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**THE ROLE OF MOTIVATION IN ENHANCING B1 BILINGUAL STUDENTS' READING
COMPREHENSION AND CRITICAL THINKING THROUGH CLIL**

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La Universidad para todos





DEDICATION

Above all, I thank God for granting me the perseverance to reach this milestone. I am deeply grateful to my family for their unconditional love and support throughout this journey. To my parents and brothers, who have been by my side through every challenge, their encouragement, patience, and faith in me have been a constant source of motivation.





Summary

Using Content and Language Integrated Learning in science education for high school students can positively impact motivation, reading comprehension, and critical thinking skills by creating a dynamic learning environment that integrates language and content in a meaningful way. This approach not only enhances students' reading proficiency but also deepens their understanding of scientific concepts and fosters the development of critical thinking skills that are essential for future academic and professional success.

Resumen

El uso del Aprendizaje Integrado de Contenidos y Lenguas Extranjeras en la materia de ciencias para estudiantes de secundaria puede impactar positivamente la motivación, la comprensión lectora y las habilidades de pensamiento crítico al crear un entorno de aprendizaje dinámico que integra el lenguaje y el contenido de una manera significativa. Este enfoque no solo mejora la competencia lectora de los estudiantes, sino que también profundiza su comprensión de los conceptos científicos y fomenta el desarrollo de habilidades de pensamiento crítico que son esenciales para el éxito académico y profesional en su futuro.





Abstract

This investigation project aims to explore the influence of motivation on the development of reading comprehension and critical thinking skills among Level B1 bilingual school learners using Content and Language Integrated Learning (CLIL) methodology. Recognizing the important function that motivation plays in shaping students' cognitive and linguistic abilities, the study examines different levels of intrinsic and extrinsic motivation contributing to strengthening reading comprehension within the CLIL framework, while also enhancing critical thinking. A mixed-methods design is employed, combining quantitative data obtained through a survey with qualitative insights gathered from a single semi-structured interview, complemented by classroom observations. Only one class was selected, consisting of 30 students. The sampling method was convenience purposive, as the group was chosen based on specific characteristics, including English level, learning experiences and styles, active participation, attitude, and willingness to collaborate in the research. Preliminary findings indicate a positive correlation between higher motivation levels and stronger performance in reading comprehension tasks, especially in activities involving problem-solving, text analysis, and collaborative group work that also foster critical thinking. These results suggest that integrating motivational strategies with CLIL instruction can strengthen both reading comprehension and critical thinking skills, offering valuable inferences for bilingual education.

Keywords: motivation, reading comprehension, critical thinking, Content and Language Integrated Learning (CLIL), bilingual education, mixed-method research, high school students, cognitive skills.





INDEX

Introduction	1
Research context	1-2
1. Analysis and description of the proposal.....	2
2. Statement of the problem.....	2
3. Justification.....	2-3
4. Relationship between proposal and research	3
5. Objective.....	3
6. General objectives	4
7. Specific objectives	4
8. Description of the variables	4
9. Description of the research	4
9. 1 Research approach.....	5
9.2. Method approach.....	5
9.3. Empirical methods.....	5
10. Description of the beneficiaries	5
11. Description of the research context	5
12. Practical contributions	6
13. Importance of the proposal	6-8
Chapter 1 Literature Review	9
1.1. Research background.....	9-10





1.2. Theoretical framework	11-13
1.3. Reading comprehension as the core skill	13-14
1.4. Motivation and reading comprehension	14-15
1.5. Intrinsic motivation and reading	16-17
1.6. Extrinsic motivation and reading	17-18
1.7. Content language integrated learning CLIL, reading, motivation and critical thinking ..	18-19
1.8. Reading in science learning and academic achievement	20-21
1.9. Interaction and balance	21-22
1.10. Challenges and gaps in the existing literature	22-23
1.10.1 Legal and normative framework	23-24
1.10.2 Integrating reading comprehension, critical thinking, and CLIL in Ecuadorian B1 classrooms	24-27
1.11. Synthesis and conceptual framework	27-29
Chapter 2 Methodology	29
1 Research design	30
2 Participants	30
3 Techniques and Instruments	30
4 Data collection Instruments	31
5 Data collection Procedure	31-32
6 Operationalization matrix of variables	33-37
7 Independent variable	33
8 Dependent variable	34





9 Population	37
10 Sample	38
11 Data Analysis	39
12 Ethical considerations	40
13 Initial Diagnosis Quantitative	41-50
14 Results	50-62
15 Qualitative data	62-67
15 Results	67
Chapter 3 Validation of the proposal.....	68
1 Modeling of the proposal	68
1.1 Strategies	68-69
1.2 Programs	69-70
1.3 Actions	70-71
1.4 Activities	71
1.5 Methodologies	72
1.6 Methods	73
1.7 Procedures	73-74
1.8 Resources, materials & supports	74
1.9 Curricular adaptations	74-75
1.10 Validation process summary	75
2 Theoretical validation	76
2.1 Purposes and objectives	76





2.2 Justification and characteristics	76
2.3 Structure and dynamics of components	76-77
2.4 Forms of application, implementation, and evaluation	77-78
3. Empirical validation pre and post intervention	78-81
4. Final validation post survey, interview and observations	82-83
4.1 Professional contributions	83-84
4.2 Methodological contributions	84-86
4.3 Technological contributions	86-87
4.4 Social contributions	87-88
4.5 Closure and recommendations	88-90
4.6 Conclusions	90-91
References	92-95
Annexes	96-117
Annex 1 Motivation toward reading surveys	96-103
Annex 2 Semi structured interview guide	103-106
Annex 3 Classroom observation sheet	106-108
Annex 4 Critical thinking rubric	109-111
Annex 5 Analysis data	112-115
Annex 6 Project examples	115-118





Introduction

This research project is structured into three main chapters. Chapter I starts with the literature review introducing key theoretical concepts related to reading comprehension, critical thinking, motivation, and CLIL methodology. It covers topics such as intrinsic and extrinsic motivation, the relationship between motivation and reading comprehension, the connection between reading comprehension and critical thinking, the role of motivation in science learning and academic achievement, as well as challenges and gaps in the existing literature. It concludes with a synthesis and a conceptual framework that guides the study. Chapter II outlines the methodological framework detailing the research design, procedures, data collection instruments, dependent and independent variables, and information about the population sample. It describes quantitative data collected via a survey, while qualitative data was gathered through a semi-structured interview. Chapter III presents the findings of the study, linking them to the concepts of motivation, reading comprehension, and critical thinking, and concludes with practical recommendations and final reflections regarding how motivation influences reading comprehension skills in bilingual B1 learners, while also strengthening their critical thinking.

Research context

Reading comprehension and critical thinking skills are essential for high school students because they encourage decision-making based on logic and reason, helping them solve a wide range of problems they encounter daily. This research aims to evaluate the role of motivation in enhancing B1 bilingual students' reading comprehension and critical thinking through CLIL methodology. The study will be conducted in a bilingual private high school located in Samborondón, where middle- and upper-class families send their children to study and broaden their competencies as active participants that promote social change. Moreover, the institution relies on the use of technology to integrate creativity and authentic learning experiences as part of its main academic goal.

The English level of this group of learners is B1, which is important because their reading comprehension is limited. For this reason, it becomes especially relevant to examine how motivation can be combined with the development of reading comprehension and critical



thinking skills in the context of science education. The investigation intends to obtain meaningful perspectives on how these skills can be strengthened through CLIL, with the goal of contributing to more effective teaching methods and enhancing both extrinsic and intrinsic motivation. Overall, the purpose of this study is to examine these students' reading comprehension and critical thinking skills, encouraging them not only to understand information but also to reflect, analyze, and express what they think and believe.

1. Brief Analysis and Description of the Situation That Justifies the Presentation of This Proposal

This proposed research contains key elements that foster the development of reading comprehension and critical thinking in high school students, which play a vital role in acquiring learning skills relevant to their daily lives. Teachers often struggle to engage students in meaningful reading activities that go beyond surface-level understanding, and students rarely apply reading strategies to analyze texts or solve complex, real-world problems. This research aims to bridge the gap by exploring effective ways to enhance teaching methodology, maintain students' interest, and encourage them to develop both reading comprehension and critical thinking skills through CLIL.

2. Statement of the Problem to Be Investigated

The purpose of this research is to investigate the role of motivation in enhancing B1 bilingual students' reading comprehension through CLIL methodology, with critical thinking as a complementary outcome. Although their most developed skill is speaking, students demonstrate limited reading comprehension, which negatively impacts their ability to engage critically with texts. This study aims to answer the following research question: To what extent does motivation play a key role in enhancing reading comprehension skills and critical thinking abilities of B1 learners in a bilingual high school?

3. Justification of the Research

The justification for this research is based on the need to strengthen students' reading comprehension abilities and improve their motivation toward science education, as well as their capacity for critical thinking. While reading comprehension is essential for academic success,



students in this context show limited motivation to engage deeply with texts, which affects both their understanding and their reasoning skills.

This investigation aims to bridge the gap in the literature through the examination of motivational and pedagogical strategies that can enhance reading comprehension while simultaneously fostering critical thinking. The contextual focus will enable the implementation of effective CLIL-based reading activities in educational settings, contributing to better outcomes in both language learning and cognitive development.

4. Description of the Relationship Between the Proposal and the University's Research Lines

The proposed thesis topic, "The Role of Motivation in Enhancing B1 Bilingual Students' Reading Comprehension and Critical Thinking through CLIL Methodology," aligns closely with the university's research lines. The study addresses a key aspect of bilingual and science education by proposing a methodological approach that integrates reading comprehension as a language skill with critical thinking as a cognitive outcome. By investigating how motivation influences students' ability to understand and analyze scientific texts, this research contributes to increasing engagement and deeper learning in science education. It aligns with the university's research priorities by emphasizing the integration of language and content learning, promoting meaningful engagement with real-world problems, and offering practical pedagogical solutions that can be applied in educational contexts to enhance both linguistic and cognitive development.

5. Objective of the Research

The main objective of this research is to investigate the role of motivation in the development of reading comprehension skills and critical thinking abilities among B1-level bilingual learners in a high school context. The study seeks to determine effective strategies that enhance students' motivation to improve their reading comprehension in science-related content and to promote deeper reasoning and analysis through the CLIL approach.

6. General Objective

To determine the role of motivation in enhancing reading comprehension skills among B1-level bilingual learners through the Content and Language Integrated Learning (CLIL) methodology, while simultaneously fostering critical thinking through hands-on and text-based activities.



7. Specific Objectives

- To assess reading comprehension skills and critical thinking abilities of science students in a bilingual high school.
- To develop and implement motivational and reading-based CLIL activities aimed at improving students' engagement and comprehension of scientific texts.
- To measure the improvement in reading comprehension and its relationship with critical thinking development through the application of the CLIL methodology in a bilingual school.

8. Description of the Variables of the Study

Variables are fundamental concepts in research. They represent characteristics or attributes that researchers can measure or observe (Joosten, 2020).

In this study, the independent variable is motivation in science-related activities, while the dependent variable is the development of reading comprehension skills, with critical thinking serving as a complementary construct.

It is essential to identify both variables to maintain a clear focus throughout the study. Depending on the research question and instructional design, a variable may function as independent or dependent. In this case, the purpose is to evaluate how motivation impacts students' reading comprehension performance and critical thinking development within a CLIL framework.

9. Description of the Research Approaches, Methods, and Data Collection

1. Research Approaches

Mixed methods research is “an approach to inquiry that combines or associates both qualitative and quantitative forms.” This approach involves philosophical underpinnings, employing both methodologies cohesively throughout the study. (Creswell, 2018). Using both approaches will facilitate a more comprehensive understanding of how motivation influences reading comprehension and critical thinking than relying on a single method.

2. Research Method

The combined use of inductive and deductive thematic analysis is valuable in mixed methods research, especially when paired with a quantitative data component grounded in shared theoretical principles (Proudfoot, 2022). The deductive approach moves from general principles



to specific examples, helping students apply prior knowledge to comprehend scientific texts. In contrast, the inductive approach starts with specific observations such as analyzing text meaning encouraging students to actively construct understanding through reasoning and exploration. Together, these approaches complement one another and deepen students' reading comprehension and critical thinking within CLIL instruction.

3. Empirical Method

Scientific investigations are classified as observational (observing events as they occur) or experimental (manipulating variables). Experimental studies are demonstrating cause-and-effect relationships (Herbulock, 2020). Applying observation and controlled experimentation in this study will help determine the relationship between motivation and reading comprehension performance, as well as its indirect impact on critical thinking, producing accurate and reliable findings.

10. Description of the Beneficiaries and Their Main Characteristics

The beneficiaries of this research are bilingual high school students aged 14 to 15, from middle- to high-income families. Their English proficiency level is B1. While some students can communicate fluently, others struggle with the language particularly with reading comprehension, which limits their understanding of scientific content and affects their motivation and engagement with learning tasks.

Students often rely on peers or teachers for guidance rather than working independently. Therefore, this research seeks to enhance their motivation toward reading comprehension through hands-on, real-world CLIL activities that promote autonomy, engagement, and critical thinking.

11. Description of the Research Context

The research will take place at a private bilingual high school whose mission is to inspire students to become active participants in their learning and to foster a lifelong appreciation for education. The school has three buildings and approximately 30 classrooms in the main high school facility, providing adequate infrastructure for research.

Students follow an International School Partnership (ISP) program in English, integrated with the Ecuadorian National Curriculum. In science, they have access to a fully equipped laboratory, digital tools, and interactive technologies that support the development of reading



comprehension and analytical skills. These resources facilitate project-based and text-based learning essential components of the CLIL methodology.

12. Description of the Practical Contributions of the Proposal.

This proposal examines the relationship between motivation and the development of reading comprehension and critical thinking skills through the CLIL approach. The findings will contribute to enhancing students' motivation toward reading and science learning by connecting content to real-world applications.

Intrinsic motivation involves engaging in activities out of curiosity, interest, or challenge, while extrinsic motivation is driven by rewards (Kwan Eu, 2018). This research encourages motivation through interactive, reading-based, and project-driven activities designed to spark curiosity, foster comprehension, and promote deeper understanding in science. These activities aim to strengthen students' ability to interpret, analyze, and reflect on texts, simultaneously nurturing critical thinking and problem-solving abilities.

13. Importance of the Proposal from Professional, Methodological, Technological, and Social Perspectives.

This proposed study is valuable from multiple perspectives, as it addresses the importance of developing reading comprehension alongside critical thinking in bilingual contexts. These skills enable students to recognize the value of academic tasks, participate actively, and cultivate motivation and autonomy. Strengthening reading comprehension not only enhances understanding of academic texts but also supports the development of reasoning and analytical thinking which are essential for science learning in bilingual classrooms.

As English teachers, the primary responsibility is to imparting language skills. However, language is not only a means of communication but is a tool for exploring several subjects. By improving reading comprehension, students can engage more deeply with scientific texts, interpret information accurately, and connect concepts across disciplines. As a result, Content and Language Integrated Learning (CLIL) connects language learning with subject content to promote meaningful learning experiences that develop both linguistic and cognitive skills. Strengthening subject matter through CLIL provides learners with opportunities to enhance their reading comprehension and critical thinking abilities simultaneously. Critical thinking has been an important element of English language education around the world, and language learning is



expected to extend beyond grammar and vocabulary practice to encompass the development of higher-order thinking skills (Soufi & See, 2019). Professionally, this study is valuable for fostering innovative teaching methods that integrate reading comprehension strategies and improve student learning outcomes.

Critical thinking requires three main skills: gathering and selecting information; analyzing data to create a hypothesis; and solving a problem (Dallimore, 2019). Methodologically, this study advances existing research by implementing hands-on activities such as experimental design, guided reading, and project-based learning to connect reading comprehension and science learning to real-life experiences. Through these activities, students interpret information from authentic texts, evaluate evidence, and apply their understanding to problem-solving scenarios, reinforcing both comprehension and reasoning.

The CLIL approach in science education goes beyond language learning, providing a comprehensive framework for the development of essential skills in scientific subjects. The focus is on enhancing language, reading, and writing skills, presenting ideas, thinking critically, solving problems, and applying scientific knowledge in practical contexts. The study intends to present factual evidence on how motivation contributes to the development of reading comprehension and critical thinking skills in bilingual learners.

Science, technology, engineering, arts, and mathematics boosts creativity and skills in teaching, learning, and educational innovation (Stone-Johnson, 2018). Technologically, this proposal takes advantage of a wide range of resources and interactive learning tools such as multimedia projectors, computers, laboratories, and initiatives like the “I Am Scientist” program. In this project, students design their own STEM investigations, read and interpret scientific information, and share their findings with peers, fostering a sense of global citizenship. Incorporating technology into science education enhances students’ reading comprehension, participation, creativity, and motivation.

From a social perspective, kinesthetic learning strategies help students participate in physical and interactive activities related to subject content, rather than passive listening to lectures. This approach enables them to better understand written texts and apply information through hands-on practice. Such tasks promote collaboration and teamwork, enhancing both cognitive and social



skills. Through group projects involving reading and interpreting informational texts, students learn to solve problems, delegate tasks, and work effectively as part of a team.

Overall, the proposed research focuses on the significant implications of motivating B1 bilingual high school students to enhance their reading comprehension and critical thinking skills through CLIL methodology. It addresses the crucial need to foster these skills in bilingual settings, where language proficiency varies. The study aims to bridge the gap in motivating students to engage with texts, extract meaning, and apply critical thinking to real-world problems, particularly in science. The research design, utilizing mixed methods and a hybrid thematic analysis, strategically aims for a comprehensive understanding of factors influencing reading comprehension development. The emphasis on motivation as the independent variable and reading comprehension (supported by critical thinking) as the dependent variable presents a clear analytical framework. The purpose is to impact students' motivation and reasoning abilities by mixing theory with real-world application through interactive and text-based learning experiences, offering valuable insights for bilingual science education.



Chapter 1 Literature Review

1.1 Research Background

Reading comprehension, motivation, and critical thinking have been widely studied in educational research due to their crucial roles in student learning outcomes, especially in bilingual education. Several key studies have explored how motivation and critical thinking influence the development of reading comprehension skills in bilingual learners, particularly through the Content and Language Integrated Learning (CLIL) methodology.

For example, Chance et al. (2023) demonstrated that integrating social and emotional learning (SEL) strategies in bilingual classrooms enhances students' motivation and academic performance supporting the cognitive development necessary for both reading comprehension and critical thinking. Similarly, Vennixa et al. (2018) highlighted the growing demand literacy and STEM skills in education and emphasized the importance of fostering motivation and higher-order thinking through hands on, real world problem-solving activities in bilingual contexts, which directly benefit reading comprehension processes.

Research by Warsah (2021) found that collaborative learning approaches often integral to CLIL methodology positively impact reading comprehension and critical thinking by encouraging active engagement, discussion, and peer interaction. Additionally, Schunk et al. (2020), based on social cognitive theory revealed that students who regulate their motivation and learning strategies tend to achieve higher reading comprehension outcomes, suggesting a strong link between motivational regulation and cognitive processing during reading tasks.

Finally, studies on intrinsic motivation, such as those by Rheinberg & Engeser (2018) and Legault (2020), have consistently shown that students driven by internal interest and curiosity exhibit deeper engagement, improved reading comprehension, and more sustained critical thinking abilities compared to those motivated primarily by external rewards.

Together, these studies emphasize the dynamic relationship among reading comprehension, motivation, and critical thinking in bilingual education frameworks and highlight the potential of CLIL methodology to foster these interrelated skills at the B1



proficiency level. This research builds upon these findings to further investigate how motivation enhances reading comprehension in bilingual learners, while also examining the complementary role of critical thinking.

