permits learners to develop language skills parallel to their subject knowledge and does not require a major change in the existing syllabus, which renders it apt for technical fields where specialized language can easily become a hindrance (Pérez-Cañado, 2012).

Soft CLIL has been shown to improve the motivation and engagement of learners by linking language competence directly to the subject of study, particularly important in cases like Algeria, where English language proficiency is a passport to technical specialties worldwide (Lasagabaster, 2017).Research into hybrid learning models points out the potential of CLIL in such settings, indicating that a blended approach can accommodate diverse learning needs and preferences (Wegner, 2016). Most CLIL research has primarily focused on European contexts, making generalization challenging and creating a gap in our understanding of how CLIL is implemented in non-European settings, such as Algeria (Wegner, 2016).

The integration of CLIL presents more challenges in countries where English is a foreign language. For example, Lasagabaster (2017) points to the aspect of context; sociolinguistic factors can seriously influence learners' motivation. Thus, the aim of this research is to address this gap in the literature by adapting Soft CLIL principles to meet the needs of Algerian electronics students, whose English proficiency often lags that of their European peers.The use of a hybrid model for learning provides a possibility to smoothly shift towards bilingualism without relying on extensive changes in the curriculum (Pérez-Cañado, 2012). Though there are many studies examining the impact of CLIL on various domains, studies of its application in hybrid learning settings to technical disciplines such as electronics are not numerous and common, especially in the

context of Algeria. This underscores the need for special procedures that focus on the specific language and technical challenges these students face.

The use of language and subject-specific content is always associated with improved cognitive processing, because students employ language to analyze, interpret, and apply subject matter (Dalton-Puffer, 2011; Luelmo del Castillo et al.,2025). This aligns with the 6Ts framework (topics, texts, tasks, tools, talk, and time) used in this study to structure the instructional unit, which has been shown to enhance both content comprehension and language acquisition (Ball et al., 2015). More generally, although Soft CLIL has been implemented successfully in many settings, its application in hybrid models with non-European countries such as Algeria merits more research. This article attempts to contribute to this niche by relating how language and technical knowledge may be integrated in Algerian higher education through a Soft CLIL adaptation, with special regard for the context.

3. Steps for Designing and Implementing Instructional Units

To develop an effective instructional unit, several practical steps must be followed so that the needs of language and content can be met. This section restates those overall points in an organized form with an explicit detail of each step.

3.1. Needs Analysis

A needs analysis allows one to establish what language and content needs the students would have. It is a measure of where they are at in terms of language ability and what technical vocabulary and concepts would be required so that they could learn electronics. Some tools that can be used in collecting data on students' needs include surveys, diagnostic tests, and interviews (Mehisto, Marsh, & Frigols, 2008). This information allows for the tailoring of the instructional unit to more closely fit learners' needs, thus making it more effective.

3.2. Clear Learning Objectives

Defining integrated, clear, specific, and measurable learning objectives is the key to successful curriculum design. These objectives explicitly state what students are to achieve at the end of this unit in terms of both content and language goals. For example, the instructional goals in circuit design may be: "Students will describe, in English, how various circuit components operate" and "Students will construct a simple electronic circuit." Well-formulated objectives ensure that teaching activities are linked to the intended outcomes and create an integrated learning process (Coyle, Hood, & Marsh, 2010). From the perspective of curriculum design, these objectives provide a working blueprint for the teachers to select optimal teaching techniques and assessments.

3.3. Selection of Appropriate Materials

The selection of appropriate learning materials is most crucial in facilitating both

language and content learning. Appropriate material can be technical manuals, academic papers, video clips, and interactive computer simulations of electronics, and all serve the purpose of adapting to students' language skill levels. The application of multimedia materials facilitates in activating learners and demystifying abstract concepts in simpler terms (Lasagabaster & Sierra, 2009). For instance, the use of graphic materials like circuit diagrams along with instruction texts can facilitate major concepts in being more easily understood by students. Selection of materials that are student-friendly and of scholarly significance can indeed become motivation and learning performance boosters.

3.4. The 6Ts Framework

In constructing instruction units, the 6Ts (Theme, Topic, Text, Task, Transition, Thread) are one way of organizing content (Coyle, 2006). They start with the selection of a *thematic* emphasis that is the reference point of the unit; there are specific *topics* surveying the various fields of the topic at hand, and *threads* interlink the topics so ensuring consistency and shepherding the learner through a reasonable sequence (Linares, Morton & Whittaker, 2012). *Transitioning* from topic-to-topic permits maintenance of flow and explication of complex concepts. *Texts*, readings and multimedia resources are selected to the level of increasing learning accomplishments (Dalton-Puffer, 2011). Finally, *tasks* are planned to give students an opportunity to practice and develop some skills. This organization ensures that instruction units are rational, well-prepared, and effective in evoking students' learning.