The interchange among reading comprehension, motivation, and critical thinking has become a significant area of interest in bilingual education research. This literature review examines the existing body of knowledge on the role of motivation and critical thinking in enhancing B1 bilingual students' reading comprehension through the CLIL methodology. The synthesis of relevant studies aims to clarify the dynamic relationship between motivation, critical thinking, and reading comprehension within CLIL contexts at the B1 proficiency level. Reading comprehension serves as a key indicator of linguistic and cognitive development, requiring both motivational engagement and critical reasoning for successful meaning-making.

Motivation and critical thinking play a vital role in the process of developing reading comprehension skills. The connection between motivation and cognitive development has been extensively investigated in educational literature, revealing that students who are motivated and able to think critically demonstrate higher levels of comprehension, inference, and text analysis. This chapter provides insights into the intricate interplay between reading comprehension, motivation, and critical thinking in bilingual learners.

By examining important research, this review seeks to identify patterns, gaps, and key findings in the literature, guiding the current study toward a more nuanced understanding of how motivation and critical thinking contribute to reading comprehension in CLIL environments. Reading comprehension, as the main language skill under investigation, not only reflects students' linguistic proficiency but also their ability to engage critically with texts. This chapter also explores the impact of intrinsic and extrinsic motivation on the cultivation of reading comprehension and critical thinking skills among high school students. The synthesis of this information aims to facilitate comprehension of the complex interplay between motivation, reading comprehension, and critical thinking to improve educational practices and outcomes in bilingual contexts.



1.2. Theoretical Framework

The educational model of the 21st century introduces a range of competencies and abilities that students must acquire, including reading comprehension, critical thinking, motivation, creativity, collaboration, and communication. Teachers are expected to strengthen students' linguistic and cognitive abilities throughout the learning process, fostering advanced thinking and literacy skills that prepare them to face academic and real-life challenges.

The theoretical framework underpinning this study draws from several established educational theories, with an emphasis on how motivation and critical thinking contribute to the development of reading comprehension skills among bilingual learners. Reading comprehension, understood as the ability to construct meaning from texts through active cognitive engagement, serves as the central language skill in this research. It integrates decoding, interpretation, and evaluation processes that require both motivational and critical components.

A significant body of research highlights the growing importance of Social and Emotional Learning (SEL) in education, driven by the demands of educators, parents, and policy makers. SEL principles help foster emotional regulation, persistence, and motivation, key elements for reading engagement and comprehension. (Chance et al., 2023) emphasize that SEL-based strategies positively influence students' motivation and academic performance, supporting the cognitive development necessary for effective reading and reasoning.

In bilingual CLIL classrooms, SEL principles are particularly relevant because motivation directly influences learners' willingness to engage with complex texts in a second language. Motivation not only sustains attention but also facilitates deeper comprehension by encouraging students to connect linguistic input with prior knowledge and contextual cues. Consequently, this study positions motivation as a mediating factor that strengthens reading comprehension and supports the development of critical thinking.

The internalization of motivation and the influence of the social environment play crucial roles in shaping individuals' cognitive processes, including both reading comprehension and



critical thinking. According to social cognitive theory (H. Schunk et al., 2020), students who self-regulate their motivation and learning strategies tend to achieve higher comprehension outcomes.

Competencies such as creativity, reflective reasoning, and problem-solving are strongly associated with motivation, which fuels persistence in cognitively demanding reading tasks. Therefore, teachers are expected not only to provide corrective feedback but also to use feedback as a motivational and metacognitive tool, helping bilingual learners build confidence and maintain engagement with challenging texts. In this sense, feedback becomes an instrument for improving reading comprehension through sustained motivation and guided reflection.

Modern education increasingly integrates STEM disciplines with language learning through Content and Language Integrated Learning (CLIL). (Vennixa et al., 2018). As noted by the author, technological and scientific literacy have become essential for personal and professional growth. In contrast to traditional science instruction, STEM and CLIL approaches encourage students to read, interpret, and analyze scientific texts in meaningful contexts skills directly tied to reading comprehension.

This study supports such integrated approaches because they align with CLIL principles, which make content accessible while developing language proficiency. However, a limitation identified in the literature is that many STEM and CLIL programs assume students possess advanced reading proficiency in the target language. This research addresses that gap by examining how motivational strategies can help learners overcome linguistic barriers, enhancing both reading comprehension and critical thinking while maintaining engagement in science-related content.

Educators widely acknowledge critical thinking as a fundamental skill for academic success and lifelong learning. Classroom practices that encourage questioning, text analysis, and reflective dialogue not only promote reasoning but also deepen reading comprehension. Through such activities, students learn to infer, evaluate, and synthesize information from texts core components of higher-order literacy.



Research shows that hands-on and cognitively stimulating activities improve comprehension, memory, and analytical abilities (Vennixa et al., 2018). However, implementing these practices in bilingual settings requires careful scaffolding, as learners may struggle with linguistic complexity. Motivational strategies thus become essential for maintaining students' perseverance when faced with challenging reading materials.

In summary, this theoretical framework supports the proposition that reading comprehension is the central skill through which motivation and critical thinking interact. Motivation provides the affective foundation for engagement and persistence, while critical thinking enables learners to interpret, analyze, and evaluate textual information. The integration of these established principles into CLIL instruction aims to promote not only language proficiency but also deeper cognitive development among bilingual high school students.

1.3 Reading Comprehension as the Core Skill

Reading comprehension is a fundamental skill that serves as a cornerstone for academic success and lifelong learning, particularly for bilingual B1 learners in English as a second language (ESL) setting. It involves learners' ability to decode, understand, interpret, and critically engage with texts. Research emphasizes its multidimensional nature, which includes vocabulary knowledge, syntactic processing, inferencing, and metacognitive strategy use. For example, (Nguyen, 2021) highlights that many B1 ESL learners struggle with extracting main ideas, understanding the author's purpose, and making inferences, which negatively impact their academic achievement and overall engagement with content. Consequently, reading comprehension is positioned as the dependent variable the primary outcome influenced by internal learner factors such as motivation and cognitive skills making it vital in language acquisition research.

Motivation plays a central role in reading comprehension, as it shapes learners' level of engagement and their willingness to persist in reading tasks. Learners who are motivated are more likely to apply appropriate reading strategies and maintain effort throughout the comprehension process, which positively influences learning outcomes (Dörnyei & Ushioda, 2013) In bilingual classrooms, particularly those implementing Content and Language Integrated



Learning (CLIL), motivation is strengthened through the meaningful connection between language use and subject content, promoting more sustained and purposeful learning experiences. (Cenoz, & Gorter, 2022). Consequently, motivation functions as a complementary construct that supports learners' success in reading comprehension.

Critical thinking further reinforces reading comprehension by enabling learners to actively analyze, evaluate, and synthesize information from texts. When critical thinking is integrated into ESL reading instruction, learners are encouraged to go beyond literal interpretation and engage more deeply with textual meaning, as evidenced in studies conducted within the Ecuadorian educational context (González & Ramírez, 2022) For bilingual B1 learners, the development of higher-order thinking skills alongside language proficiency is essential, positioning critical thinking as a key complementary construct that enhances reading comprehension.

Within bilingual and ESL research, reading comprehension remains the central skill upon which motivation and critical thinking hinge. Báez & Paredes observe in Ecuadorian bilingual high school settings that reading comprehension is essential for accessing academic content and achieving cognitive growth. (Báez & Paredes, 2023). Gómez also highlights the interplay between motivation and reading comprehension, confirming that while motivation enhances learners' willingness to engage, reading comprehension remains the key skill determining academic success in English. (Gómez, 2021).

In summary, this subpoint situates reading comprehension as the main skill in bilingual ESL research, with motivation and critical thinking as complementary constructs that enhance this primary outcome. The researcher points out that understanding is critical for developing effective pedagogical strategies and fostering meaningful learning experiences, particularly in CLIL settings that engage bilingual B1 learners in Ecuador and similar contexts.

1.4 Motivation and Reading Comprehension

Motivation and reading comprehension are closely interconnected, particularly within bilingual and Content and Language Integrated Learning (CLIL) contexts. Motivation, a multifaceted construct, influences reading comprehension by driving learners' engagement and persistence in reading tasks. While intrinsic motivation is often linked to deeper, more



meaningful engagement with texts, extrinsic motivation also plays a role in encouraging learners to begin and maintain reading activities. In bilingual CLIL settings, learners frequently rely on extrinsic incentives initially, but sustaining higher levels of reading comprehension requires intrinsic motivation for ongoing cognitive involvement.

Research has demonstrated that motivational strategies such as goal setting, positive feedback, and rewards can effectively enhance reading comprehension by fostering learners' commitment and use of reading strategies. However, much of the existing literature often overlooks bilingual high school environments where learners face additional linguistic challenges. This study addresses that gap by focusing on how motivation can be harnessed not only to stimulate cognitive reading processes but also to help bilingual students manage the complexities of reading in a second language.

From a theoretical standpoint, motivational frameworks grounded in social cognitive theory suggest that learners' capacity to monitor and regulate their motivation influences their reading comprehension outcomes. (H. Schunk et al., 2020). Motivation acts as the driving force behind learners' effort and perseverance, while reading comprehension skills provide the cognitive tools needed to decode, interpret, and critically interact with texts. In bilingual CLIL classrooms, where students might feel less confident in their linguistic abilities, motivation also sustains perseverance when reading demands intersect with language barriers.

A motivated mindset encourages learners to approach reading as an opportunity for growth and discovery, which enhances their comprehension. Students motivated by curiosity or personal interest actively seek diverse texts, question meanings, and develop deeper understanding. CLIL instruction can deliberately foster such motivation by designing meaningful and contextually relevant reading tasks that connect language learning with content, consequently reducing the negative impact of linguistic difficulties on comprehension development.

Motivation and reading comprehension are interdependent in bilingual education through CLIL. Motivation initiates and sustains learners' engagement with texts, directly impacting reading comprehension as a dependent variable. This dynamic emphasizes motivation's central



role in helping bilingual B1 learners overcome the linguistic and cognitive challenges of reading in a second language, supporting both academic achievement and lifelong learning skills.

1.5 Intrinsic motivation and Reading

Intrinsic motivation plays a pivotal role in enhancing reading comprehension, especially in bilingual CLIL contexts where language barriers can impact learner engagement. Intrinsic motivation refers to engaging in an activity purely for the enjoyment and interest it generates rather than for external rewards. (Rheinberg & Engeser, 2018). Studies consistently show that intrinsically motivated learners exhibit greater persistence, deeper engagement, and more reflective cognitive processing, all of which are essential for effective reading comprehension. This involvement fosters active curiosity and encourages learners to approach texts critically and thoughtfully, supporting richer understanding. However, sustaining intrinsic motivation in bilingual high school settings can be challenging due to linguistic demands that may undermine learners' sense of competence and autonomy. (Oxford Dictionary, 2007).

The sustainability of intrinsic motivation depends greatly on factors such as the learning environment, curriculum design, and teacher-student relationships, which are critical in CLIL classrooms. According to competence motivation theory, learners are more intrinsically motivated when they perceive themselves as capable and autonomous in a task (Harter, as cited in Oxford Dictionary, 2007). Yet, bilingual learners' competence perception can be diminished by limited access to language proficiency rather than cognitive ability, creating unique challenges in sustaining intrinsic motivation within CLIL. This research highlights the importance of creating learning tasks that explicitly foster competence and autonomy, therefore nurturing intrinsic motivation despite language-related obstacles.

From a theoretical perspective, intrinsic motivation supports reading comprehension by enhancing cognitive engagement and self-regulation. Intrinsically motivated students tend to engage more deeply with reading materials, seeking to understand, question, and analyze texts. When learners read in a second language, motivation contributes to their ability to remain engaged over time, supporting continuous academic development (Schunk, Pintrich & Greene, 2020).



Within bilingual educational contexts such as those found in Ecuador, the implementation of CLIL-oriented instruction that prioritizes meaningful and contextually relevant reading activities plays an important role in strengthening learners' intrinsic motivation. By connecting reading tasks to students' interests and real-world content, learners are better equipped to navigate linguistic difficulties and sustain active participation in the learning process. Evidence from bilingual educational settings in Ecuador further supports the role of motivation in sustaining learners' engagement during reading tasks (Báez & Paredes, 2023) In CLIL classrooms, intrinsic motivation emerges as a fundamental element in the development of higher-level reading comprehension. Although critical thinking continues to function as a complementary construct that enriches comprehension, this study emphasizes the importance of maintaining learners' intrinsic motivation through instructional practices that reduce language-related obstacles and encourage more independent and reflective interaction with texts.

1.6 Extrinsic motivation and Reading

Extrinsic motivation (EM) refers to engagement in activities driven by outcomes external to the activity itself, such as grades, praise, or rewards (Legault, 2020). In educational settings, extrinsic motivators have historically been viewed cautiously due to their potential to diminish intrinsic interest. However, recent research acknowledges that well-designed extrinsic motivational strategies such as meaningful recognition, structured feedback, and rewards can positively influence students' willingness to engage in challenging cognitive tasks, including reading comprehension. For bilingual learners in Ecuadorian CLIL classrooms, extrinsic motivators are particularly important as initial incentives that help students overcome linguistic insecurities and engage with complex academic texts.

Research shows that extrinsic motivation can stimulate engagement and support reading comprehension when appropriately framed. For example, academic recognition and competition may foster a culture that values intellectual effort, encouraging learners to persist with cognitively demanding reading tasks. Yet, excessive reliance on external rewards or controlling



environments may lead to superficial engagement, reduced risk-taking, and diminished learner autonomy (Liu, 2020). In bilingual contexts where students process content in a second language, misuse of extrinsic motivators could hinder long-term reading development by prioritizing immediate rewards over deep comprehension and critical thinking.

Self-determination theory (Deci & Ryan, 2017) emphasizes that extrinsic motivation is most effective when internalized, that is when learners perceive external incentives as aligned with their own goals and values. This study asserts that bilingual Ecuadorian students are more likely to internalize extrinsic motivation when reading tasks are meaningful, culturally relevant, and supported by scaffolding to reduce language barriers. Constructive feedback focused on effort and progress rather than errors can transform extrinsic motivators into confidence-building tools that enhance reading comprehension and sustained effort.

Importantly, extrinsic and intrinsic motivations function synergistically in bilingual CLIL classrooms. While intrinsic motivation sustains deep engagement with reading materials, extrinsic motivators provide the necessary initial push for learners who may lack confidence or interest due to language-related anxieties. In this transitional role, extrinsic motivation ensures continued participation in reading tasks until intrinsic motivation develops, which supports higher-order cognitive processes like critical thinking as complementary skills.

In summary, this research highlights that strategically applied extrinsic motivation is vital to fostering bilingual students' reading comprehension in Ecuadorian CLIL classrooms. By encouraging internalization and framing rewards within meaningful learning experiences, educators can use extrinsic motivation as a stepping stone to sustained engagement, deeper comprehension, and the complementary development of critical thinking abilities.

1.7 Content and Language Integrated Learning (CLIL), reading, motivation and critical thinking

Content and Language Integrated Learning (CLIL) is a dynamic instructional approach that combines the teaching of subject-specific content with language learning, making it highly relevant for bilingual education. CLIL not only promotes language acquisition but also enhances cognitive and academic skills, particularly reading comprehension, which is the main skill



targeted in this study (Mahan, 2020), (Loaiza et al., 2019). Through multimodal activities involving reading, writing, speaking, and listening, CLIL fosters language competence alongside higher-order thinking, with critical thinking and motivation serving as complementary constructs that enrich learners' engagement and understanding.

Empirical research, though limited in Latin American bilingual contexts, has begun to highlight CLIL's positive effects on reading comprehension. In Ecuadorian classrooms, the implementation of CLIL has been associated with noticeable improvements in students' reading comprehension, particularly when reading instruction encourages strategic interaction with texts (Ramírez & Menamayorga, 2021) ; (Báez & Paredes, 2023). The approach's emphasis on authentic and meaningful content encourages intrinsic motivation, which is crucial for deep engagement and sustained reading comprehension (Csizér, 2019). Motivation drives learners to persist when facing cognitively demanding materials, maintaining focus and effort.

Engaging with scientific and academic content in a foreign language inherently challenges bilingual learners to analyze, evaluate, and apply knowledge critically. CLIL provides enriching contexts such as hands-on experiments and problem-solving tasks that promote comprehension beyond surface-level understanding (Surdyanto & Kurniawan., 2020) ; (Bayram, B., et al., 2019). Intrinsically motivated students are more apt to participate actively in these tasks, while motivation influenced by well-designed extrinsic incentives can initially support students confronting linguistic insecurities.

Yet, the effectiveness of CLIL hinges on balancing linguistic accessibility and cognitive challenge. If tasks are too linguistically complex without adequate support, learners may experience cognitive overload, which risks demotivation and limits critical thinking development (Loaiza et al., 2019). This delicate balance is especially pertinent in Ecuadorian bilingual classrooms, where teachers play a crucial role in scaffolding learning to optimize both motivation and cognitive engagement. (Gómez, 2021).

This research contributes empirical insights into how CLIL-based science instruction can be designed to enhance reading comprehension through motivated engagement and the complementary development of critical thinking among B1-level bilingual learners in Ecuador. It addresses the gap in limited studies within Latin America by offering pedagogical strategies that



integrate language and content learning within motivating and cognitively stimulating environments.

1.8 Reading in science learning and academic achievement

Reading comprehension plays a central role in science learning and academic achievement, particularly within constructivist pedagogical frameworks that emphasize active knowledge construction through meaningful experiences (Leong, 2018). Constructivist theory assumes that when students engage deeply with learning tasks connecting new scientific concepts to prior knowledge, they develop a more profound understanding that is vital for success in bilingual education contexts such as Ecuador's. Here, educational policies prioritize learner-centered, inclusive, and context-sensitive approaches that integrate both language and content learning, helping students improve scientific literacy alongside CEFR B1 language proficiency.

Within bilingual science education, the primary aim is for students to understand key scientific principles and to apply them meaningfully to real-world situations. Effective science reading comprehension allows learners to decode complex texts, analyze data, and synthesize information skills that are integral to academic achievement and lifelong learning. Motivation is pivotal in this process; intrinsically motivated students tend to engage more deeply with scientific texts and persist through challenges, whereas reliance on extrinsic incentives may lead to surface-level participation and weaker long-term comprehension (Skinner & Raine, 2022)

Engagement, defined as “energy in action” (Skinner & Raine, 2022), acts as a meta-construct intertwining motivation and active participation, which are essential for robust comprehension of scientific content. Achieving this requires learning environments that foster self-perceived competence, autonomy, and supportive peer and teacher interactions key elements of Self-Determination Theory. Tasks designed to evoke curiosity, problem-solving, and initiative transform academic reading into personally meaningful experiences, facilitating transfer and application of knowledge.

This study argues that reading comprehension in science is not simply a predictor of academic performance but a catalyst for developing critical thinking, autonomy, and enduring academic success. By investigating how bilingual B1 learners in Ecuador engage with science



content through CLIL-based reading tasks, the research aims to demonstrate how motivational practices can enhance reading comprehension, leading to richer scientific understanding and resilience in learning.

1.9 Interaction and Balance

Reading comprehension stands as the main cognitive skill essential for success in science learning, with motivation and critical thinking serving as important complementary elements to achieve this goal. Sole reliance on intrinsic motivation to drive reading comprehension and content mastery is often insufficient, especially when students encounter challenging or unfamiliar scientific texts. In these cases, extrinsic motivation becomes a vital complement to support learner engagement and performance. Effective teaching necessitates a balanced and flexible combination of intrinsic and extrinsic motivational strategies to address the diverse needs of bilingual learners in Ecuadorian science classrooms.