3. 5. Organizational Structure of the Unit

Choice of organizational patterns is of immense importance in organization of content to facilitate effective transfer of lessons. An organized pattern allows students to relate ideas and engage with material to achieve higher levels of cognition. For example, organizing a unit on problem-based learning makes it possible for students to deploy knowledge in problem situations that reinforce development of critical thinking. Aligning the learning objectives with organizational structure ensures that the instruction and assessment tool accurately measure student progress toward meeting those objectives (Brown & Green, 2020). By considering the diverse learning needs and preferences of students, it enables teachers to create a dynamic, interactive learning environment that facilitates academic success for all (Miller & Anderson, 2021).

3.6. Scaffolding Instruction

Scaffolding instruction provides the learner with the support needed while learning content and language. Scaffolding is an explanation of how learning is divided into smaller steps and temporary supportive frameworks are offered to assist the learners until a point in time when they can manage independently. Scaffolding is like building scaffolding which is dismantled progressively as the building becomes able to support itself (Gibbons, 2002). This could involve, for instance, pre-teaching focal lexis,

bringing in visual material like diagrams, and bringing in sentence starters or language frames to assist learners in order to prepare them to communicate their ideas. Scaffolds can help learners feel confident and slowly learn to use language in content-based situations.

3.7. Collaborative Work

Students in a Soft CLIL classroom will be encouraged to communicate on content by using collaborative work in the target language. Group projects, peer instruction, and discussion provide ample opportunities to use the language abilities in a communicative setting in a meaningful manner. Linguistically, this kind of collaboration supports language learning through the creation of authentic opportunities for interaction that encourage negotiation for meaning, where vocabulary specific to the subject matter arises naturally (Swain, 2000). These activities allow students time to interact with each other, building their subject knowledge and linguistic ability. Group work activity also enhances critical thinking and problem-solving skills very much needed in technical fields like electronics (Dalton-Puffer, 2007).

3.8. Formative Assessment

Formative assessment is also very important in giving continuous feedback on both content learning and language learning. These can be in the form of written reflective diaries, verbal reporting, and examinations, among others, as a medium for peer feedback. Notably, peer feedback will allow students to provide more critical feedback to one another; hence, their inclination to reflect on themselves is increased, thereby areas of improvement are identified (Topping, 2009; Luelmo del Castillo et al.,2025). Having students comment on each other's work offers a more interactive educational experience in which students can learn from each other. The information that is gained from formative assessment is then applied to instructional adjustment and correct areas of weakness to build a more personalized learning experience. Formative assessments, as Black and Wiliam (1998) have pointed out, are crucial in tracking students' learning and intervening early in a way that enhances learning.

3.9. Use of Technology

Technology use in the teaching of Soft CLIL has several benefits in both content and language learning. Online simulations, interactive modules, and language-learning software can be used to enhance practice and reinforcement outside the normal classroom. Technology makes interactive and dynamic approaches to presenting complex ideas, such as circuit analysis or programming (ElFathi et al., 2025), more transparent and comprehensible (Levy, 1997; Martínez-Soto & Prendes-Espinosa, 2023). Use of multimedia features, such as animations and videos, helps to concretize ideas so that they are easily grasped. It promotes the creation of personalized learning routes so that students can continue at their own speed, revisiting difficult material when

necessary. These digital tools can also support language practice through gamified apps or digital storytelling, where students' motivation to take part in the learning process is enhanced.

3.10. Professional Development for Educators

This include serious continuous professional development of teachers so as to be appropriately prepared to undertake the functions needed for effective Soft CLIL instruction. It involves subject matter and language teaching strategy training, along with ample opportunities for peer collaboration in sharing best practices. Most importantly, Training the professionals will illuminate teachers on new methods and will provide them with the knowledge and capability to make CLIL efficient in the classrooms (Marsh, 2002; Banegas, 2019). Through professional development, teachers will be trained to respond to changing students' needs and develop an elastic learning environment that supports both language and content learning.

By following these practical steps, instructors can design and implement instructional materials to effectively integrate language support into content learning and at the same time increase overall proficiency and understanding in other fields. Such a structured approach ensures seamless embedding of language development within the content learning process; in this way, it finally prepares students for possible success in their academic and professional life. Staged instruction, technology, group work, and adapted materials, supported by formative assessment and staff development, form a coherent model of content and language learning and therefore render Soft CLIL a feasible and realistic solution in the tertiary sector (Black & Wiliam, 1998; Coyle, Hood, & Marsh, 2010; Dalton-Puffer, 2007; Levy, 1997; Mehisto, Marsh, & Frigols, 2008; Swain, 2000; Topping, 2009).