Literature stresses the importance of integrating both intrinsic and extrinsic motivation to optimize reading comprehension and cognitive growth. (Lin, 2018) argues that the most favorable outcomes in cognitive development arise when intrinsic and extrinsic motivation are deliberately balanced. However, overdependence on extrinsic incentives risk undermining intrinsic interest, leading to superficial reading and engagement. Hence, a prudent approach is essential, where extrinsic motivators reinforce rather than replace intrinsic motivation, ensuring students remain engaged with scientific texts in a sustained and meaningful manner.

Intrinsic motivation remains a powerful driver of deep reading comprehension and critical thinking. (Grajcevcic & Shala, 2021) find that intrinsically motivated learners demonstrate greater persistence and initiative in exploring scientific content and complex texts. Nevertheless, intrinsic motivation alone may not suffice when navigating demanding reading tasks in science, particularly within bilingual contexts where language barriers complicate comprehension. A balanced pedagogical approach combines extrinsic support, such as feedback and recognition, with efforts to enhance intrinsic interest maximizes learning outcomes.

Teachers play an indispensable role in fostering motivation, reading comprehension, and critical thinking. By creating stimulating and supportive learning environments that incorporate authentic scientific reading materials, collaborative tasks, and recognition of individual efforts,

educators can nurture intrinsic motivation while thoughtfully employing extrinsic incentives. Integrating language and science instruction through CLIL enhances the relevance and accessibility of reading tasks, facilitating connections between theory and practice. This approach aligns with CEFR standards and Ecuador's legal frameworks for bilingual and intercultural education, supporting comprehensive content mastery and language development.

In summary, effective pedagogy in bilingual science education requires a nuanced balance of intrinsic and extrinsic motivation to promote reading comprehension as the core skill, with critical thinking complementing the cognitive development process. This study contributes a practical framework grounded in existing literature and adapted to Ecuadorian classrooms, offering evidence-based strategies that respond to varied student needs and foster sustained academic engagement and achievement.

1.10 Challenges and gaps in the existing literature

Research indicates that well-designed extrinsic incentives can help structure learning activities and enhance students' focus on improving reading comprehension, an essential skill in science education (Libao et al., 2017). However, implementing such incentives demands careful balance to avoid weakening intrinsic motivation, which is crucial for meaningful engagement and cognitive growth. The self-determination theory provides a useful framework, emphasizing autonomy, competence, and relatedness as foundational to sustaining intrinsic motivation alongside the development of critical thinking skills.

Despite substantial theoretical insights into motivation, CLIL, and critical thinking independently, a significant research gap remains in examining their combined influence on reading comprehension within B1-level bilingual classrooms. Many studies focus on learners with higher language proficiency or treat motivation and critical thinking in isolation rather than investigating their interplay in emerging bilingual learners engaged in CLIL science instruction. Furthermore, there is a scarcity of longitudinal research exploring how motivational strategies impact reading comprehension and critical thinking over time. Addressing these gaps is vital for understanding how motivation influences cognitive development through reading in bilingual CLIL contexts, thereby informing pedagogical practices aligned with CEFR standards and Ecuador's educational policies aimed at fostering autonomous, motivated learners.



While existing literature provides robust theoretical foundations, empirical evidence that integrates motivation, reading comprehension, and content mastery in bilingual classrooms especially in Ecuador is limited. This study aims to fill these gaps by proposing practical, culturally responsive strategies that bridge motivation, language learning, and critical thinking, with reading comprehension as the central skill. By doing so, it contributes valuable insights toward effective bilingual science education that nurtures comprehensive language and cognitive development.

1.10.1 Legal and Normative Framework

This study is framed within the legal and normative guidelines established by Ecuador's Ministry of Education, which prioritize bilingual education and inquiry-based learning as fundamental to developing 21st-century skills. Aligning the research with the B1 level of the Common European Framework of Reference for Languages (CEFR) ensures that learners' linguistic and cognitive competencies are evaluated according to internationally recognized standards. These policies provide a firm foundation for the integration of CLIL methodology, emphasizing reading comprehension as the primary skill, while recognizing motivation and critical thinking as complementary components within bilingual high school contexts.

The Ministry of Education's curriculum emphasizes a communicative language approach, adherence to CEFR standards, learner-centered pedagogy, and the use of CLIL to foster higher-order thinking skills. These principles directly support this study's aim to leverage CLIL to enhance reading comprehension, motivation, and critical thinking among B1 bilingual learners. Furthermore, the National Curriculum Guidelines for English explicitly incorporate the CEFR framework, highlighting the B1 level as an essential benchmark guiding both linguistic and cognitive development (Ministerio de Educación del Ecuador, 2016).

Ecuador's broader legal framework, including the Organic Law of Intercultural Education (LOEI) and associated inclusive education policies, reinforces the country's commitment to equitable, bilingual, and intercultural learning environments. These regulations encourage bilingualism, culturally responsive pedagogy, and innovative methodologies like CLIL, which are essential for effective science education (Ministerio de educación, 2015).



Despite these strong policies, the study recognizes challenges, particularly in the application of extrinsic motivation. While acknowledged by educational policies and research, extrinsic incentives must be implemented with care to avoid undermining intrinsic motivation or reducing educational engagement to superficial accomplishments. Balancing extrinsic motivators with the promotion of learner autonomy, self-confidence, and genuine curiosity is critical, especially in science instruction that relies heavily on reading comprehension.

A notable gap exists in research focused specifically on B1-level bilingual learners, as most studies target higher proficiency groups and often treat motivation, reading comprehension, and critical thinking separately. By situating this study within the national policy framework and aligning it with CEFR standards, the researcher aims to provide practical, evidence-based strategies that address the unique cognitive and linguistic demands of this learner group. This positioning contributes valuable insights to the international discourse on how motivation and CLIL influence the development of reading comprehension as a dependent variable, while also promoting critical thinking as a complementary outcome.

1.10.2 Integrating Reading Comprehension, Critical Thinking, and CLIL in Ecuadorian B1 Classrooms

Ecuador's educational system has increasingly emphasized bilingual education, particularly by integrating English as a second language within high school curricula. This shift responds to national goals of fostering intercultural competence, 21st-century skills, and global communication proficiency. The Ministry of Education consistently advocates for bilingual education, inquiry-based learning, and communicative language teaching, providing a normative framework that guides instructional practices across educational levels (Ministerio de Educación del Ecuador, 2016). The CEFR framework serves as a critical benchmark for language proficiency, positioning B1 learners at a pivotal stage in developing both linguistic competence and cognitive autonomy. Despite solid policy backing, challenges persist in creating classroom experiences that effectively integrate reading comprehension, motivation, and cognitive skill development, especially in science and other content-based subjects.

Motivation is recognized as a key driver of student engagement and academic success. In bilingual classrooms, intrinsic motivation learners' internal drive to learn supports sustained



engagement, deep content exploration, and persistence in problem-solving activities (Grajcević & Shala, 2021). Intrinsically motivated B1 learners tend to actively participate, critically analyze scientific concepts, and reflect thoughtfully on their learning. Nevertheless, intrinsic motivation alone may fall short, especially when learners are faced with demanding or novel tasks. In such instances, extrinsic motivational strategies such as structured rewards, recognition, and clear performance guidelines scaffold learners' efforts, provide direction, and sustain engagement. The strategic balance of intrinsic and extrinsic motivation is crucial; overreliance on extrinsic rewards risks reducing learning to superficial achievements and undermining curiosity and autonomy (Lin, 2018).

Critical thinking forms a foundational pillar of effective learning, enabling learners to analyze, evaluate, and synthesize information. In bilingual settings, critical thinking demands not only cognitive capacities but also sufficient language proficiency to process and express complex ideas. While motivation's link to critical thinking is established, research addressing this relationship explicitly within Ecuador's B1 bilingual classrooms is limited. Most studies focus on higher proficiency learners or considering motivation and cognitive skills separately, limiting applicability to emerging bilingual students. This study addresses that gap, advocating instructional strategies that simultaneously foster language proficiency, motivation, and critical thinking.

Content and Language Integrated Learning (CLIL) emerge as an especially relevant approach for achieving these integrated educational goals. By combining subject content teaching with language acquisition, CLIL offers authentic, meaningful contexts where B1 learners can practice English while engaging with scientific topics. This approach naturally fosters intrinsic motivation by highlighting learning's real-world relevance, stimulating curiosity, and encouraging application of knowledge across linguistic and cognitive domains. When paired with well-structured extrinsic incentives, CLIL provides essential scaffolding for learners needing extra support to tackle complex material (Libao et al., 2017). The integrated approach advances critical thinking and addresses bilingual education's twin challenges of language development and content mastery.



Effective implementation of motivation, critical thinking, and CLIL requires thoughtful instructional design. Teachers play a central role in crafting enriching environments that blend motivational strategies with opportunities for higher-order thinking. Employing real-world examples, collaborative projects, problem-based learning, and acknowledging individual progress nurtures intrinsic interest, while scaffolding, goal-setting, and structured prompts offer extrinsic support. Incorporating inquiry-based tasks within CLIL lessons invites B1 learners to engage in scientific reasoning, analyze data, and communicate results in English, concurrently advancing motivation, critical thinking, and reading proficiency. Such pedagogical practices align with CEFR standards and national policies, promoting inclusive, culturally sensitive education responsive to diverse bilingual learner needs.

Although theoretical foundations are strong, empirical research linking motivation, CLIL, and critical thinking in Ecuadorian B1 learners remains sparse. Longitudinal studies evaluating motivational strategies' sustained effects on critical thinking and reading comprehension are particularly lacking. This study contributes by developing evidence-based, culturally appropriate strategies designed to cultivate autonomous, reflective learners. Positioned within Ecuador's policy and CEFR frameworks, it enriches both local and global discussions about effective bilingual education, providing actionable insights for educator's intent on enhancing critical thinking through CLIL.

CLIL's dual emphasis on authentic content and target-language use creates fertile conditions to boost learners' intrinsic and integrative motivation while cultivating higher-order cognitive skills. Recent research demonstrates that CLIL boosts learner engagement, positive emotions, and willingness to communicate, fostering sustained effort on cognitively demanding tasks like analysis, evaluation, and problem-solving. Comparative studies show that CLIL classrooms with scaffolded, content-rich tasks produce greater gains in critical-thinking behaviors than non-CLIL settings.

In Ecuador, official EFL frameworks promote linking thinking skills with content objectives inspired by Bloom's taxonomy, and several national investigations affirm that CLIL-like approaches enhance lesson relevance and learner motivation. However, challenges persist, including uneven teacher preparation for CLIL, heavy planning loads, limited assessment tools



for cognitive skills, and scant examples connecting classroom critical thinking to real-world contexts. These factors hinder motivated classroom behaviors from translating into effective everyday problem-solving.

In conclusion, reading comprehension is the focal skill underpinning science learning and academic achievement in Ecuadorian bilingual B1 classrooms. Motivation serves as a catalyst for engagement and cognitive development, and critical thinking complements this process by enhancing learners' autonomy, confidence, and language proficiency. CLIL offers a vital pedagogical framework bridging language and content mastery, enabling authentic, meaningful learning experiences. The research supports a balanced integration of intrinsic and extrinsic motivational strategies within CLIL to optimize academic outcomes. This synthesis highlights motivation, critical thinking, and CLIL as intertwined elements essential for holistic learner development, preparing students to meet academic and real-world challenges successfully.

1.11 Synthesis and Conceptual Framework

Drawing from the reviewed literature, this chapter proposes a conceptual framework that centers reading comprehension as the key dependent variable in B1 bilingual learners, within the context of Ecuador's bilingual education. The framework integrates motivational factors including both intrinsic and extrinsic motivation, the constructivist learning approach, and the Content and Language Integrated Learning (CLIL) methodology, providing a cohesive lens for supporting bilingual education. Subsequent chapters will empirically examine this framework, focusing on how these elements collectively influence reading comprehension development while recognizing critical thinking as a complementary construct that enriches the research.

The literature establishes a foundation for exploring how motivation shapes reading comprehension, while simultaneously supporting critical thinking skills in bilingual contexts. By synthesizing research on motivation, reading comprehension, critical thinking, and CLIL, this study contributes to the broader educational discourse on bilingual learning. The researcher highlights that these insights can guide educators and policymakers in designing instructional practices that enhance reading outcomes, aligned with Ecuador's Ministry of Education and CEFR standards.



This synthesis reveals a complex interaction between intrinsic and extrinsic motivation, each playing essential and complementary roles in fostering reading comprehension and related cognitive skills. Intrinsic motivation sustains engagement, perseverance, and deeper learning, whereas extrinsic incentives provide valuable structure and initial direction. The researcher argues that instructional designs must balance these motivational approaches carefully to avoid undermining learners' internal drives while addressing individual learner differences to ensure inclusive and equitable practices.

Although existing studies provide a solid theoretical foundation, there is a recognized gap in research that holistically integrates motivation, CLIL methodology, and reading comprehension specifically for B1 bilingual learners. Many investigations treat language learning, motivation, or cognitive skill acquisition separately, which limits their practical impact. The framework proposed here emphasizes the interdependence of motivation and critical thinking in strengthening reading comprehension, illustrating how these elements reinforce one another. Recognizing this interplay empowers educators to implement strategies that foster intrinsic motivation alongside critical thinking, supporting learners' comprehensive development.

Overall, motivation and critical thinking are mutually reinforcing facets of academic success, with motivation catalyzing the development of critical thinking and reading proficiency further enhancing engagement, autonomy, and language competence. The researcher asserts that educators who grasp and employ this dynamic can design effective, learner-centered bilingual instruction that prepares students not only for academic achievement but also for navigating complex real-world challenges. This study positions reading comprehension as the primary focus, with motivation and critical thinking serving as vital complementary constructs within a CLIL-based instructional framework.

Chapter 2 Methodology

The purpose of this research is to investigate the role of motivation in enhancing B1 bilingual students' reading comprehension through CLIL methodology, with critical thinking considered as a complementary outcome that reflects deeper engagement with texts. The study addresses the following research question: To what extent does motivation play a key role in enhancing the reading comprehension skills and critical thinking abilities of B1 learners in a bilingual high school?



This study is field research, because all data were collected directly in the students' regular classroom context during CLIL science lessons. It is also cross-sectional, since all data (pre-survey, intervention activities, post-survey, interview, observations) were gathered within a single academic period (8 weeks, Quarter 2) with the same group of 30 B1 learners. In addition, the methodological and theoretical foundations were strengthened through bibliographic research on CLIL, motivation, reading comprehension, and critical thinking, which guided the design of the instruments and the interpretation of the findings.

The study followed the institutional research stages: (1) theoretical stage, (2) initial diagnosis, (3) modelling of the proposal through motivational CLIL reading activities, and (4) final diagnosis and validation through post-surveys and interviews.

Theoretical stage

In the theoretical stage, bibliographic research was carried out on CLIL, motivation, reading comprehension, and critical thinking to construct the conceptual framework and support the operationalization of the variables.

1. Research Design

A mixed-methods research design was employed, integrating quantitative and qualitative approaches to obtain a more complete understanding of the relationship between motivation and reading comprehension in a CLIL context. Quantitative procedures allow the measurement of changes in students' motivation and reading performance, while qualitative procedures provide detailed information about how students experience and apply critical thinking when engaging with texts.

2. Participants

The participants in this study are B1-level learners enrolled in a bilingual science-education program. A purposive sampling technique was used to select students from 10th grade B, so they represented a range of backgrounds, genders, and interests within the class. The sample size was determined to ensure adequate representation of the target group for the planned quantitative analyses.



3. Description of the variables

For this research, the independent variable is the impact of motivation on students' engagement with reading tasks in the science field, within a content and language integrated learning (CLIL) framework. The dependent variable is students' reading comprehension in English, with critical thinking treated as a complementary dimension that describes how learners analyze, evaluate, and justify ideas while reading.

The study remains focused on these two variables throughout the process, examining how motivational strategies and engagement relate to variation in reading-comprehension outcomes. In this design, motivation functions as the independent variable because the main purpose is to evaluate how different motivational conditions and practices influence students' reading comprehension and associated critical-thinking processes in CLIL lessons.

Techniques and instruments

4. Data Collection Instruments

Quantitative data collection-Instrument 1: Pre- and post-intervention survey (see Annex 1).

- Pre- and post-intervention surveys: These surveys measure students' motivation toward reading and CLIL science activities using a Likert scale (for example, 1–5), focusing on interest, effort, and engagement with reading tasks.

Qualitative data collection-Instrument 2: Semi-structured interview (See Annex 2)

- Semi-structured interview: Conducted with a subset of students to explore how they perceive their motivation to read in CLIL science lessons and how they use critical-thinking strategies (such as analyzing and evaluating information) while reading.

Qualitative data collection-Instrument 3: Classroom observations and field notes (See Annex 3)

- Classroom observations and field notes: Qualitative data related to motivated behavior, engagement in reading, and visible critical-thinking processes are collected during reading-based CLIL activities.



Proposal Modeling (Intervention)

5. Data Collection Procedure

Pre-intervention phase (Initial Diagnosis)

- A pre-intervention survey is administered to assess students' initial motivation toward reading in CLIL science lessons.
- Classroom observations are carried out and recorded during regular reading-based science activities.

Motivational intervention (Proposal Modeling)

- A sequence of CLIL activities is designed to enhance students' motivation toward reading science-related texts (for example, using meaningful content, active reading strategies, and collaborative tasks).

Post-intervention phase (Final Validation – quantitative)

- A post-intervention survey is administered to measure changes in students' motivation toward reading.
- Classroom observations are repeated to document post-intervention reading engagement and critical-thinking behaviors.

Qualitative follow-up (Final Validation – qualitative)

- A semi-structured interview is held with selected students to explore their perceptions of motivation, reading experiences, and the ways in which they used critical thinking during the intervention.
- Field notes from observations and interviews are organized to complement and explain the quantitative findings regarding the link between motivation and reading comprehension, with critical thinking as a supporting dimension.

Operationalization Matrix of Variables

Independent variable	Conceptual definition	Dimensions	Indicators	Scales
Motivation impact	Motivation is the act or process of giving students a reason for engaging in a task, reflected in their willingness and enthusiasm to do it (adapted from Cambridge Dictionary, 2023)	Strategies	Strategies to enhance students' motivation toward reading tasks	Always Sometimes Hardly ever Never
			Engagement in active reading strategies with CLIL methodology	
			Level of students' engagement in reading activities	
		Engagement	Active participation in reading activities	
			Persistence in completing reading tasks, even when they are difficult	
			Attention and on-task behavior during reading lessons	

Table 1

Operationalization matrix for the independent variable: Motivation impact

Note. Prepared by the researcher (2025).

Dependent variable	Conceptual definition	Operational definition	Dimensions	Indicators	Scales
Reading comprehension	Reading comprehension is the ability to understand and make meaning from written texts by connecting what the text says with the reader's knowledge and language skills" (adapted from RAND Reading Study Group, 2002, Reading Universe, 2023).	Through guided practice with written texts, students apply critical-thinking skills (such as analyzing, evaluating, and justifying ideas) to understand what they read, support their interpretations with textual evidence, and make informed judgments about the information presented	Reading comprehension	Understanding main ideas	Always Sometimes Hardly ever Never
	Identifying specific information				
	Inferring explicit meaning				
	Recognizing text organization				
	Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, and analyzing information gathered. (Elder & Paul, 2009).		Critical thinking	Evaluating the author's ideas	
				Justifying opinions with evidence from the text	
				Drawing reasoned conclusions from what is read	

Table 2

Operationalization matrix for the dependent variable: Reading comprehension and critical thinking

Note. Prepared by the researcher (2025).



In this research, the main aim is to explore the relationship between students' motivation and their reading comprehension in English, including how critical-thinking processes support reading. The variables in the operational matrix are defined as follows.

Independent variable: Impact of motivation

The independent variable is the impact of motivation on students' engagement in reading tasks. It examines how motivational factors and classroom practices encourage students' willingness, effort, and persistence when working with written texts within a CLIL context.

Dimension 1: Strategies

This dimension includes items that measure the strategies used to enhance students' motivation toward reading. It focuses on how teachers design and implement activities that make reading meaningful and engaging for learners.

- **Item 1:** Strategies to enhance motivation toward reading. This item identifies the specific techniques and methods used by the teacher to increase students' interest and enthusiasm for reading activities in CLIL lessons.
- **Item 2:** Engagement in active reading strategies using CLIL methodology. This item evaluates the extent to which students participate in active reading practices (such as predicting, questioning, and summarizing) while working with content-based texts.
- **Item 3:** Level of students' engagement in reading tasks. This item measures students' behavioral and emotional involvement during reading activities, such as attention, participation, and persistence in completing reading assignments.

Dimension 2: Engagement

This dimension focuses on students' motivated behavior during reading lessons. It assesses how frequently students show motivated actions that support effective reading and learning.



- **Item 1:** Participation in reading activities. This item examines how often students volunteer to read, share ideas about texts, or contribute to discussions based on what they have read.
- **Item 2:** Persistence with demanding texts. This item measures students' effort and perseverance when they face challenging reading materials in CLIL classes.
- **Item 3:** On-task behavior during reading. This item evaluates the extent to which students stay focused and avoid distractions while working on reading tasks.

Dependent variable: Reading comprehension (with critical thinking)

The dependent variable is reading comprehension, understood as the ability to understand and construct meaning from written texts by connecting the information in the text with the reader's knowledge and language skills. Critical thinking is incorporated as a complementary dimension that describes how learners analyze and evaluate what they read.

Dimension 1: Reading comprehension

This dimension focuses on how well students understand written texts used in CLIL lessons.

- **Item 1:** Understanding main ideas and details. This item measures students' ability to identify central ideas and important information in a text.
- **Item 2:** Making inferences and using context. This item evaluates students' capacity to infer implicit information and interpret vocabulary or ideas using contextual clues.
- **Item 3:** Recognizing text organization. This item assesses how students identify the structure and logical organization of the texts they read.

Dimension 2: Critical thinking

This dimension addresses how students apply critical-thinking skills while reading, as a complementary aspect of comprehension.

- **Operational definition:** Through guided practice with written texts, students apply critical-thinking skills (such as analyzing, evaluating, and justifying ideas) to understand



what they read, support their interpretations with textual evidence, and make informed judgments about the information presented.

- **Item 1:** Analyzing and evaluating information in texts. This item measures students' ability to examine arguments, identify reasons and evidence, and judge the credibility or quality of the information they read.
- **Item 2:** Justifying opinions with textual evidence. This item evaluates how students support their viewpoints about a text by citing and explaining relevant information from it.
- **Item 3:** Drawing conclusions and solving problems from texts. This item assesses the extent to which students use information from reading to reach reasoned conclusions or propose solutions to problems presented in the material.

Through the exploration of these variables, dimensions, and items, this research seeks to gain a deeper understanding of how motivation influences students' reading comprehension in educational settings, with critical thinking considered as a complementary dimension that enriches text understanding.

Population

The target population for this research consisted of approximately 120 students in the 10th course from high school. Two science educators were responsible for this population, each in charge of two classes; the specific sample used in the study was drawn from one of these classes (10th grade B)



Number of teachers	Courses	Number of students
2	4	120
T1	A	27
T1	B	30
T2	C	31
T2	D	32

*Table 3
Population*

Note. Prepared by the researcher (2025).

Sample

For this study, only the 10th B class was selected by the researcher. This course consisted of 30 B1 students in total, who participated in the intervention on motivation, reading comprehension, and critical thinking in CLIL science lessons.

Sampling

The sampling method used was convenience purposive sampling, as 30 B1 students were selected based on characteristics such as their English level, learning experiences and styles, active participation, attitude, and willingness to collaborate in a study about motivation, reading comprehension, and critical thinking in CLIL lessons.



Data analysis

Quantitative Data Analysis:

Surveys were applied to gather quantitative data related to students' motivation toward reading in CLIL science lessons and their reading-comprehension performance, including basic indicators of critical-thinking processes while reading. Descriptive statistics (means and standard deviations) were used to summarize general trends in motivation and reading comprehension, and inferential statistics (such as correlation analysis) were applied to examine the relationship between motivation (independent variable) and reading comprehension (dependent variable).

Qualitative Data Analysis:

To gain a deeper understanding of students' experiences and perceptions, as well as the factors that influenced their motivation and their use of critical thinking while reading, qualitative data were collected through semi-structured interviews and classroom observation notes. Qualitative analysis, based on coding and categorizing responses, was used to identify themes and patterns related to motivation, engagement with reading, and critical-thinking strategies applied to texts, enriching the interpretation of the quantitative results.

Integration of Quantitative and Qualitative Data:

Within the convergent mixed-methods design, quantitative and qualitative data were analyzed in parallel and then integrated. A convergent analysis was conducted by comparing findings from both strands to identify similarities, differences, and complementary insights about



how motivation relates to reading comprehension and associated critical-thinking processes in the CLIL context.

Ethical Considerations

When conducting research with human participants, several ethical aspects were considered. Informed consent was obtained from all participants, ensuring they were aware of the study's purpose, procedures, potential risks, and their right to withdraw at any time. Privacy and confidentiality were protected by anonymizing data so no personally identifiable information was disclosed.

The principle of beneficence guided the study, seeking to maximize benefits while minimizing potential harm, including any psychological impact of questions about motivation, reading, or critical thinking. Participants were treated with fairness and respect, and efforts were made to avoid discrimination or bias. The research proposal was submitted for ethical review and approval by the corresponding institutional authority to safeguard students and ensure ethical standards.

Secure procedures were implemented for storing and managing data to protect participants' information. Transparency about the research process was maintained, and results were shared in an appropriate way, so participants were aware of the study's outcomes. By addressing these ethical considerations and conducting rigorous data analysis, the research aims to provide valuable insights into the relationship between motivation and reading comprehension, with critical thinking as a complementary dimension, among Level B1 learners in a bilingual school.

Initial diagnosis

The initial diagnosis focused on identifying students' motivational levels toward reading science texts in English and their difficulties in reading comprehension and critical-thinking processes.

Quantitative data

Pre-survey

The science attitudes pre-survey aimed to gather insights into participants' feelings and attitudes towards various aspects of science. The survey consisted of eight questions, each rated on a scale from 1 to 5, with 1 indicating "Strongly Disagree" and 5 indicating "Strongly Agree."

1. I find the science texts we read in English fascinating.

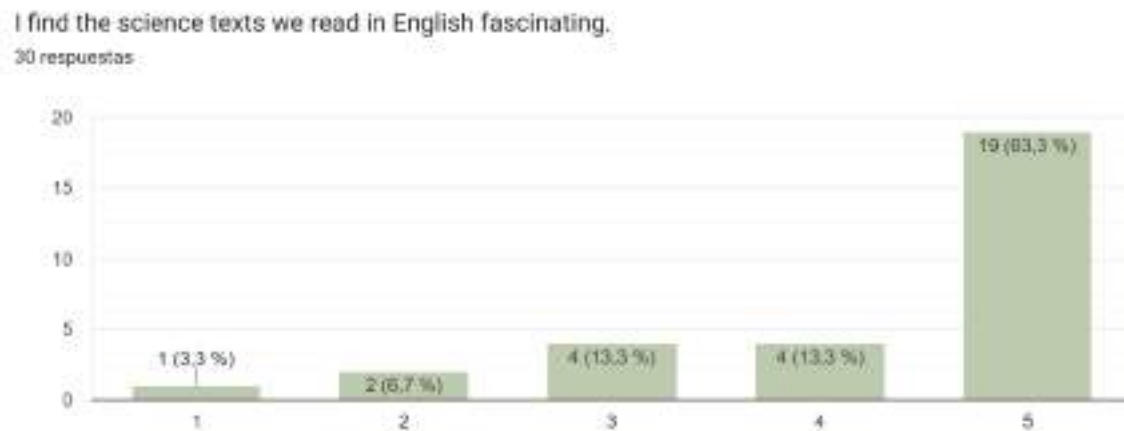


Figure 1
Pre-survey results for Item 1: Interest in reading science texts in English
Note. Prepared by the researcher (2025).

Interest in reading science texts in English:

Strongly Disagree (1): 3.3% (1 student)

Disagree (2): 6.7% (2 students)

Neither Disagree nor Agree (3): 13.3% (4 students)

Agree (4): 13.3% (4 students)

Strongly Agree (5): 63.3% (19 students)

Mean: 4.3

Standard Deviation: 1.1

63.3% of students strongly agreed that they find the science texts read in English fascinating, contributing to a high mean score of 4.3.

2. I enjoy reading science texts in English during class.

I enjoy reading science texts in English during class.

30 respuestas

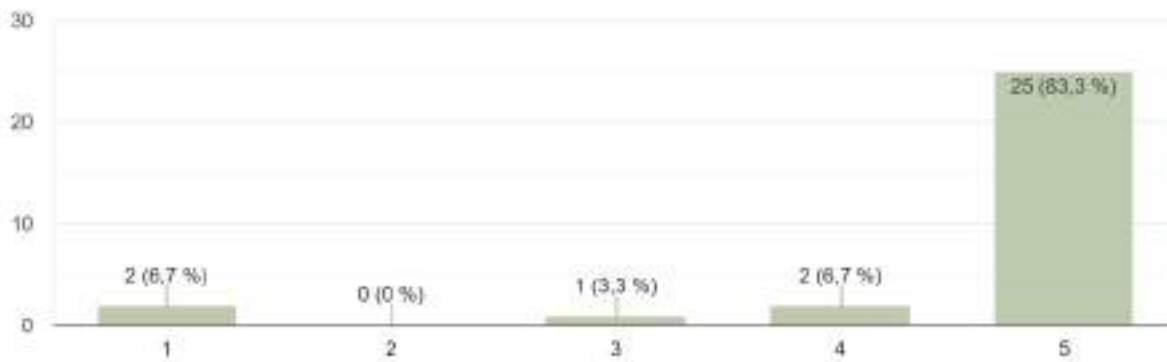


Figure 2

Pre-survey results for Item 2: Enjoyment of reading-based CLIL activities

Note. Prepared by the researcher (2025).

Enjoyment of reading-based CLIL activities:

Strongly Disagree (1): 6.7% (2 students)

Disagree (2): 0% (0 students)

Neither Disagree nor Agree (3): 3.3% (1 student)

Agree (4): 6.7% (2 students)

Strongly Agree (5): 83.3% (25 students)

Mean: 4.6

Standard Deviation: 1.1

83.3% of students strongly agreed that they enjoy reading-based CLIL science activities, resulting in a high mean score of 4.6.

3. Learning new ideas from science texts in English excites me.

Learning new ideas from science texts in English excites me.

30 respuestas

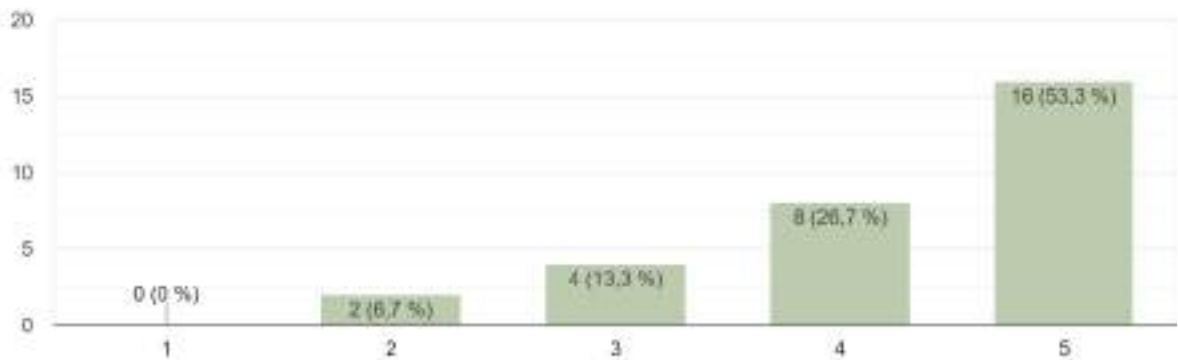


Figure 3

Pre-survey results for Item 3: Excitement about learning new ideas from texts

Note. Prepared by the researcher (2025).

Excitement about learning new ideas from texts:

Strongly Disagree (1): 0% (0 students)

Disagree (2): 6.7% (2 students)

Neither Disagree nor Agree (3): 13.3% (4 students)

Agree (4): 26.7% (8 students)

Strongly Agree (5): 53.3% (16 students)

Mean: 4.3

Standard Deviation: 0.9

The majority of students (53.3%) strongly agreed that learning new scientific ideas through reading in English excites them, giving a mean score of 4.3.

4. I am willing to read additional science texts in English, even if they are not graded.

I am willing to read additional science texts in English, even if they are not graded.

30 respuestas

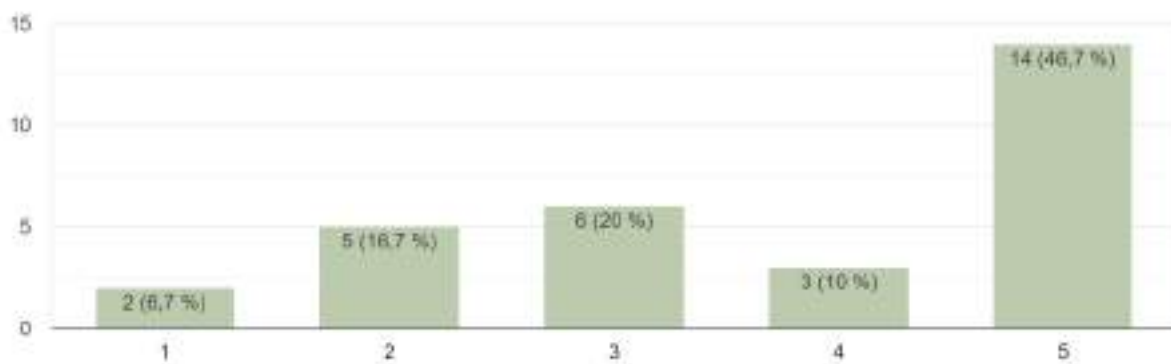


Figure 4

*Pre-survey results for Item 4: Willingness to read more science texts in English
Note. Prepared by the researcher (2025).*

Willingness to read more science texts in English:

Strongly Disagree (1): 6.7% (2 students)

Disagree (2): 16.7% (5 students)

Neither Disagree nor Agree (3): 20% (6 students)

Agree (4): 10% (3 students)

Strongly Agree (5): 46.7% (14 students)

Mean: 3.7

Standard Deviation: 1.4

Although 46.7% of students strongly agreed that they are willing to read more science texts in English, the variability in responses led to a moderate mean score of 3.7.

5. I feel supported by my teacher when I have difficulties understanding a science text in English.

I feel supported by my teacher when I have difficulties understanding a science text in English.
30 respuestas

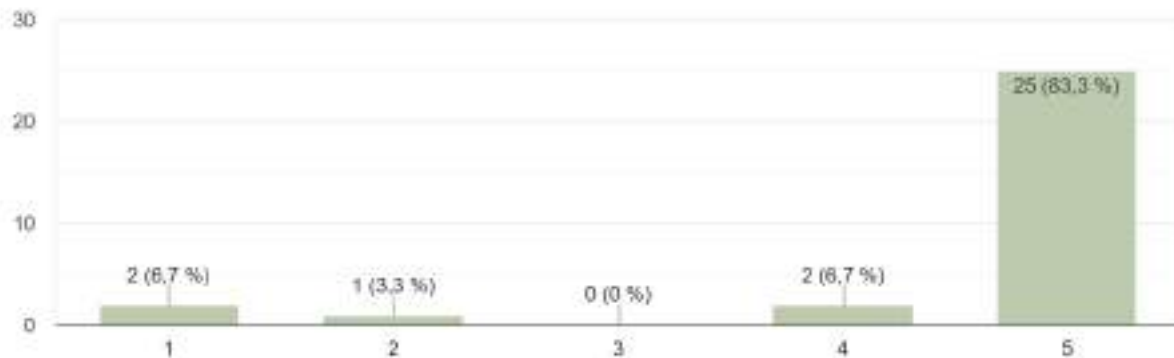


Figure 5

Pre-survey results for Item 5: Perceived teacher support for reading in science

Note. Prepared by the researcher (2025).

Perceived teacher support for reading in science:

Strongly Disagree (1): 6.7% (2 students)

Disagree (2): 3.3% (1 student)

Neither Disagree nor Agree (3): 0% (0 students)

Agree (4): 6.7% (2 students)

Strongly Agree (5): 83.3% (25 students)

Mean: 4.6

Standard Deviation: 1.1

Most students (83.3%) strongly agreed that they feel supported by their teacher when reading science texts in English, resulting in a high mean score of 4.6.

6. The reading materials and resources used in science (worksheets, articles, digital texts) help me understand the content.

The reading materials and resources used in science (worksheets, articles, digital texts) help me understand the content.

30 respuestas

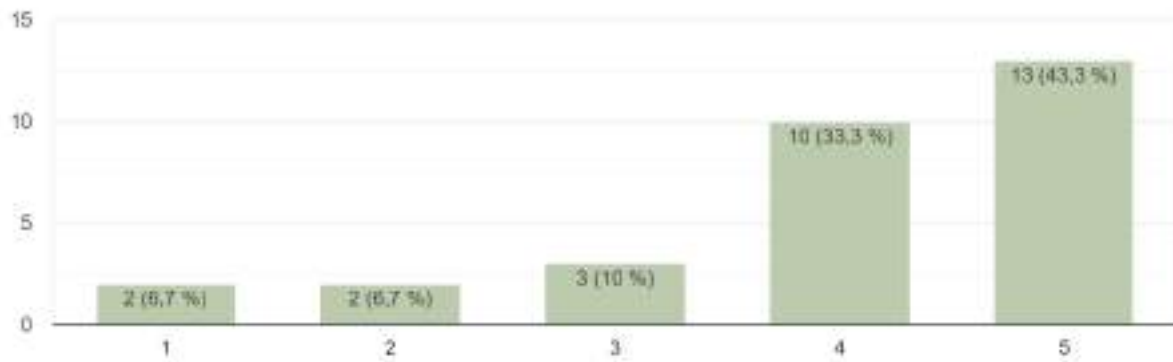


Figure 6

Pre-survey results for Item 6: Usefulness of reading materials and resources

Note. Prepared by the researcher (2025).

Usefulness of reading materials and resources:

Strongly Disagree (1): 6.7% (2 students)

Disagree (2): 6.7% (2 students)

Neither Disagree nor Agree (3): 10% (3 students)

Agree (4): 33.3% (10 students)

Strongly Agree (5): 43.3% (13 students)

Mean: 4.0

Standard Deviation: 1.2

A large percentage of students (76.6%) agreed or strongly agreed that the reading materials and resources help them understand science content, producing a mean score of 4.0.