4. Translating the Theoretical Framework into a Practical Unit Design

The next part presents the structure and most significant pedagogical characteristics of the Soft CLIL unit, ideologically tested but not yet practically applied. Based on the Integrated Content and Language (ICL) approach, the unit addresses the subject of Electronics, i.e., Analog-to-Digital Converters (ADCs), following the latest applications of CLIL in technical education and its engineering specialties (Andriichuk, Lazorenko, & Doronina, 2024). Its pedagogical composition deliberately integrates the 6Ts and 5Es models to bring about a harmonious union between subject matter competency and language acquisition. Before elaborating on its composition, however, it is essential to explain why Soft CLIL was chosen as the referent pedagogical framework of this study.

4.1. CLIL as a Strategic Approach in Algerian Higher Education

In Algerian universities, where subject matter and linguistic competence have to be in equilibrium, CLIL is a smart move to improve learning outcomes. The

combination of CLIL offers a safer and more effective way of teaching that is parallel to the two goals of technical content competence and language development. This approach is particularly useful in settings like Algeria, where English is a second language and where students find it hard to apply language skills in their own subject areas (Coyle, Hood, & Marsh, 2010).

Furthermore, CLIL serves as a bridge between language learning and subject content, hence the students can gain their English language skills and knowledge in electronics. By integrating language teaching into subject contexts like electronics, the technical vocabulary and linguistic abilities necessary for communication are conveyed to the learners. The integration of this has brought the learning process to life and becomes more practical and meaningful, because the students are acquiring language in an environment that directly relates to what they are learning, hence more meaningful and engaging (Linares, Morton, & Whittaker, 2012). This contextual learning also enhances students' ability to retain both content knowledge and language, since they apply what they have learned in actual situations

In relation to this, the use of authentic materials becomes the cornerstone of effective CLIL implementation. The inclusion of professional documentation, research papers, and technical manuals used in CLIL help create a realistic learning environment for Algerian students. This is extremely crucial in subjects such as electronics, which depend largely on understanding conventions and terminologies in writing with importance to future academic and professional success (Dalton-Puffer, 2007).

Through CLIL, students encounter language which mirrors the demands of their future profession, that reinforces their ability to comprehend challenging texts and to communicate in a suitable manner in a professional setting. Authentic language use helps improve not only students' language abilities but also get them used to the conventions of technical communication (Mehisto et al., 2008). Moreover, CLIL fosters the development of transferable skills that extend beyond linguistic and disciplinary boundaries.

Integrating language and content in CLIL encourages critical thinking, problem-solving, and effective communication (Coyle et al., 2010). For Algeria, where analytical reasoning and accurate expression are required to the field of electronics, this ability proves particularly useful. CLIL makes students execute tasks wherein they must think analytically about technological aspects, do practical problems correlating with content knowledge, and share findings with the use of English.

This dual focus helps to prepare them not only for academic challenges but also for the demands of a globalized workforce (Dalton-Puffer, 2007). As students wrestle with complex content and seek clear expression of their ideas, they become professionals of high ability in their respective chosen fields. The CLIL framework can support Algerian students with beneficial gains related to both the language and content acquirements. While challenges such as adequate teacher preparation and availability of needed materials will exist, CLIL can provide dynamic and rather 'immersing'

possibilities of learning an integrated manner with proper assistance. Moreover, it boosts language learning and deepens subject areas while developing all skills meant for success in both individual academic and future professional settings (Marsh, 2002).

4.2. Unit Development Rationale

This unit on Analog to Digital Converters (ADCs) has been designed especially for third-year students of Electronics at Eloued University with an intermediate level of language proficiency (B1 in the CEFR scale). The course is delivered in a hybrid system, wherein both face-to-face and online components are utilized in order to address different learning needs and styles. The online component of the hybrid system employs Moodle for content and testing, zoom for virtual classroom, and simulation software to enable students to engage in experiential learning of electronics concepts. These are designed to enable transition between classroom-based and web-based sessions with ease to accommodate various learning styles. The Instructional approach used in this case is CLIL. The content of the 6 Ts will be about Analog to Digital Converters (ADCs). In this way, the three main topics that are included in the unit are: Introduction of Analog and Digital Signals, Analog-to-Digital Conversion, and the Types of Analog-to-Digital Converter (ADCs). The unit is designed to guide the students progressively from building a foundational understanting of analog and digital signals, to exploring the conversion process, and finally to examining the various types of ADCs.