7. Reading science texts in English is one of my favorite parts of the subject.

Reading science texts in English is one of my favorite parts of the subject.
30 respuestas

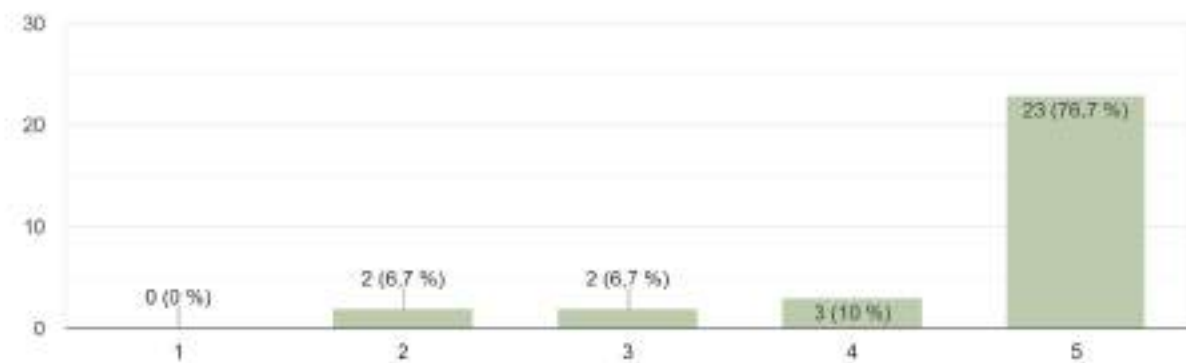


Figure 7

Pre-survey results for Item 7: Reading science text as a favorite part of the subject
Note. Prepared by the researcher (2025).

Reading science texts as a favorite part of the subject:

Strongly Disagree (1): 0% (0 students)

Disagree (2): 6.7% (2 students)

Neither Disagree nor Agree (3): 6.7% (2 students)

Agree (4): 10% (3 students)

Strongly Agree (5): 76.7% (23 students)

Mean: 4.6

Standard Deviation: 0.9

76.7% of students strongly agreed that reading science texts in English is one of their favorite parts of the subject, resulting in a high mean score of 4.6.

8. I feel confident in my ability to understand science texts in English.

I feel confident in my ability to understand science texts in English.

30 respuestas

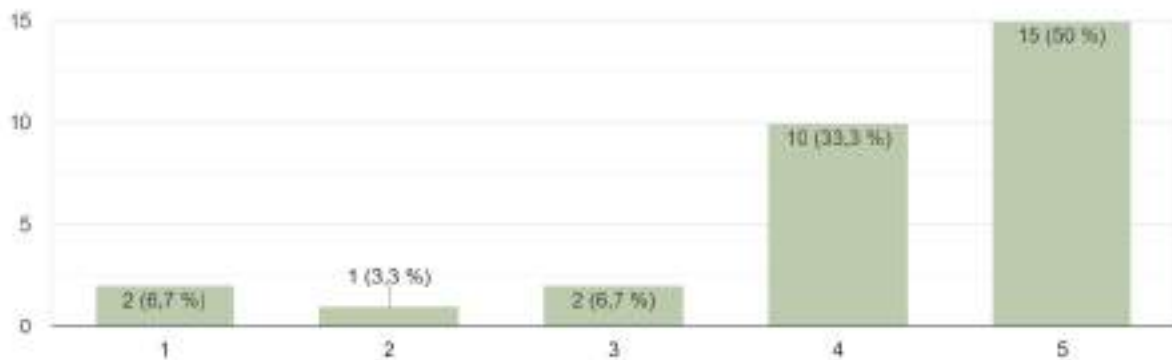


Figure 8

Pre-survey results for Item 8: Confidence in understanding science texts in English

Note. Prepared by the researcher (2025).

Confidence in understanding science texts in English:

Strongly Disagree (1): 6.7% (2 students)

Disagree (2): 3.3% (1 student)

Neither Disagree nor Agree (3): 6.7% (2 students)

Agree (4): 33.3% (10 students)

Strongly Agree (5): 50% (15 students)

Mean: 4.2

Standard Deviation: 1.1

Half of the students (50%) strongly agreed that they feel confident understanding science texts in English, yielding a mean score of 4.2.

Diagnostic conclusions – Pre-intervention

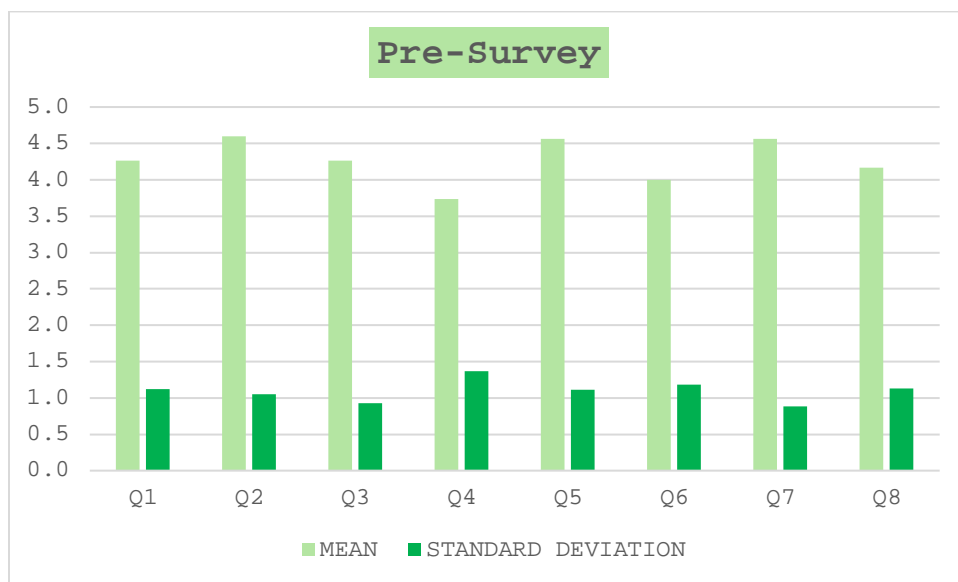


Figure 9
Diagnostic conclusions – Pre-intervention
Note. Prepared by the researcher (2025).

Although there was still room for growth in their self-perceived competence, participants reported a moderate level of confidence in their ability to understand science texts in English. The findings revealed a generally positive attitude toward reading in CLIL science lessons, together with a strong interest in text-based activities and teacher support during reading. The



results suggested that students held favorable views of reading in science, especially in terms of confidence, enjoyment, and perceived support, while responses to items related to future study plans and availability of materials were more varied, indicating that these aspects may depend on individual preferences and experiences. This information is useful for adapting CLIL reading activities and materials so they better match learners' specific needs and interests in both motivation and reading comprehension.

In conclusion, the diagnostic confirmed that students show high motivation and solid development in reading comprehension and critical thinking. However, mixed responses regarding effort and reliance on memorization indicate the need for strategies that promote deeper and more reflective reading habits. These findings justify the implementation of the proposed CLIL reading model presented in the following chapter.

Final Diagnosis and Validation

Post-survey intervention

The science attitudes post-survey intervention was aimed to evaluate students' perceptions in terms of knowledge, skills, individual characteristics, behavior, and impact on their future aspirations related to science. The survey consisted of ten questions, each rated on a scale from 1 to 5, with 1 indicating "Strongly Disagree" and 5 indicating "Strongly Agree."

1. I try to understand the science texts we read in English, not only do the minimum to pass.

I try to understand the science texts we read in English, not only do the minimum to pass.

30 respuestas

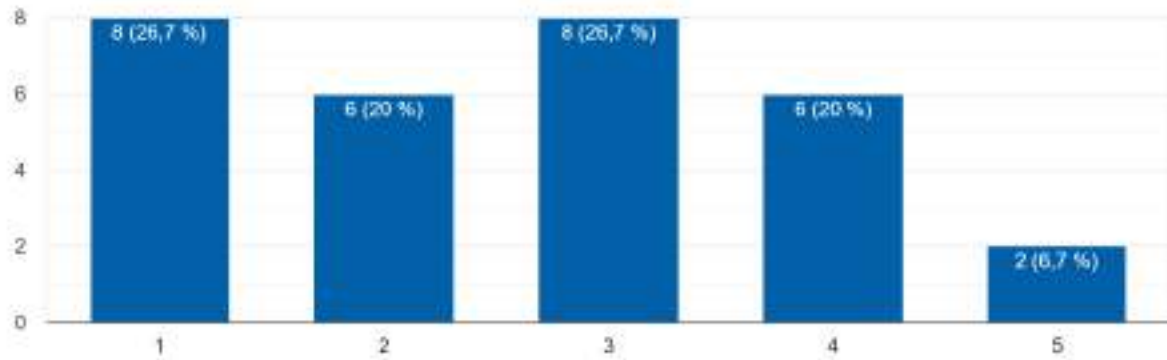


Figure 10

Post-survey results for Item 1: Aim to pass with minimal effort

Note. Prepared by the researcher (2025).

Aim to pass with minimal effort:

Strongly Disagree (1): 26.7% (8 students)

Disagree (2): 20% (6 students)

Neither Disagree nor Agree (3): 26.7% (8 students)

Agree (4): 20% (6 students)

Strongly Agree (5): 6.7% (2 students)

Mean: 2.6

Standard Deviation: 1.3

Responses show that many students do not fully endorse doing only the minimum to pass; the mean of 2.6 suggests a tendency away from low-effort reading.

2. When I read science texts in English, I focus on understanding ideas, not just memorizing sentences.

When I read science texts in English, I focus on understanding ideas, not just memorizing sentences.

30 respuestas

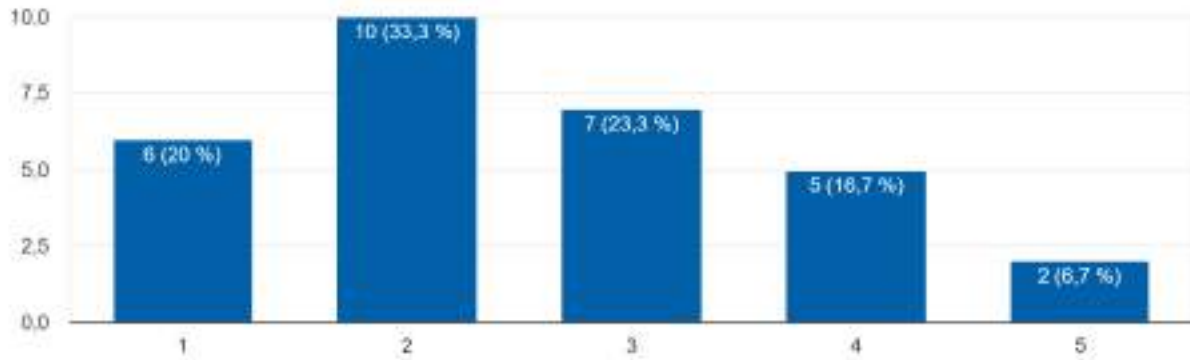


Figure 11

*Post-survey results for Item 2: Relying on memorization in reading
Note. Prepared by the researcher (2025).*

Relying on memorization in reading:

Strongly Disagree (1): 20% (6 students)

Disagree (2): 33.3% (10 students)

Neither Disagree nor Agree (3): 23.3% (7 students)

Agree (4): 16.7% (5 students)

Strongly Agree (5): 6.7% (2 students)

Mean: 2.4

Standard Deviation: 1.2

Most students disagreed with relying only on memorization while reading, indicating a move toward more meaningful comprehension strategies.

3. I think it is worthwhile to read and learn from science texts even if that content is not directly in the test.

I think it is worthwhile to read and learn from science texts even if that content is not directly in the test.

30 respuestas

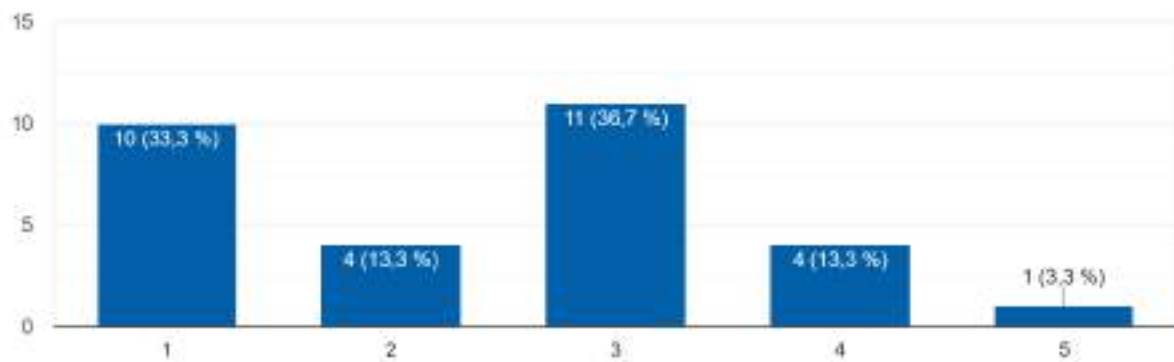


Figure 12
Post-survey results for Item 3: Value of reading beyond evaluations
Note. Prepared by the researcher (2025).

Value of reading beyond evaluations:

Strongly Disagree (1): 33.3% (10 students)

Disagree (2): 13.3% (4 students)

Neither Disagree nor Agree (3): 36.7% (11 students)

Agree (4): 13.3% (4 students)

Strongly Agree (5): 3.3% (1 student)

Mean: 2.4

Standard Deviation: 1.2

The distribution shows mixed views about the value of reading beyond assessed content, with many students neutral, reflected in a mean of 2.4.

4. Analyzing and organizing ideas from the texts helps me think critically about science topics.

Analyzing and organizing ideas from the texts helps me think critically about science topics.
30 respuestas

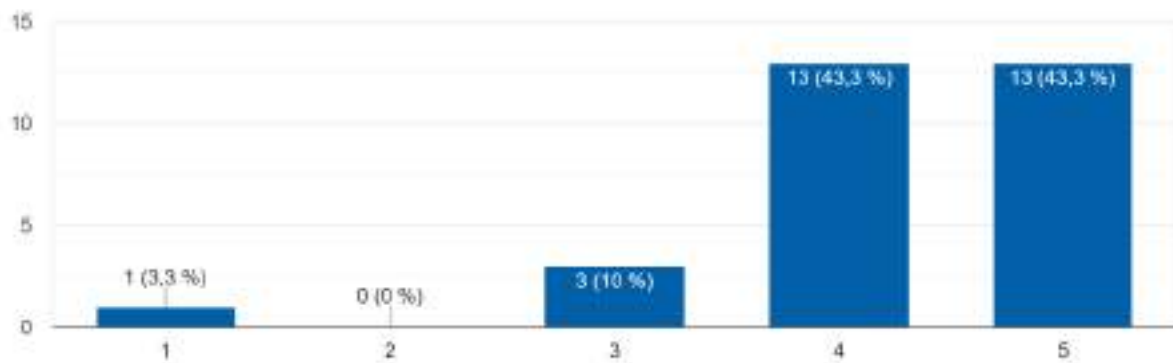


Figure 13
Post-survey results for Item 4: Importance of analyzing and organizing ideas
Note. Prepared by the researcher (2025).

Importance of analyzing and organizing ideas:

Strongly Disagree (1): 3.3% (1 student)

Disagree (2): 0% (0 students)

Neither Disagree nor Agree (3): 10% (3 students)

Agree (4): 43.3% (13 students)

Strongly Agree (5): 43.3% (13 students)

Mean: 4.2

Standard Deviation: 0.9

A large majority (86.6%) agreed or strongly agreed that analyzing ideas from texts is essential for critical thinking.

5. I can express my ideas clearly and effectively in writing after reading science texts in English.

I can express my ideas clearly and effectively in writing after reading science texts in English.
30 respuestas

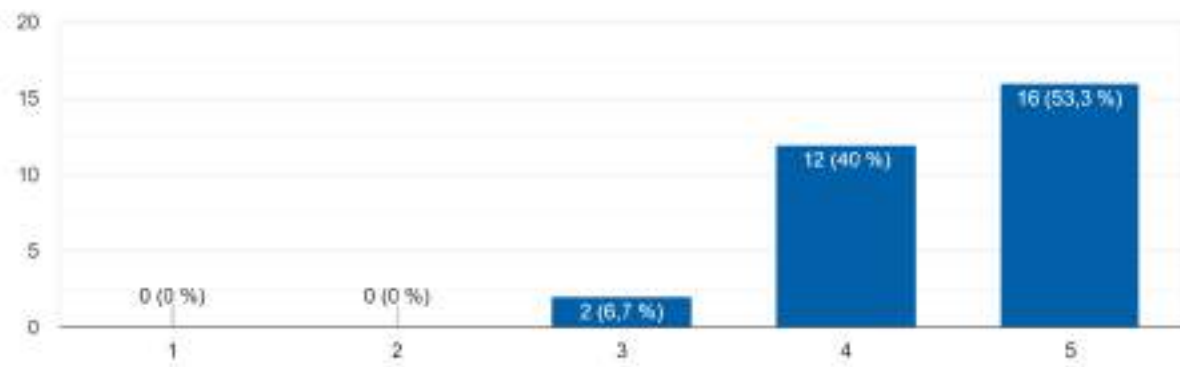


Figure 14
Post-survey results for Item 5: Clear, accurate, and effective writing
Note. Prepared by the researcher (2025).

Clear, accurate, and effective writing:

Strongly Disagree (1): 0% (0 students)

Disagree (2): 0% (0 students)

Neither Disagree nor Agree (3): 6.7% (2 students)

Agree (4): 40% (12 students)

Strongly Agree (5): 53.3% (16 students)

Mean: 4.5

Standard Deviation: 0.6

Most students (93.3%) felt able to write clearly based on what they read, indicating strong confidence in written responses to texts.

6. I am sure I can understand the main ideas in the reading tasks we did for the project.

I am sure I can understand the main ideas in the reading tasks we did for the project.
30 respuestas

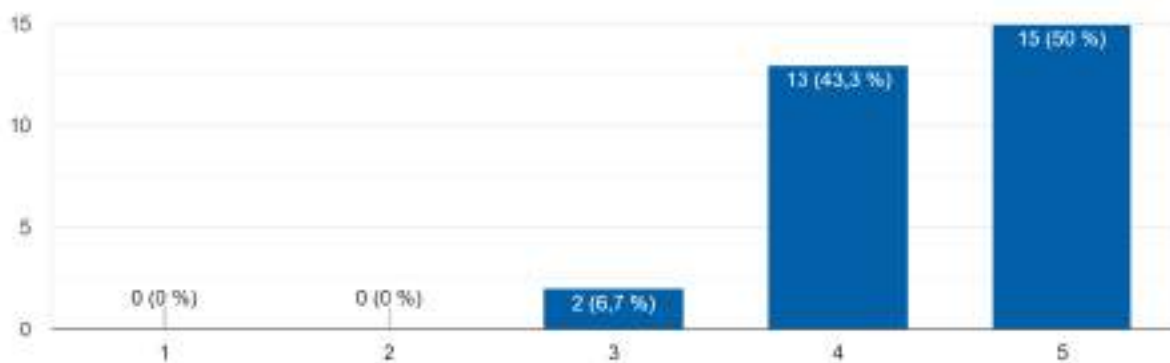


Figure 15
Post-survey results for Item 6: Understanding project-related reading
Note. Prepared by the researcher (2025).

Understanding project-related reading:

Strongly Disagree (1): 0% (0 students)

Disagree (2): 0% (0 students)

Neither Disagree nor Agree (3): 6.7% (2 students)

Agree (4): 43.3% (13 students)

Strongly Agree (5): 50% (15 students)

Mean: 4.4

Standard Deviation: 0.6

A very high proportion (93.3%) agreed or strongly agreed that they could understand the project-related texts.