4.3. The Application of the 6Ts Framework in the Electronics Unit Design

The 6Ts methodology gave us a disciplined process, defining the order of our material for our students. The topic of communications, signals, and wireless systems presents a clear order, having students progress from simple information-bearing signals through to the advanced designs and implementations of communication systems, stretching the limits of physical medium. Subject transitions are explicitly stated and identified in the unit so that students will not be lost and remain on track. Some of the topics covered in the unit are Analog Communications, Data Conversion, and Digital Communications. It has written and aural texts, e.g., articles from different websites. Tasks vary by topic, including sentence scrambles, matching exercises, graph connections, and picture-based learning. Online quizzes and reflective activities are also incorporated to encourage student engagement and deepen their understanding of the content.

Exit tickets and KWL charts are among the instructional strategies that teachers use to check for student understanding and allow learning to continue. Exit tickets are short activities at the end of a lesson for the students to summarize what was learned and to pose any questions that remain. This provides very useful feedback to the instructor as it helps in planning future lessons that are modified based on the needs of students.

KWL is an acronym for Know, Want to know, and Learned. They act as a graphic organizer for activating prior knowledge and establishing learning objectives. Students

fill out what they already know about a topic in the "K" column, what they want to learn in the "W" column, and what they have learned after the lesson in the "L" column. This kind of reflective practice leads to deeper engagement with content. Tasks also include jigsaw activities and reflection on their learning journey to encourage collaborative learning and critical thinking. Transitions between topics, particularly from analog to digital communications and onward to data conversion, are critical. This makes the learning experience cohesive for the students so that they understand the interrelations of the different aspects of the subject area. The specific organization of these components, including topic sequence and associated learning tasks, is detailed in the following subsection on Unit Structure.

4.3.1 Unit Structure

This course design, therefore, organizes the big-picture themes under development, from signals to communications, and finally to wireless systems. This reflects a similar developmental path taken by the student in moving from very basic ideas on signal transmission to the highly complex issues in designing and implementing communications systems. Thread illustrates this pedagogical flow, emphasizing how all these ultimately come together in providing unlimited wireless connectivity. There are three major topic areas:

- **Topic 1**: Introduction to Analog Communications includes both written and aural texts, along with activities such as learning exercises, scrambled sentences, matching tasks, graphical connections, and visual learning through pictures.
- **Topic 2**: Digital Communications includes written and aural texts with accompanying activities such as gap-filling exercises, exit tickets, student roadmaps, online quizzes, and group discussions that reinforce comprehension.
- **Topic 3:** Data Conversion is very dependent on the articles from websites and engages in activities such as KWL (Know, Want to Know, Learned) charts, jigsaw activities, reflection journeys, and creating digital transformation projects.

These transitions between topics are clearly explained to the students, and the learners are taken through the logical flow from analog communications to digital communications, and finally to data conversion, clearly making learners aware of relationships among these concepts.

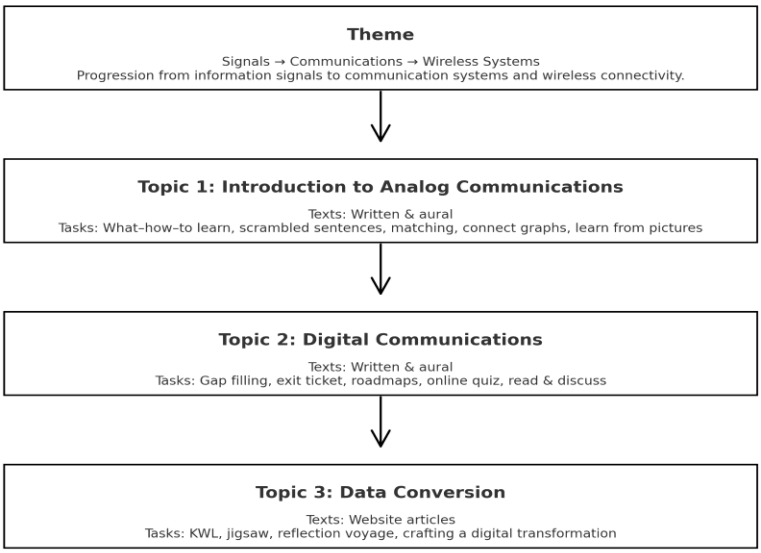

Figure 1. The 6Ts Framework in Unit Design

4.4. The Selected Organizational Pattern

Selecting an organizational framework is crucial for effective unit design. For this unit, the "5 Es" framework has been selected to guide all tasks: *Engage*, *Explore*, *Explain*, *Elaborate*, and *Evaluate* (Bybee, 2014). This method guarantees an interactive and logical learning process by integrating different onsite and online activities in order to enrich learning. Additionally, the students will be directly engaged in every step of the learning process via this method.

- Engage: This is the phase that attempts to generate curiosity and establish a context for learning. Employing actual examples, asking intriguing questions, or employing multimedia aids generates curiosity and interest for students to investigate and learn more regarding the subject matter.
- Explore: During this phase, there are opportunities provided for students to investigate the principles and ideas of analog communications, digital communications, and data conversion through experiments and group assignments.
- Explain: After the exploration period, deliberate explanations and explicit instruction are introduced to enable the learning of the basic principles of analog communications, digital communications, and data conversion.
- Elaborate: Students are now motivated to further elaborate what they have learned and to apply their learning in more intricate situations.