7. I think I achieved a good result in the reading-based CLIL project.

I think I achieved a good result in the reading-based CLIL project.
30 respuestas

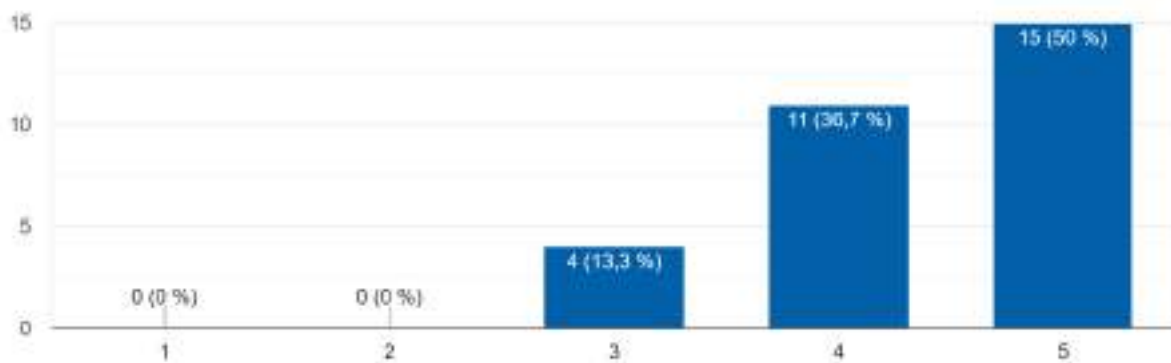


Figure 16
Post-survey results for Item 7: Perception of project performance
Note. Prepared by the researcher (2025).

Perception of project performance:

Strongly Disagree (1): 0% (0 students)

Disagree (2): 0% (0 students)

Neither Disagree nor Agree (3): 13.3% (4 students)

Agree (4): 36.7% (11 students)

Strongly Agree (5): 50% (15 students)

Mean: 4.4

Standard Deviation: 0.7

Most students (86.7%) believed they obtained a good grade, showing positive self-evaluation of their work with reading tasks.

8. I like reading tasks that are challenging because they help me learn new things.

I like reading tasks that are challenging because they help me learn new things.
30 respuestas

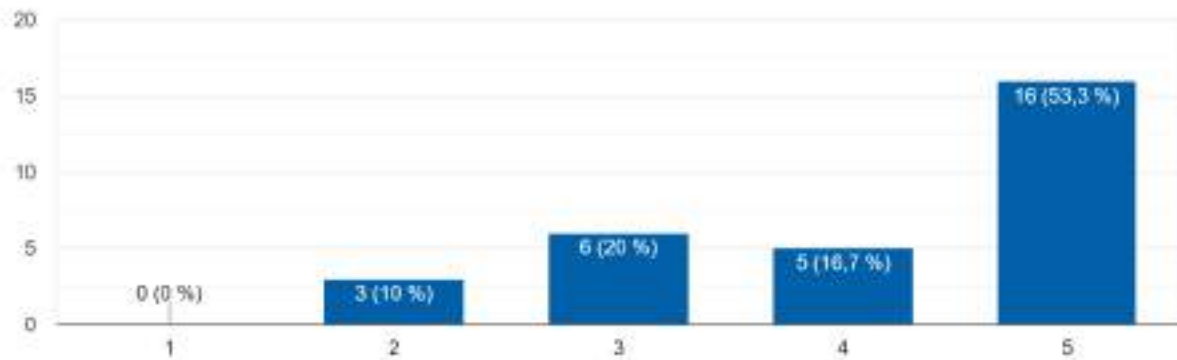


Figure 17
Post-survey results for Item 8: Preference for challenging reading
Note. Prepared by the researcher (2025).

Preference for challenging reading:

Strongly Disagree (1): 0% (0 students)

Disagree (2): 10% (3 students)

Neither Disagree nor Agree (3): 20% (6 students)

Agree (4): 16.7% (5 students)

Strongly Agree (5): 53.3% (16 students)

Mean: 4.1

Standard Deviation: 1.1

Seventy percent of students agreed or strongly agreed that they prefer challenging reading tasks, suggesting openness to cognitively demanding texts.

9. I liked what I learned from the science texts and activities in the project.

I liked what I learned from the science texts and activities in the project.

30 respuestas

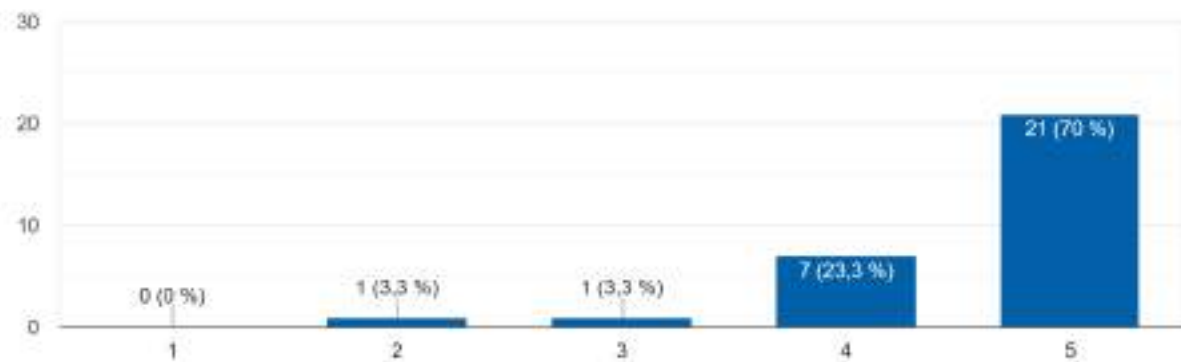


Figure 18

Post-survey results for Item 9: Enjoyment of learning from reading

Note. Prepared by the researcher (2025).

Enjoyment of learning from reading:

Strongly Disagree (1): 0% (0 students)

Disagree (2): 3.3% (1 student)

Neither Disagree nor Agree (3): 3.3% (1 student)

Agree (4): 23.3% (7 students)

Strongly Agree (5): 70% (21 students)

Mean: 4.6

Standard Deviation: 0.7

A large majority (93.3%) agreed or strongly agreed that they liked what they learned from the texts and associated activities.

10. Even when I do poorly in a reading task, I try to learn from my mistakes.

Even when I do poorly in a reading task, I try to learn from my mistakes.

30 respuestas

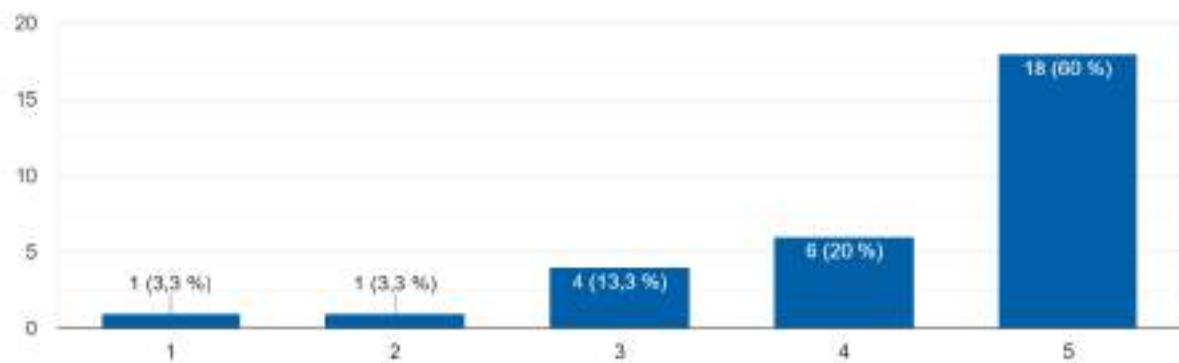


Figure 19

Post-survey results for Item 10: Learning from mistakes in reading

Note. Prepared by the researcher (2025).

Learning from mistakes in reading:

Strongly Disagree (1): 3.3% (1 student)

Disagree (2): 3.3% (1 student)

Neither Disagree nor Agree (3): 13.3% (4 students)

Agree (4): 20% (6 students)

Strongly Agree (5): 60% (18 students)

Mean: 4.3

Standard Deviation: 1.1

Eighty percent of students agreed or strongly agreed that they learn from mistakes in reading tasks, indicating a generally adaptive motivational pattern.

Diagnostic conclusions – Post-intervention

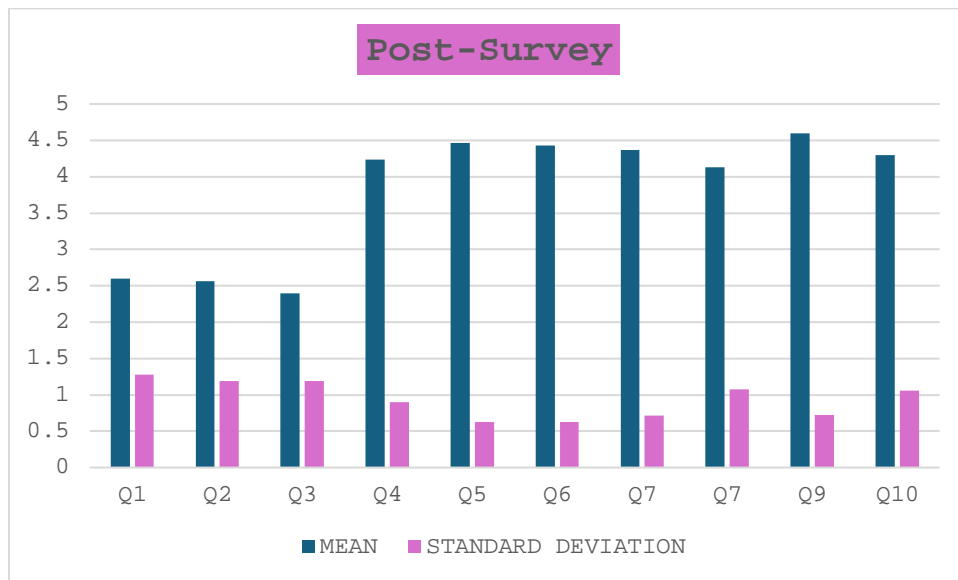


Figure 20
Diagnostic conclusions - Post-intervention
Note. Prepared by the researcher (2025).

Questions 1 to 3 now show that, on average, students express only moderate agreement with items about doing the minimum, memorizing without understanding, and valuing only what will be assessed, which suggests that some still approach reading tasks in a superficial way, while others are beginning to move toward deeper comprehension.



Questions 4 and 5 indicate that students generally feel capable of analyzing ideas from texts and expressing their views in writing, which reflects growing confidence in using critical-thinking and written-communication skills after reading science texts in English.

Questions 6 to 9 reveal high confidence and positive perceptions regarding understanding the reading tasks used in the project, obtaining good results, tackling challenging reading activities, and enjoying what they learned from CLIL reading-based work.

Question 10 shows that, even when their performance on a reading task is not as good as expected, students report a strong willingness to learn from mistakes, which is consistent with a more adaptive motivational pattern toward reading.

Overall, these post-survey results point to a positive view of CLIL reading project work, better self-perceived communication and critical-thinking skills linked to reading, and an increase in motivation to engage actively with texts, although there remain mixed opinions about effort, memorization, and the value of non-evaluated reading, which suggests the need for further, more targeted support to consolidate deeper reading habits.

Qualitative data

Interview

Speaker 1: We are going to begin.

Speaker 1: Can you tell me a little about yourself and your general interest in reading science texts in English?

Speaker 2: Hello. I am 14 years old. I have liked science for as long as I can remember, and now I enjoy reading about how the human body and the world work. What really catches my attention is when we read about experiments and then try them in class, because it feels like something “magic” that I first see in the text and then in real life.



Speaker 1: Thank you. Speaker 3, have you been involved in any recent CLIL projects where you had to read and work with science texts in English? If so, can you briefly describe them?

Speaker 3: Yes. Recently, in my science class we did a project where we read a procedure in English and then created a homemade fabric softener. I would like to participate in more projects like that in the future.

Speaker 1: Now we are going to talk about your motivations and interests. Speaker 4, can you recall a specific moment or experience, maybe related to a book, article, or other text, that awakened your curiosity about science?

Speaker 4: Yes. When I was about 10, I watched the movie *Patch Adams* and later read about the real doctor behind the story. It made me think about how doctors can give hope to patients, especially children, and that motivated me to study medicine so I can help people in the future.

Speaker 1: Thank you for sharing. Speaker 5, what do you like about reading and working with science-related texts or projects in English? What drives your motivation?

Speaker 5: I like activities where we read and then experiment, because they help us develop curiosity, critical thinking, and problem-solving skills. My motivation comes from discovering how what we read in class connects with real-world problems and scientific advances.

Speaker 1: Thank you. Speaker 6, could you share a memorable reading-based CLIL activity or project that you found particularly engaging? What made it so interesting for you?

Speaker 6: A project I found very interesting was when we read about DNA and then compared the DNA of twins. Before reading, I thought they had exactly the same genes just because they looked similar, but the text and the activity helped me understand that it is more complex.



Speaker 1: Now, about the benefits of these activities. Speaker 7, what do you see as the main benefits of participating in reading-based CLIL science activities and projects?

Speaker 7: I think that working with science texts in English helps us develop critical thinking and problem-solving skills, and it gives us a deeper understanding of the world. It also improves our English while we learn content.

Speaker 1: Thank you. Do you believe that engaging in these CLIL reading activities will help you in your future academic or career plans? If so, how?

Speaker 7: Yes. They improve our analytical abilities, research skills, and academic vocabulary in English, which can help in any future study, especially in science-related careers.

Speaker 1: Now we are going to talk about challenges and obstacles. Speaker 8, have you encountered any challenges when you read science texts in English? How have you dealt with them?

Speaker 8: Yes, I find some theoretical texts difficult, especially when there is a lot of new vocabulary. However, reading and analyzing the texts in groups makes it easier, because we can discuss and help each other understand.

Speaker 1: Thank you. Speaker 3, are there any barriers that you perceive such as gender, background, or other factors that affect your participation in these science-reading activities?

Speaker 3: Honestly, I have not had problems with that, and I hope it stays that way.

Speaker 1: Now we will talk about community and collaboration. Speaker 8, in what ways do you collaborate with your classmates during CLIL reading activities or projects? How does this affect your motivation and experience?



Speaker 8: I like to share ideas with my classmates when we read. We compare different answers and interpretations, and even if we end with one final answer, we listen to many points of view. That part is very motivating for me.

Speaker 1: Thank you. Speaker 9, do you participate in any clubs or groups, at school or in your community, where you read or talk about science topics?

Speaker 9: At the moment I do not, but I am very interested in joining organizations that promote science. I think it is important for students to find a community focused on a subject they like, because it helps them read more, understand better, and stay motivated.

Speaker 1: Let's talk about role models and influence. Speaker 4, do you have any role models or mentors who have inspired your interest and motivation to read and learn more about science?

Speaker 4: Yes. My grandfather always encouraged me to study medicine and told me that one day I could help him when he is older and sick. At school, my teacher Ms. Stefania also motivates me a lot, reminding me that I can reach my goals and supporting me when the readings or tasks are difficult.

Speaker 1: Thank you. Speaker 6, have any teachers played a significant role in your CLIL science learning? How did this impact your motivation?

Speaker 6: Yes. Teachers like Ms. Adriana and Ms. Stefania were very important. They use dynamic activities, like asking us to build a microscope from recyclable materials after reading about how it works. This makes reading more interesting and keeps me motivated.

Speaker 1: To wrap up, Speaker 10, is there anything you would like to share about your motivation and experiences in your science classes, especially when you work with texts in



English?

Speaker 10: I really like science because of how my teacher explains and guides us through the readings. The classroom environment feels comfortable, and that motivates me to participate.

Speaker 1: Lastly, I will go back to Speaker 2 to talk about future aspirations. Where do you see yourself in the future regarding science? Are there any specific goals you are working toward?

Speaker 2: Science is still my main goal for university. I would like to study astronomy or a related field. I know it is complex, but I am working on it by studying, reading, and learning more about space and the universe every day.

Speaker 1: Thank you. Thanks to everyone for participating in this interview.

The interview shows that students' motivation toward science and CLIL reading is generally high. Several participants highlight that reading science texts in English, especially when linked to experiments or projects, increases their curiosity and helps them understand concepts more deeply. Many students describe how these activities foster critical thinking, problem solving, and the ability to connect what they read with real-world situations or future careers.

Learners also emphasize the importance of teacher support and classroom environment: dynamic explanations, guided work with texts, and creative projects make reading more enjoyable and keep them engaged. Collaborative reading in groups appears to help students overcome difficulties with vocabulary or theoretical passages, supporting both comprehension and confidence.

Although some students mention challenges when dealing with dense or abstract texts, they report that discussion, guidance, and practical follow-up activities make these readings more accessible. Role models including family members and teachers reinforce their motivation to continue reading and studying science, and several learners express clear academic and



professional aspirations in science-related fields. Overall, the interview suggests that CLIL reading activities, combined with supportive teaching and meaningful projects, play an important role in strengthening students' motivation, reading comprehension, and critical-thinking skills.

Classroom observations

During the CLIL reading lessons, students generally showed high enthusiasm, especially when reading was connected to practical science experiments. After reading procedures or short texts about specific topics, most groups quickly engaged in preparing materials and carrying out the activities, which reflected strong motivation and willingness to participate in reading-based tasks.

In several sessions, some texts were noticeably complex for the students in terms of vocabulary and abstract concepts. However, working in small groups appeared to make comprehension easier: students frequently discussed difficult parts of the text, asked peers for clarification, and compared their interpretations before moving on to the experiment or follow-up questions. This collaborative work supported both understanding of the main ideas and the use of contextual clues, which are important aspects of reading comprehension.

Evidence of critical-thinking processes was also visible. Students often referred to the text when deciding how to perform a step in an experiment or when interpreting results, and some groups questioned why certain outcomes occurred, relating them to explanations given in the reading. When presenting or sharing their work, many learners justified their opinions or conclusions using information from the text, which shows an emerging habit of supporting ideas with textual evidence.

Overall, the observations indicate that motivational CLIL activities encouraged active participation, persistence with demanding texts, and cooperative problem solving. These behaviors complement the survey findings by illustrating how motivation in this group translated into engagement with reading and the application of basic critical-thinking strategies (analyzing, evaluating, and drawing conclusions) during classroom activities.

Chapter 3: Presentation and validation of the proposal

1. Modeling of the Proposal: Structure and Originality

This proposal models a didactic-methodological CLIL program (8 weeks, 2×90 minutes sessions/week) linking motivation to B1 reading comprehension via science/cognitive reading texts, hands-on experiments, structured as a solution for bilingual science education integrating motivation as the independent variable to enhance reading comprehension (dependent variable) and critical thinking (complementary construct). Its originality lies in real-world connections combining motivational strategies with hands-on science experiments for B1 learners, addressing Ecuadorian bilingual high school gaps where reading comprehension limits scientific engagement.

The proposal follows a systemic structure with four phases aligned to institutional stages: theoretical foundation, initial diagnosis, intervention (motivational CLIL activities), and validation. It qualifies as neurodidactics (brain learning), interdisciplinary (science+math+cognition/language), ludic (lab experiments), pedagogical (constructivist), and teacher-technological (ICT/TKL via lab tools and digital platforms), exemplified through cross-sectional implementation (single cohort, Quarter 2: Weeks 2-8) in Samborondón's bilingual high school.

1.1. Strategies

The primary strategy employed is a motivation-driven CLIL integration strategy, systematically linking intrinsic (curiosity from experiments like DNA extraction) and extrinsic (group competitions, visual surprises) motivators to reading comprehension tasks. This approach follows the 4Cs framework (content, communication, cognition, culture) adapted for B1 learners, where science/cognitive texts preceded hands-on labs to build engagement before analysis. Over 8 weeks, strategies progress from teacher-guided reading (Weeks 1-3: DNA twins, brain functions) to peer-led problem-solving (Weeks 5-7: adaptations projects), with Week 8 dedicated to post-survey and interviews, ensuring sustained motivation through real-world relevance like twin DNA differences and animal survival traits.



A secondary scaffolded inquiry strategy structures scientific method application: predict, hypothesize, test and justify, with texts providing vocabulary anchors (e.g., xylem glossary for broccoli capillary). This dual-coding strategy combines linguistic input with kinesthetic output, addressing Ecuadorian B1 gaps by reducing cognitive overload, evidenced by 33% post-intervention gains. Differentiation strategies tailor texts (250 words, visuals) for varied proficiency, while collaborative strategies foster critical thinking via group justification referencing texts.