- Evaluate: This is the last phase that encompasses evaluation of students' learning and grasp of material covered through formative tests.

By employing the "5 Es" framework, unit planning fosters an active learning community in which students are engaged, knowledgeable, and challenged to think critically regarding the material.

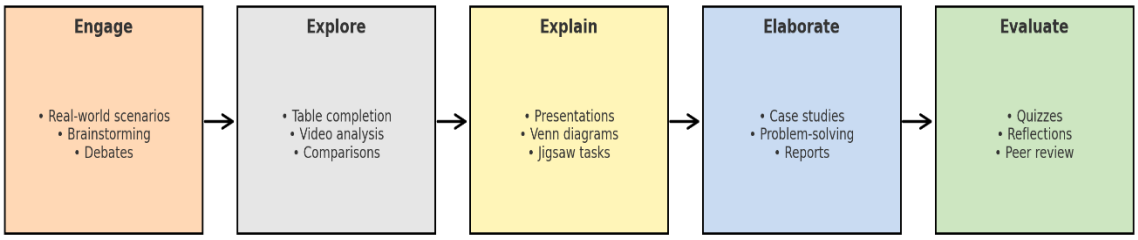

Figure 2. The "5 Es" Organizational Pattern

4.5. Language and Academic Skills

This sophisticated process of digital conversion from analog to digital necessitates students acquiring pertinent academic and language competence. The unit is thus designed to facilitate extensive comprehension of ADC concepts in technological contexts, as well as improve the overall communication skills of the students. Development is attained through the synthesis of content and language, allowing students to make sense of the subject matter in a proper, effective, and meaningful manner.

- **Technical Terms:** Defining and solidifying the terms used in the modulation techniques, coding schemes, error detection methods, and conversion processes will provide the students with the confidence to articulate correctly their knowledge of the abstract terms.
- **Reading Skills:** The students will be provided with suitable texts and articles that will enable them to read and understand, infer, and analyze the dominant concepts. These skills will facilitate critical interaction with scholarly materials.
- **Listening Skills**: The students will be led, through listening exercises, lectures, or recordings, to comprehend the content of a passage and infer information relevant to them, which is fundamental to grasping technical discussions.
- **Speaking Skills**: Debates, discussions, and presentations on analog and digital communications offer an avenue to promote and enhance oral communication. Students will build their persuasive communication thought and expression.

- **Writing Skills**: Writing assignments that include, but are not limited to, explaining an idea, various technique comparisons, and contrasting different methods of communication will work towards strengthening students' abilities in presenting their own knowledge in writing.
- **Academic Skills**: Last but not least, promoting critical thinking, problem-solving, and evidentiary argumentation on real-world scenarios will enable students to apply knowledge to real-world scenarios in academic and professional practice more efficiently.

4.6. Resources

A variety of materials are utilized in a manner that will enhance the learning process to the greatest extent and give the students a comprehensive idea about the subject. A YouTube video is embedded to present complex concepts visually in a way that makes it easier for students to grasp the real-life examples and demonstrations associated with analog to digital conversion processes. Diagrams are added as visual aids for students to help them visualize the steps and principles of conversion, hence grasping the concept more clearly.

Building on these visual and conceptual resources, the unit also incorporates interactive activities that deepen students' engagement. For instance, a jigsaw exercise makes learning more enjoyable and interesting. Dividing the class into small groups, each group learns one specific area of ADCs, with the option to delve further into the subject. Through sharing with one another, students are learning greater and deeper about the topic. Finally, formative assessment is integrated in the mode of an online quiz, with instant feedback and the potential for students to be able to identify areas of improvement. Through reflective use of diverse resources, YouTube videos, diagrams, jigsaw activities, and online quizzes, the unit ensures active learning and reinforces analog-to-digital conversions in the minds of the students, enhancing their overall learning experience.

4.7. Evaluation

Assessment is a crucial part in the learning process as it provides feedback and encouragement for continued student learning. During the on-site sessions, in-class exercises directly engage students in implementing what they have acquired, which supports enhanced learning of the subject. The presentation of projects is a platform that allows students to show their comprehension and good communication skills, while tests will further assess understanding and identify areas that require improvement.

4.8. Unit Overview

To illustrate the integration of content learning, language development, and disciplinary competences, Table 1 summarizes the unit's design components, highlighting the alignment among objectives, learning activities, and targeted outcomes.

Table 1.

Unit Design Summary: ***Lessons Overview, Objectives, and Competences***

Lesson	*Duration*	*Delivery Mode*	*Key Tasks*	*Language Objectives*	*Content Objectives*	*Competences*
Lesson 1: Introduction to Analog and Digital Signals	2 hours	Face-to-face	Brainstorming, diagram labeling, vocabulary mapping	Identify and describe key technical terms related to analog and digital signals	Explain the main characteristics of analog and digital signals and distinguish between them	Analyze and evaluate the operation and performance of basic signal types
Lesson 2: Analog-to-Digital Conversion	2.5 hours	Hybrid	Group discussion, video analysis, concept mapping	Use accurate terminology to explain the process of analog-to-digital conversion	Describe and demonstrate the steps of signal conversion from analog to digital form	Apply knowledge gained to real-world challenges related to ADC conversion
Lesson 3: Types of Analog-to-Digital Converters	2.5 hours	Online (Moodle and Zoom)	Jigsaw reading, peer presentation, reflective journal	Communicate effectively in English to compare and contrast different types of ADCs	Differentiate between various ADC types and illustrate their applications in engineering contexts	Develop the ability to design and construct basic ADC circuits

Source: Tasks adapted from The Monster Book of Language Teaching Activities

4.8.1 Sample Onsite Lesson

The following onsite lesson exemplifies how the Soft CLIL hybrid unit fosters interaction, collaboration, and language-supported engagement in the classroom. It demonstrates the integration of content and language learning through hands-on activities structured according to the 5Es model (Engage, Explore, Explain, Elaborate, Evaluate). Designed for Electronics students, this lesson promotes analytical thinking, teamwork, and contextual use of English in technical communication.

Table 2.

Sample Onsite Lesson Plan: Introduction to Analog and Digital Signals

Lesson Phase (5Es)	*Task & Description*	*Language Objectives*	*Content Objectives*	*Academic Skills*	*Type & Time*
Engage	**Four Corners Discussion**	Develop oral communication	Distinguish between analog	Collaboration, active listening,	Group work – 20

	Students form small groups to discuss characteristics of analog and digital signals, then present findings to the class.	skills and use comparative terminology; practice attentive listening.	and digital signals; recognize their real-world relevance.	presentation skills.	min
Explore	**Signal Sorting Table** In pairs, students categorize examples of analog and digital signals, providing justifications.	Use technical terms accurately; express reasoning using cause-effect language.	Identify key differences between analog and digital signals.	Analytical thinking, justification, teamwork.	Pair work – 20 min
Explain	**Venn Diagram Comparison** Groups complete a Venn diagram comparing analog and digital signal features.	Record and describe similarities and differences using precise terminology.	Consolidate understanding of continuous vs. discrete values.	Critical comparison, synthesis, oral explanation.	Group work – 20 min
Elaborate	**Reading Comprehension Activity** Students read a short passage about real-world signal examples and answer comprehension questions.	Acquire specialized vocabulary; interpret written information accurately.	Connect theoretical concepts to practical applications.	Reading comprehension, reasoning, interpretation.	Individual – 20 min
Evaluate	**Signal Hunt** In small groups, students identify real-life examples of analog and digital signals within the classroom environment and report findings.	Explain choices clearly using descriptive and technical vocabulary.	Apply learned concepts to classify real-world phenomena.	Observation, synthesis, oral reporting.	Group work – 20 min

4.8.2. Sample Online Lesson

This online lesson illustrates how digital platforms such as Moodle and Zoom can be leveraged to extend classroom learning into a flexible and interactive virtual environment. It emphasizes learner engagement through visual, reflective, and collaborative tasks that strengthen comprehension and communication in a technologically supported setting. By combining asynchronous and synchronous elements, the lesson promotes independent inquiry, critical reflection, and sustained practice of technical and linguistic skills relevant to the field of electronics.

Table 3.

Sample Online Lesson Plan: Analog-to-Digital Conversion (Moodle-Based)

Lesson Phase (5Es)	***Task & Description***	***Language Objectives***	***Content Objectives***	***Academic Skills***	***Type & Time***
Engage	**Reflective Journal Entry** Students write a paragraph on how analog-to-digital conversion affects their daily lives.	Use reflective writing and topic-specific vocabulary.	Relate ADC concepts to real-world technological contexts.	Reflection, written communication.	Individual – 10 min
Explore	**Reading with Annotations** Students read a short article on the ADC process and highlight key terms.	Summarize key concepts and use annotation strategies.	Describe the main stages of analog-to-digital conversion.	Reading for gist and detail, note-taking.	Individual – 20 min
Explain	**Diagram Creation Task** Students design a labeled ADC process diagram using Google Drawings or Moodle tools.	Apply technical terminology in written form; label components accurately.	Visualize ADC stages and explain each step.	Visual literacy, digital creation, explanation.	Individual – 20 min
Elaborate	**Peer Discussion (Zoom Forum)** Students present and discuss diagrams in breakout rooms, explaining differences in design.	Use functional language for comparison and clarification.	Deepen conceptual understanding through peer interaction.	Speaking, listening, critical feedback.	Pair/Group – 15 min
Evaluate	**Peer Review with Rubric** Students assess one peer's diagram and written explanation using provided criteria.	Give constructive feedback in academic English.	Assess comprehension of ADC principles and design clarity.	Evaluation, metacognition, written expression.	Pair work – 15 min