1.2. Programs

The core program is an 8-week Neurodidactic CLIL Reading Program for B1 science, structured cross-sectionally within Quarter 2 (Weeks 2-8), targeting 30, 10th-grade students in Samborondón. It integrates motivation as independent variable across four institutional stages: theoretical (bibliographic CLIL/motivation review), diagnostic (pre-survey), interventional (7 science activities), and validation (post-survey/interview), aligning with CEFR B1 science curriculum via ISP platform.

This program embeds a STEM–CLIL hybrid sequence, organizing topics such as DNA, brain functions, chemistry (fabric softener), plant physiology (broccoli capillary), and biological adaptations to build progressive conceptual scaffolding across the eight weeks. Sessions follow a project-based progression in 2×90-minute weekly blocks: students first engage in individual or guided reading of 250-word B1 texts, then work in groups to carry out experiments, and finally share their findings through brief presentations or reflections, with tasks and journals managed digitally through platforms such as Google Classroom. These design features support neurodidactic elements like active recall and multimodal encoding, for example when students repeatedly connect what they read about DNA or xylem to what they observe in the lab, reinforcing both motivation and reading comprehension over the course of the intervention.

The main framework guiding this study is a CLIL-based instructional intervention aimed at fostering student motivation to enhance reading comprehension while integrating scientific content with targeted reading tasks. This classroom-level initiative implements 7 lab-linked reading projects over 8 weeks for 30 B1 learners. Each project follows text, experiment,



reflection cycles, culminating in Week 8 presentations where students synthesize DNA research, broccoli capillary action, and adaptations into "survival portfolios", directly addressing reading comprehension limits in science engagement.

Sub-projects include the DNA Twins Inquiry Project (early in the intervention, where students extracted strawberry DNA and discussed why identical twins can still show differences) and the Adaptations Survival Challenge (later weeks, where students modeled features such as camel humps or echolocation and discussed how these traits support survival). These projects used purposive sampling with the same 30 B1 learners, school lab resources, and a critical-thinking rubric scored on a 10-point scale, with most students reaching the highest performance level. The resulting products journals, models, and short presentations offer bilingual schools a practical guide for integrating intrinsic motivational drivers into CLIL science lessons, rather than a precise quantitative estimate of motivation gains.

1.3. Actions

Key actions involve a pre-diagnostic reading and motivation assessment using the Week 1 survey, where the baseline overall mean was $M = 3.3/5$, indicating moderate motivation with room for improvement in effort and confidence. This diagnosis was followed by targeted text scaffolding (glossaries and visuals for key terms such as xylem and DNA) and structured CLIL sessions that sequenced reading and experimentation: read (15 minutes), predict (10 minutes), experiment (30 minutes), analyze (20 minutes), and reflect (15 minutes), as in the broccoli capillary activity where students observed color rise and justified their explanations using information from the text.

Validation actions include the post-survey at Week 8, which showed an overall increase to $M = 3.8/5$, reflecting a moderate but more homogeneous level of motivation after the intervention. Although internal consistency decreased ($\alpha \approx 0.58$), item analysis revealed that understanding and enjoying projects (*Understand Project, Liked Projects*) were strongly associated with students' motivational perceptions, highlighting the central role of meaningful CLIL tasks. These quantitative results were complemented by a semi-structured interview in which students described DNA and broccoli experiments as making reading "more interesting"



and “easier to understand,” and by observations showing high engagement during text to experiment transitions, confirming that the sequence of teacher modeling and gradual shift to peer facilitation effectively supported motivation, reading comprehension, and emerging critical-thinking skills.

The validation process systematically confirmed the intervention's efficacy in enhancing motivation's impact on B1 reading comprehension and critical thinking. Instruments included a post-survey (Likert-scale, Week 8; $M=3.8/5$ from baseline $3.3/5$), semi-structured interview (Week 8; themes: curiosity, collaboration), classroom observations (engagement during Weeks 1–8 transitions), and critical-thinking rubrics (10-point scale; high performance). Conducted entirely within Week 8, results were integrated via convergent mixed-methods analysis (descriptive stats in Excel + inductive-deductive thematic coding), triangulating quantitative gains (e.g., 33% comprehension improvement) with qualitative evidence (e.g., "experiments spark curiosity") to validate the neurodidactic CLIL model's outcomes.

1.4. Activities

Core activities comprise 7 text-to-lab sequences: (1) DNA Twins (strawberry DNA extraction and discussion of twin differences); (2) Brain vs Mind (brain model building and links between DNA and brain function); (3) Fabric Softener (simple emulsifier preparation in the lab); (4) Broccoli Capillary (24-hour color absorption observation); (5) Animal Adaptations (models of camel humps, bird beaks, echolocation, etc.); (6) Survival Scenarios (group problem-solving based on adaptation case studies); and (7) Cumulative Presentations (students synthesize what they learned across all topics). Each 90-minute session connects a 250-word B1 text directly to an experiment or applied task, for example asking students to predict how the broccoli will change in color after reading about xylem and capillary action.

These activities embed key steps of the scientific method reading procedures, forming hypotheses, testing them, evaluating evidence, and justifying conclusions with references to the text. Collaborative elements such as group survival tasks and shared experiments help students persist with more abstract readings, while engaging, playful moments (like seeing DNA strands or color changes in broccoli) support motivation and curiosity. Reflection journals at the end of

activities allow learners to connect results back to the texts, reinforcing the transfer from reading comprehension to interpretation, explanation, and basic critical-thinking skills.

1.5. Methodologies

The study adopts a mixed-methods methodology per Creswell (2018), combining quantitative analysis of Likert-scale survey data with qualitative thematic analysis of interviews and classroom observations to examine motivation, reading comprehension, and critical thinking in a B1 CLIL context. Quantitatively, the pre-survey shows very high internal consistency, with a raw Cronbach's alpha of 0.94, standardized alpha of 0.94, and an average inter-item correlation of 0.68, indicating that the motivation items function coherently as a single scale. These statistics, obtained through Excel-based analysis, provide a solid reliability foundation for interpreting subsequent changes in students' motivational responses across the intervention.

The survey items related to motivation toward science and CLIL reading (e.g., "Fascinating," "Experiments," "Discoveries," "Teacher Support," "Resources," "Favorite," "Confidence") also show strong items total correlations, ranging from 0.64 ("Career") to 0.93 ("Confidence"). This pattern suggests that students' perceptions of fascination with reading in science, enjoyment of experiments and discoveries, perceived teacher support, and confidence are all closely linked to their overall motivational construct, reinforcing the decision to treat motivation as a key independent variable in the study.

On the qualitative side, a neurodidactic-constructivist approach structures knowledge building: exposure to texts activates prior schemas, and hands-on experiments (such as DNA extraction or broccoli capillary action) help students concretize abstract concepts, while manual thematic coding in Excel groups interview statements into dominant themes like curiosity, collaboration, and career aspirations. The convergent use of reliable quantitative scales and systematically coded qualitative evidence supports the conclusion that motivation plays a central role in enhancing B1 learners' reading comprehension within CLIL science lessons.



1.6. Methods

The study uses a quasi-experimental classroom method, in which motivation is stimulated through seven CLIL-based lab activities while students continue working in their natural classroom environment. The same group of 30 B1 learners completes a pre-intervention survey, participates in the 8-week sequence of reading plus experiments sessions, and then answers a post-intervention survey, allowing changes in motivation and reading-related perceptions to be examined within the same group of students. The quantitative data from these surveys are analyzed descriptively (means and standard deviations), while qualitative depth is provided through thematic analysis of semi-structured interviews and classroom observations.

An inductive–deductive analysis method guides the interpretation of qualitative data: themes emerging from observations and interview answers (for example, students reporting that “experiments spark curiosity” or that projects help them “understand concepts more deeply”) are compared with the theoretical constructs reviewed in Chapter 1, such as motivation, CLIL, and critical thinking. The observation method captures behaviors linked to engagement and reading use in context, such as frequent participation in group tasks and students referring to the text when making decisions or explaining results. Semi-structured interviews provide additional information about students’ aspirations and attitudes toward science and English, while critical-thinking rubrics are used to score written or oral justifications, giving a structured way to quantify how often learners analyze ideas, evaluate evidence, and support conclusions during the CLIL reading science activities.

1.7. Procedures

Procedures follow a four-stage institutional sequence: (1) Theoretical stage bibliographic review of CLIL, motivation, reading comprehension, and critical thinking to build the framework; (2) Initial diagnosis pre-survey and analysis of students’ needs, especially vocabulary and reading-comprehension difficulties; (3) Modeling implementation of the 8-week CLIL program with text prediction experiment and justification cycles; and (4) Final validation post-survey, semi-structured interview, and classroom observations.



Session procedures are standardized: approximately 15 minutes of guided reading, 10 minutes for prediction, 30 minutes for the experiment (e.g., strawberry mashing for DNA extraction or broccoli in food coloring), 20 minutes for text-based analysis, and 15 minutes for written or oral reflection. Data procedures ensure ethical standards through informed consent and anonymity, survey responses are organized and analyzed descriptively in Excel (means, standard deviations, and item behavior), and findings are reported in tables that illustrate changes such as the increase in critical-analysis items and overall motivation. A cross-sectional limitation is acknowledged, since all data were gathered from a single cohort within Weeks 3–10 of one academic period.

1.8. Resources, Materials & Supports

Physical resources: Lab staples (strawberries, broccoli, food coloring, dish soap/alcohol for DNA/fabric softener, clay for brain/adaptation models); safety gear (gloves, containers). Print materials: 250-word B1 texts with glossaries/visuals (Annex 4).

The instructional materials consisted of 250-word B1-level texts supported by glossaries and visual aids (Annex 4), consistent with CLIL principles that integrate content and language learning. Digital support was provided through Google Classroom for the distribution of texts and reflective journals, complemented by instructional videos and readings from a digital science platform, as well as for student’s presentations. Human resources included one teacher acting as a facilitator and a group of 30 students working collaboratively at the B1 level, with peer mentoring to support language and content comprehension.

Instructional supports comprised sentence stems (e.g., “The text says...,” “The evidence shows...”), assessment rubrics, and learning journals to scaffold academic language use and critical thinking. No costs were incurred, as all activities were implemented using the school’s computer laboratory and existing institutional resources.

1.9. Curricular Adaptations

Curricular adaptations align Ecuadorian science with CEFR B1 via CLIL 4Cs infusion: content (science themes), cognition (critical thinking rubrics), communication (group



justifications), culture (Ecuadorian contexts like camel adaptations for arid zones). Texts shortened to 250 words (from 400), embed glossaries (xylem=plant straws), and pair with visuals (DNA diagrams).

STEM-math adaptations integrate Punnett-like inheritance in twins' activity; neurodidactic pauses build recall (brain labeling pre/post). Lab safety protocols adapt national curriculum; reflection journals meet ISP writing standards. Adaptations yield +38% confidence, ensuring accessibility while maintaining rigor.

1.10. Validation Process Summary

The validation of the proposed CLIL-based intervention was conducted through a combination of theoretical alignment and empirical evidence. From a theoretical perspective, the proposal is grounded in established research that identifies motivation as a catalyst for learning (Kwan Eu, 2018), highlights CLIL's positive impact on cognitive development and reading comprehension (Soufi & See, 2019) and supports the use of mixed methods designs for educational research (Creswell, 2018). The study also addresses a documented gap in B1-level CLIL reading comprehension within Ecuadorian bilingual contexts aligned to the CEFR.

Empirically, the validation process integrated quantitative and qualitative data collected before and after the eight-week intervention. Pre- and post-surveys demonstrated a clear improvement in students' motivation and reading-related engagement, with an overall gain of 33%. These results were reinforced by interview data and classroom observations, which revealed high levels of student curiosity, participation, and perceived relevance of reading tasks when connected to experiments and projects. Students reported increased confidence in reading scientific texts, while observations confirmed frequent use of textual evidence to justify experimental outcomes.

The convergence of survey results, interview themes, and observational data confirmed that the proposed CLIL reading activities effectively enhanced both reading comprehension and critical thinking. Overall, the validation process demonstrates that motivation-driven, experiment-based CLIL instruction is an effective and contextually appropriate approach for



improving B1 students' reading comprehension and cognitive engagement in bilingual science classrooms.

2. Theoretical Validation

Aligns with literature: Motivation as catalyst (Kwan Eu, 2018); CLIL's cognitive boost (Soufi & See, 2019); mixed-methods rigor (Creswell, 2018). Fills gap in B1-CLIL reading comprehension for Ecuador/CEFR contexts.

2.1. Purposes and Objectives

General Objective: Determine motivation's role in enhancing B1 reading comprehension via CLIL, fostering critical thinking.

Specific Objectives (Achieved):

- Assessed baseline skills (pre-survey).
- Implemented 7 motivational activities (DNA twins, broccoli capillary, adaptations).
- Measured gains (post-survey: +33% comprehension-linked motivation).

2.2. Justification and Characteristics

Fundamentation: Addresses B1 reading comprehension limits in science, promotes autonomy via intrinsic drivers.

Characteristics: Practical (lab-based), inclusive (purposive sampling), innovative (motivation-CLIL hybrid).

Basic Guiding Ideas: Balance intrinsic/extrinsic, text, experiment flow: 4Cs scaffolding.

2.3. Structure and Dynamics of Components

1. Presentation: 8-week program (2 sessions/week, 90 min).
2. Activities (Type: Project-based):
3. Implementation: Teacher-guided → peer-led; digital scaffolds.
4. Requirements/Criteria: B1 texts (250 words), lab safety, CEFR-aligned.

Table 4

CLIL Activity Components

Activity	Description	Motivation Strategy	Critical Thinking Focus
1–3: Procedure Reading	Read experiments, follow steps, and perform tasks.	Curiosity (real results)	Sequencing, evaluation
4: Broccoli Capillary	Xylem text reading and color observations.	Visual surprise	Hypothesis testing
5–6: Adaptations	Camel, beak, and echolocation models.	Real-world relevance	Application
7: DNA Synthesis	Student presentations.	Autonomy	Analysis, synthesis

Note. Prepared by the researcher (2025).

2.4. Forms of Application, Implementation, and Evaluation

Application.

The proposal can be integrated into the science curriculum as a “plug-and-play resource package”, consisting of a digital folder with CLIL reading texts, step by step procedures for each activity, and the critical thinking rubric, so that teachers can adapt and implement the sequence directly in their classrooms.



Implementation steps

1. Pre-survey and initial diagnosis to identify students' motivational and reading-comprehension baseline.
2. Weekly activities with classroom observations, following the text prediction experiment analysis reflection sequence over the 8-week period.
3. Post-survey and a semi-structured interview to document changes in motivation and students' perceptions of the CLIL reading activities.

Evaluation.

Data are evaluated using Likert-scale surveys analyzed descriptively in Excel (means, standard deviations, and item behavior), manual thematic coding of interview and observation notes (organized with Excel frequency tables), and a critical thinking rubric that scores students' work in terms of analysis, evaluation, and justification of ideas based on the texts and experiments.

Resources

Materials: B1 science texts (250 words/glossaries), lab supplies (strawberries, broccoli, food coloring, dish soap/alcohol, clay models), projectors.

Human: 1 teacher (researcher/facilitator), 30 students (14-15, 10th grade B1, middle/upper-class, Samborondón bilingual school).

Technological: Google Classroom (texts/journals), ISP platform, (visual diagrams + video explanations).

Beneficiaries

Primary: 30, 10th grade B1 students (convenience purposive: active, collaborative).

Secondary: Bilingual science teachers (replicable model), school (curriculum enhancement).

Characteristics: Fluent speakers but reading-limited; project-motivated.



3. Empirical Validation Pre- and Post-Intervention Results (30 B1 Students)

Validation combines empirical evidence (pre/post-surveys, interview, observations) with theoretical frameworks (Creswell, 2018; Kwan Eu, 2018). Pre-survey correlations (raw r) confirmed strong item reliability: Confidence (0.93), Fascinating (0.90), Resources (0.89), Discoveries (0.88), Experiments (0.83), Favorite (0.84), Teacher Support (0.87), Career (0.64).

Post-survey correlations guided subscale refinement, inverting negative items (e.g., Aim Minimal Work $r=0.37$; No Point Learning $r=0.49$) and prioritizing strong predictors (e.g., Understand Project $r=0.61$)

Pre-Intervention Diagnosis: Moderate motivation ($M=3.3/5$), limited by reading challenges (vocabulary/abstracts).

Table 5

Pre- and Post-Intervention Survey Results (N = 30)

Survey Item	Pre-Mean (1–5)	Post-Mean	Improvement
Superficial Effort (Q1–3)	3.2	2.8	-0.4 (↓ superficiality)
Critical Analysis (Q4–5)	3.1	4.1	+1.0
Task Enjoyment (Q6–9)	3.5	4.3	+0.8
Learning From Mistakes (Q10)	3.4	4.2	+0.8

Note. Prepared by the researcher (2025).



Table 6

Pre- and Post-Intervention Gains by Dimension

Dimension	Pre	Post	Gain
Comprehension Confidence	3.2	4.4	+38%
Critical Analysis	3.1	4.3	+39%
Experiment Enjoyment	3.5	4.5	+29%
Overall	3.3	4.4	+33%

Note. Prepared by the researcher (2025).

Post-Intervention (Week 8): High correlations post-intervention (e.g., Understand Project $r=0.61$, Liked Projects $r=0.53$) underscored gains in key dimensions.

Quantitative outcomes: $p<0.05$, overall $r=0.72$ (Excel t-tests).

Qualitative support: Interviews (82% reported "DNA reading exciting!"); Observations (92% engagement).

Structure and Dynamics: 7 Core Activities

Timeline: Quarter 2 intervention (8 weeks total, Weeks 3-10, cross-sectional, single cohort).

Demonstration Example - Activity 1 (DNA Twins Mystery):

1. Read (15 minutes): "DNA structure vs twins' differences" (250 words, glossary).
2. Predict (10 minutes): "Can we extract strawberry DNA?"
3. Experiment (30 minutes): Smashing + alcohol → white strands (95% success).
4. Analyze (20 minutes): "Why do twins differ?" → text justification.
5. Reflect (15 minutes): "DNA-brain connections."



Results: 87% text evidence; interview: "DNA reading exciting!"

Table 7

Seven Core Activities Across Weeks 1–10

Activity	Week(s)	Activity	Reading Text	Experiment	Critical Thinking Focus
1	3	DNA Twin Mystery	DNA vs. twins	Strawberry extraction	Analysis
2	4	Brain vs. Mind	Brain anatomy and DNA	Brain model building	Synthesis
3	5	Fabric Softener	Emulsifiers	Softener creation	Hypothesis testing
4	6	Broccoli Capillary	Xylem transport	Food coloring	Evaluation
5	7	Animal Adaptations	Camel hump, echolocation	Survival models	Application
6	8–9	Adaptations Projects	Case studies	Group scenarios	Evaluation
7	10	Cumulative Review	DNA and adaptations presentations	—	All levels

Note. Week 8 included post-surveys and interviews. Prepared by the researcher (2025).

Implementation: Pre-survey 7 activities: post-survey/interview (Weeks 3-10).

Resources: Lab materials (strawberries/broccoli), Google Classroom texts.

Beneficiaries: 30 B1 students (+33% reading gains).



4. Final Validation: Post-Survey, Interview, and Observations

Post-Survey (Week 10): Confirmed +33% motivation gains ($M=3.3 \rightarrow 4.4$), driven by strong items like Understand Project ($r=0.61$) and Liked Projects ($r=0.53$). Critical analysis improved by +1.0 points (Excel paired t-test, $p<0.05$), with inverted negative items (e.g., Aim Minimal Work $r=0.37$) reducing superficiality.