5. Conclusion and Recommendations

To conclude, CLIL principles in technical education, and more precisely in the field of electronics, bear huge potential for successful language and content learning. This article focused on how Soft CLIL principles could be applied in the Algerian context through a hybrid delivery where 80% of teaching is carried out in a classroom and 20% online. The course was designed in order to cater to both the language and technical requirements of electronics students at Eloued University. It also allows for flexibility through adaptation to different learning styles as well as the attainment of concordance between content scheduled and level of language required. However, the long-term consequences of CLIL on technical vocabulary retention as well as general academic performance remain to be extensively studied.

Future research should thus use longitudinal study designs for monitoring retention of vocabulary over periods of time to test how extended exposure to CLIL teaching affects learners' preparation for the global economy. Extension of the application of CLIL to other technical disciplines such as computing and engineering would also facilitate valid inference regarding the transferability and applicability of CLIL practice across subjects of study. State-of-the-art research findings would add a further dimension to a deeper comprehension of CLIL's role in shaping higher education practice in Algeria and internationally.

Moreover, effective cooperation between language and content experts remains a prerequisite for effective implementation of this practice. This kind of partnership must be about the mutual design of instruction units that combine language goals with subject-specific content so that students can approach subject matter in a more coherent, integrated, and functional way.This might also mean that, in the long run, the CLIL approach in technical education would be one way through which a move towards bilingualism among Algerian universities would really prepare students for international careers. This staged integration of language and content learning can serve as a template for other institutions to enhance their students' language competencies without sacrificing academic standards. The following are our suggestions for university administrators and education staff:

- Training workshops and other training in digital pedagogy must be provided to enable instructors to integrate digital materials into instruction with ease, with smooth transitions between online and face-to-face modalities.
- Training workshops on the use of specialized online simulation software are required; for example, circuit analysis software that can help in the creation of virtual labs supporting both content and language learning objectives.
- Regular joint planning sessions among subject and language teachers need to be fostered. The teachers can design lessons together, exchange best practices, and design cross-disciplinary assignments that involve the delivery of language support in technical classrooms for the students' integrated learning experience.

- Peer observation programs with feedback assistance sessions should be set up where teachers visit visit one another's CLIL-based lessons, and guest teacher sessions are also encouraged to promote shared professional learning and reflective practice.
- "Workshops on formative assessment and integration methods such as online quizzes, student reflection, and peer feedback must also be included. These are so important in monitoring both content knowledge as well as language acquisition to allow teachers to adjust teaching methods based on continuous assessments.
- There must be constant consultation between the language and subject specialists to follow the progress of the units and harmonize the content and language goals.

Such approaches would adequately meet the varied learning needs of students, both developing subject content knowledge as well as developing language skills in technical training. Further continuation and growth of CLIL practice will continue to empower teachers to lead students towards academic achievement and equip them to handle issues of an increasingly globalized working world.

References

[1] Aguirre-Muñoz, Z., Pando, M., & Liu, C. (2024). *Enhancing bilingual/ESL teachers' STEM instruction with targeted content and disciplinary literacy professional development: A study on knowledge and practice outcomes*. *Education Sciences, 14*(7), 745. https://doi.org/10.3390/educsci14070745

[2] Anastasi, R., & Candia, C. (2014). *Analog and digital communication systems*. Springer.

[3] Ball, P., Kelly, K., & Clegg, J. (2015). *Integrating content and language: An introduction to CLIL*. Cambridge University Press.

[4] Banegas, D. L. (2019). Teacher professional development in language-driven CLIL: A case study. *Latin American Journal of Content and Language Integrated Learning, 12*(2), 242–264. https://doi.org/10.5294/laclil.2019.12.2.5

[5] Bower, K., Coyle, D., Cross, R., & Chambers, G. N. (Eds.). (2020). *Curriculum integrated language teaching: CLIL in practice*. Cambridge University Press.

[6] Black, P., & Wiliam, D. (1998). Assessment and classroom learning. *Assessment in Education: Principles, Policy & Practice, 5*(1), 7–74. https://doi.org/10.1080/ 0969595980050102

[7] Bybee, R. W. (2014). *The BSCS 5E instructional model: Creating teaching and learning environments to promote understanding*. BSCS.

[8] Coyle, D. (2021). Revisiting the 4Cs framework: CLIL as a catalyst for innovation. *Language, Culture and Curriculum, 34*(3), 249–263. https://doi.org/10.1080/07908318.2021.1906925

[9] Coyle, D., Hood, P., & Marsh, D. (2010). *CLIL: Content and language integrated learning*. Cambridge University Press.

[10] Dalton-Puffer, C. (2007). Discourse in content and language integrated learning (CLIL) classrooms. In C. Dalton-Puffer, T. Nikula, & U. Smit (Eds.), *Diversity in CLIL: Language, culture and cognition* (pp. 27–46). John Benjamins.

[11] El Fathi, T., Saad, A., Larhzil, H., Lamri, D., & Al Ibrahmi, E. M. (2025). Integrating generative AI into STEM education: Enhancing conceptual understanding, addressing misconceptions, and assessing student acceptance. *Disciplinary and Interdisciplinary Science Education Research, 7*(6). https://doi.org/10.1186/s43031-025-00125-z

[12] Hemmi, C., & Banegas, D. L. (Eds.). (2021). *International perspectives on CLIL*. Palgrave Macmillan.

[13] Gibbons, P. (2002). *Scaffolding language, scaffolding learning: Teaching second language learners in the mainstream classroom*. Heinemann.

[14] Jantassova, D., Churchill, D., Tentekbayeva, Z., & Aitbayeva, S. (2024). STEM language literacy learning in engineering education in Kazakhstan. *Education Sciences, 14*(12), Article 1352. https://doi.org/10.3390/educsci14121352

[15] Lasagabaster, D. (2017). The impact of CLIL on students' motivation. *The Language Learning Journal, 45*(2), 236–248. https://doi.org/10.1080/ 09571 736. 2016.1167883

[16] Linares, A., Morton, T., & Whittaker, R. (2012). *The roles of language in CLIL*. Cambridge University Press.

[17] Luelmo del Castillo, M. J., Izquierdo-Sánchez-Migallón, E., Vinuesa-Benítez, V., & García-Manzanares, N. (2025). Design and validation of a self-assessment tool for STE(A)M teachers in CLIL contexts. *Journal of Technology and Science Education, 15*(1), 186–203. https://doi.org/10.3926/jotse.2933

[18] Marsh, D. (2002). CLIL/EMILE – The European dimension: Actions, trends and foresight potential. In D. Marsh & D. Coyle (Eds.), *Language and content: Teaching, education and society in a multilingual context* (pp. 2–4). Peter Lang.

[19] Marsh, D. (2002). CLIL/EMI: The European language portfolio: A framework for the future. *The Language Learning Journal, 26*(1), 1–12. https://doi.org/10.1080/09571730285200321

[20] Martínez-Soto, T., & Prendes-Espinosa, P. (2023). A systematic review on the role of ICT and CLIL in compulsory education. *Education Sciences, 13*(1), 73. https://doi.org/10.3390/educsci13010073

[21] Mehisto, P., Marsh, D., & Frigols, M. J. (2008). *English language teaching in the content classroom: CLIL in practice*. Cambridge University Press.

[22] Andriichuk, T., Lazorenko, L., & Doronina, N. (2024). Content and language integrated learning (CLIL) in teaching IT students English for specific purposes (ESP). *International Journal of Innovative Technologies in Social Science, 4*(44), 12–19.

[23] Pérez-Cañado, M. L. (2012). CLIL research in Europe: Past, present, and future. *International CLIL Research Journal, 1*(1), 1–12.
[24] Swain, M. (2000). The output hypothesis and beyond: Mediating acquisition through collaborative dialogue. In J. P. Lantolf (Ed.), *Sociocultural theory and second language learning* (pp. 97–114). Oxford University Press.
[25] Wakerly, J. F. (2010). *Digital design: Principles and practices*. Prentice Hall.
[26] Zayas-Martínez, F., Estrada-Chichón, J. L., & Segura-Caballero, N. (2024). Pre-service CLIL teachers' conceptions on bilingual education: Impact of initial training on the development of their teaching skills. *Education Sciences, 14*(12), 1331. https://doi.org/10.3390/educsci14121331

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Authors' Contributions

Ouafa Ouarniki conceived the study, developed the theoretical Soft CLIL framework, and led the alignment of technical and linguistic objectives. *Houda Boumediene* co-designed the hybrid instructional unit, coordinated lesson planning, facilitated the online learning components, and supervised data collection and thematic analysis. *Edna F. Lima* contributed to language refinement, textual coherence, and structural editing of the manuscript. All authors jointly participated in data interpretation, critically reviewed the manuscript, and approved the final submitted version.

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