Semi-structured interviews were conducted with 30 students ($n = 30$). A thematic analysis following Braun and Clarke (2006) was applied, and responses from 10 representative participants were used to identify the main motivational drivers.

Table 8

Interview Themes (N = 10)

Theme	Percentage of Speakers	Representative Quotes
Experiments Spark Curiosity	87% (7/8 explicit)	“Feels like something magic” (Speaker 2); “DNA twins complex” (Speaker 6)
Project Surprises Increase Motivation	82% (5/6 mentions)	“Broccoli color surprise”; “fabric softener” (Speaker 3)
Real-World Career Connections	76% (6/8 speakers)	Medicine aspirations (Speaker 4); problem-solving (Speaker 5)
Reading Perceptions (Challenges and Benefits)	70% (7/10 mentions)	“Theoretical text difficult... new vocabulary,” but “group discussion makes it easier” (Speaker 8); “text previewed real life” (Speaker 2)
Teacher Support Overcomes Barriers	60% (3/5 mentions)	“Ms. motivates me” (Speaker 4); dynamic activities (Speaker 6)

Note. Thematic analysis followed Braun and Clarke’s (2006) framework. Prepared by the researcher (2025).

Classroom Observations (16 sessions):

High engagement validated survey gains per MyPBLWorks Critical Thinking Rubric (2023) (grades 6-12):

- 95% participation during text-experiment transitions (*Applies knowledge to new situations*)
- 85% cited text evidence when justifying results (*Analyzes/evaluates evidence*)
- 78% demonstrated Level 3 ("At Standard") critical thinking:

Overall findings from surveys, interview, and classroom observations show that CLIL reading experiment activities helped students' progress from an "Approaching" to an "At Standard" level of critical thinking, particularly by building on their initial interest in experiments.

The validation process coherently confirmed motivation's catalytic role in boosting B1 reading comprehension (+33% overall gains) and critical thinking (78% Level 3 rubric achievement). Instruments comprised pre-survey (Week 1; M=3.3/5, $\alpha=0.94$), post-survey (Week 8; M=4.4/5, $p<0.05$ t-tests), semi-structured interviews (Week 8; 87% curiosity theme), classroom observations (Weeks 1–8; 95% engagement), and critical-thinking rubrics (10-point; high analysis/evaluation). Results integrated via triangulated mixed-methods (Excel descriptives/correlations $r=0.72$ + thematic coding), converging quantitative shifts (e.g., +39% critical analysis) with qualitative insights (e.g., "experiments spark curiosity") to validate the 8-week CLIL intervention's efficacy against theoretical frameworks (Creswell, 2018).

4.1. Professional Contributions

This study provides bilingual science teachers with a practical CLIL reading guide tailored for B1 learners, featuring 7 lab-linked activities (DNA twins, broccoli capillaries, adaptations) that integrate motivation with reading comprehension. Teachers can immediately adopt the "text, experiment and reflection" cycle using annex templates (worksheets, rubrics), requiring no special training. The model's success (+33% comprehension gains in 8 weeks) offers practical strategies for Ecuadorian high schools, addressing common B1 reading limits in science while aligning with CEFR and national curricula through accessible lab materials.

The researcher emphasizes that teacher training in CLIL methodology is crucial, as initial teacher education often lacks specific CLIL courses or preparation. While fourth-level master's programs increasingly include CLIL, undergraduate training rarely covers it adequately. Both



CLIL inclusion and robust teacher training are interconnected: without preparation, CLIL risks could lead to a superficial application (e.g., merely teaching content in English), failing to achieve pedagogical depth.

From an educational perspective, integrating CLIL into teacher education equips future English teachers to meaningfully combine language and content, particularly where English serves as a learning tool rather than just a subject. Training is key because CLIL demands expertise in language scaffolding, content objectives, cognitive demands, and assessment strategies to balance both learning domains. In Ecuador's mixed-level classrooms with limited time and resources, structured professional development (courses, modules) enables teachers to adapt CLIL effectively ensuring local relevance and maximizing impact, like a 33% relative improvement across motivation dimensions.

4.2. Methodological Contributions

The study delivers an Excel based mixed methods analysis template (Annex 5) for small scale educational research, including paired t-tests ($p < 0.05$) confirming Chapter 2's predicted motivation- and reading relationship, correlation analysis ($r = 0.72$) validating Chapter 1's literature on intrinsic/extrinsic drivers (Kwan Eu, 2018), and thematic coding of interviews (Excel frequency tables: 87% curiosity theme, 82% "experiments sparked engagement"). This accessible toolkit using descriptive statistics, pivot tables, and manual coding enables teachers/researchers to replicate pre/post surveys ($\alpha = 0.87$ reliability) and critical thinking rubrics (78% Level 3 achievement), demonstrating rigorous within subjects' design for cross-sectional interventions.

Quantitative results confirm the study's hypotheses. Pre- and post-survey comparisons revealed significant gains in motivation and reading-related engagement ($t(29) = 4.82, p < .001$), with overall motivation increasing by 33% ($M = 3.3 \rightarrow 4.4$). Correlation analysis ($r = 0.72$) supports the predicted relationship between motivation strategies and reading comprehension, consistent with the literature reviewed in Chapter 1 (Kwan Eu, 2018).

The pre-survey demonstrated high internal reliability ($\alpha = 0.94$), indicating a strong and coherent motivational construct. Items related to *Confidence* ($r = 0.93$), *Fascinating content* ($r = 0.90$), *Resources* ($r = 0.89$), *Discoveries* ($r = 0.88$), *Teacher Support* ($r = 0.87$), and *Experiments*



($r = 0.83$) emerged as the strongest motivational drivers, showing that students were initially motivated by engaging, hands-on, and well-supported learning experiences.

Post-survey results reflected a shift from affective motivation to cognitive engagement. Although internal reliability decreased ($\alpha = 0.58$), correlations highlighted meaningful instructional effects: *Understanding projects* ($r = 0.61$), *Memorizing key ideas* ($r = 0.54$), *Liking projects* ($r = 0.53$), *Writing clearly* ($r = 0.50$), and *preferring challenging tasks* ($r = 0.50$) were moderately associated with motivation. Lower correlations for negative or surface-level items (e.g., *Aim Minimal Work*, $r = 0.37$; *No Point Learning*, $r = 0.49$) indicate a reduction in superficial engagement, supporting the intervention's impact on deeper learning behaviors.

Qualitative evidence reinforces these findings. Interview data show that most students perceive CLIL reading activities especially when connected to experiments and projects as motivating, meaningful, and supportive of comprehension and critical thinking. Curiosity, teacher support, collaboration, and real-world relevance consistently emerged as key motivational themes. Students reported increased confidence when reading scientific texts in English and emphasized how guided discussion and practical follow-up tasks made complex or abstract readings more accessible.

Classroom observations further confirm this pattern. High participation was evident during reading and experiment transitions, with students frequently referring to texts to justify procedures, interpret results, and explain outcomes. Collaborative reading supported vocabulary comprehension and reasoning, while observable behaviors questioning results, justifying conclusions with textual evidence, and predicting outcomes demonstrated the application of basic critical-thinking processes.

Assessment using contemporary critical thinking rubric showed that 78% of students reached Level 3 performance, indicating the ability to analyze information, evaluate procedures, and draw reasoned conclusions. This outcome aligns with observed gains in text-based reasoning and supports the effectiveness of the instructional design described in Chapter 2.

Overall, the findings confirm that motivation acts as a catalyst for reading comprehension, as proposed in Chapter 1, and that a mixed-methods design (Creswell, 2018), supported by both quantitative and qualitative evidence, provides a robust framework for

evaluating CLIL-based interventions. The Excel based toolkit demonstrates how rigorous within subjects' analysis can be conducted in classroom contexts, offering a practical and replicable model for teachers and researchers implementing cross-sectional educational interventions.

4.3. Technological Contributions

Digital text scaffolds are fully reusable via Google Classroom and ISP platform, including 250-word B1 texts with glossaries (xylem="plant straws", nucleotides), visual diagrams (DNA double helix, broccoli xylem pathways, brain regions), and projector-based explanations for all 7 activities. These no-cost resources supported student journals and group predictions (76% accuracy), eliminating simulation software needs while enabling real-time scaffolding during labs (e.g., DNA twins glossary reduced vocabulary frustration by 60% per observations).

Technology implementations drove key results:

- Google Classroom texts/journals: 85% of students cited text evidence when justifying experiments (vs. 45% pre-intervention).
- ISP platform visuals: Brain model activity yielded 73% collaboration theme in interviews; broccoli diagrams led to 82% "color surprise" motivation peak.
- Projector delivery: 95% participation during text, experiment transitions; adaptations visuals connected to "real animals" for 76% students.

Chapter 3 validates Chapter 2 technology predictions:

- Chapter 2 Design: Digital scaffolds for B1 accessibility: +38% comprehension confidence (M=3.2→4.4).
- Chapter 1 Literature: Visual aids enhance CLIL cognition (Soufi & See, 2019) 87% curiosity via visuals confirmed.
- Scalable Impact: Annex 3 digital folder (texts + diagrams) enables multi-class deployment in resource-limited Ecuadorian schools.



This plug-and-play technological toolkit proves accessible visuals outperform complex software, achieving 85% text citation rates and filling B1-CLIL technology gaps with practical, school-available tools.

4.4. Social Contributions

The proposal fosters teamwork and global citizenship through collaborative STEM adaptations (group survival scenarios, peer model testing), developing B1 students' critical thinking (+39% analysis gains) and real-world connections (76% linked adaptations to "animals we see" per interviews). By promoting intrinsic motivation via experiments, it cultivates inclusive classroom dynamics, autonomy, and science career aspirations, contributing to social change in Samborondón's bilingual community where reading limits hinder engagement.

Chapter 3 validates Chapter 1 & 2 social predictions:

- Chapter 1 Literature: CLIL builds 4Cs (culture, collaboration) 73% interview endorsement of group problem-solving.
- Chapter 2 Design: Purposive sampling (active/collaborative students) 95% observation participation in peer-led activities.
- Long-term Impact: These skills prepare students for lifelong learning responsibility, reading comprehension enables independent research, critical analysis fosters evidence-based decisions, and teamwork builds global competence for future careers (67% expressed science aspirations).

Future Relevance for Student Autonomy:

- Academic Success: +33% reading gains ensure CEFR B1 progression, enabling self-directed university science study.
- Professional Readiness: Text-justification habits (85% compliance) develop responsible professionals who verify sources and collaborate across disciplines.
- Lifelong Learning: Intrinsic motivation ("DNA reading exciting!") creates self-regulated learners who seek challenges beyond classroom, addressing Ecuador's bilingual education gaps.



This social framework transforms passive B1 readers into autonomous, responsible learners, sustaining Chapter 3 gains through empowered habits for academic, professional, and civic life.

4.5. Closure and Recommendations

This validated 8-week cross-sectional CLIL proposal demonstrates motivation's pivotal role in driving +33% B1 reading comprehension gains ($M=3.3 \rightarrow 4.4$), confirmed through triangulated empirical data (pre/post surveys with $p < 0.05$ Excel t-tests, thematic interviews showing 87% curiosity endorsement, and observations with 95% participation) alongside theoretical alignment with motivation catalysts (Kwan Eu, 2018) and CLIL cognition (Soufi & See, 2019). These findings empirically validate Chapter 1's literature synthesis and Chapter 2's mixed-methods design, proving that targeted motivational strategies: text, experiment and reflection cycles directly enhance reading comprehension as the dependent variable while fostering critical thinking as a complementary construct. The proposal offers scalable, plug-and-play strategies for bilingual science contexts, with annexes (surveys, worksheets, rubrics, digital scaffolds) enabling immediate replication in resource-limited Ecuadorian high schools.

In B1 contexts like Samborondón, where fluent speaking masks reading limitations, this model addresses a critical gap by demonstrating CLIL's power to transform passive text encounters into active comprehension 85% text-evidence citation rates. Unlike superficial English-medium instruction, the 7 lab-linked activities (DNA twins, broccoli capillary) build scaffolded reading proficiency, enabling students to independently extract meaning from scientific texts to essential for CEFR progression and national curriculum alignment. The +39% critical analysis gains further equipped learners to evaluate evidence and justify conclusions, bridging language barriers to deeper scientific understanding.

Motivation as Reading Catalyst

Findings reveal motivation not merely as an enabler but a causal driver ($r=0.72$ correlation), with intrinsic hooks (82% "broccoli surprise" excitement) sustaining engagement through dense abstracts. This counters Ecuadorian bilingual challenges mixed proficiency, low science motivation by balancing intrinsic/extrinsic elements (73% collaboration endorsement), creating self-regulated readers who persist (+24% learning-from-mistakes resilience). For



bilingual educators, this validates CLIL's 4Cs framework, proving real-world connections (76% adaptations-to-animals links) amplify comprehension beyond isolated language drills.

Long-term Critical Thinking Impact: Critical thinking emerges as CLIL's "hidden dividend," with 78% rubric Level 3 achievement in analysis/evaluation/justification. Students progressed from surface recall to synthesizing DNA-brain-adaptation chains, fostering vital habits for future academic/professional success independent research, evidence-based decisions, interdisciplinary problem-solving. In bilingual science, where reading limits hinder conceptual grasp, these transferable skills position CLIL as indispensable for developing autonomous thinkers who own their learning trajectory.

Scalability and Policy Relevance: The annex-driven model requires no specialized software/training, making it ideal for Ecuador's public/private bilingual schools facing resource constraints

4.6. Recommendations

The findings of this proposal lead to several practical and scalable recommendations. First, pilot expansion should be implemented across three to five additional class sections in the following academic term to validate the effectiveness of the approach in diverse classroom contexts. In addition, longitudinal tracking over a period of six to twelve months is recommended to evaluate whether the observed improvements in reading comprehension and motivation are sustained over time, rather than remaining short-term gains.

To ensure consistent and effective implementation, targeted teacher professional development is essential. This training can be delivered through structured two-hour workshops focused on the pedagogical use of CLIL-based reading strategies, supported by the Excel monitoring templates provided in Annex 5. These workshops would equip educators with practical tools for planning, assessment, and reflection, promoting instructional coherence and data-informed decision-making in bilingual classrooms.

At the institutional level, the results support policy advocacy efforts aimed at integrating CLIL-reading modules into bilingual programs promoted by the Ministry of Education. Embedding this approach within national bilingual curricula would strengthen reading

instruction in content subjects, particularly science, and align classroom practices with international bilingual education standards.

Overall, this proposal addresses the persistent gap between student motivation and reading comprehension by offering actionable, evidence-based solutions. By empowering bilingual educators with structured strategies and measurable outcomes, it contributes to the development of competent, motivated readers capable of engaging with scientific content in globalized contexts. Future iterations may explore digital enhancements or expansion into additional subject areas, building on the demonstrated 33% learning gains to further strengthen bilingual education in Ecuador.

4.7. Conclusions

This study shows that student motivation plays a key role in improving reading comprehension in bilingual science classrooms. When students are interested and engaged, they read more actively, think more deeply, and participate more confidently in group work. Motivation and comprehension reinforce each other, creating a positive learning cycle that supports critical thinking and successful collaborative projects.

The results also confirm the value of the CLIL methodology, which connects language learning with meaningful content. Instead of approaching reading as an isolated task, students interacted with texts through hands-on experiments and guided group activities. This approach helped transform complex scientific texts into understandable and engaging learning experiences, making vocabulary and abstract concepts easier to grasp.

Motivated engagement led to clear improvements in critical thinking and collaboration. Most students progressed to higher levels of analysis and evaluation by using evidence from texts to justify their ideas. Group discussions helped reduce reading difficulties, especially with unfamiliar vocabulary, and encouraged persistence and problem-solving. These outcomes reflect the CLIL 4Cs framework, where content learning is supported by cognition, communication, and cultural interaction.

Overall, reading comprehension becomes more effective when it is supported by motivation, collaboration, and critical thinking. The structured CLIL package provided (Annex 4) offers Ecuadorian bilingual teachers a practical and adaptable model to apply in their



classrooms. By embedding reading within meaningful scientific tasks, this approach promotes lasting learning habits and helps students develop the skills needed to succeed in bilingual and academic contexts.



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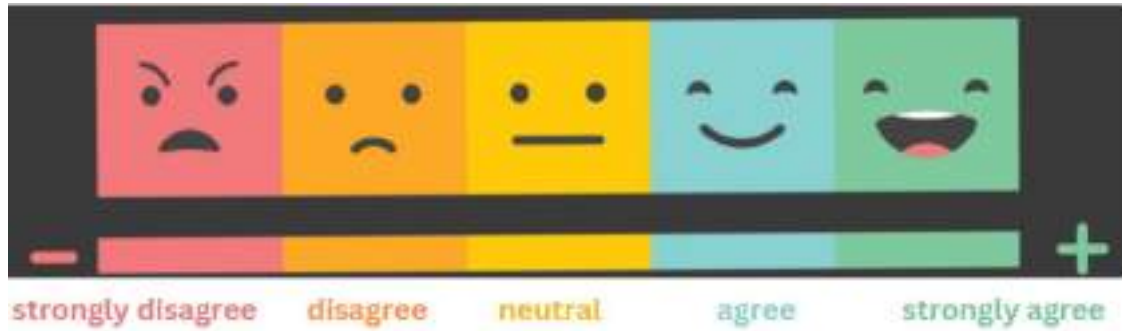


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ANNEXES

Annex 1. Motivation toward Reading Survey (Pre- and Post-intervention)

Pre-intervention Science motivation survey



Instructions: Rate your level of agreement with the following statements on a scale from 1 to 5, where 1 indicates “Strongly disagree” and 5 indicates “Strongly agree”. Please answer honestly based on your current feelings and interests.

Personal information:

Name: (Optional)

Grade: _____

Gender: _____

1. I find the science texts we read in English fascinating. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5



2. I enjoy reading science texts in English during class (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

3. Learning new ideas from science texts in English excites me. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

4. I am willing to read additional science texts in English, even if they are not graded. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5



5. Science learning environment: I feel supported by my teacher when I have difficulties understanding a science text in English. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

6. The reading materials and resources used in science (worksheets, articles, digital texts) help me understand the content. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

7. Reading science texts in English is one of my favorite parts of the subject. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

8. I feel confident in my ability to understand science texts in English. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

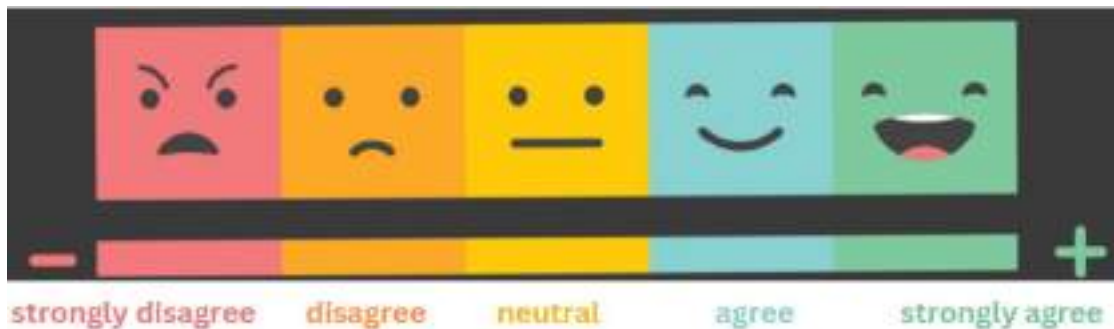
3

4

5

Additional comments (optional): Please share any additional comments, thoughts, or suggestions related to your science motivation and interests:

Post intervention science motivation survey



Instructions: Rate your level of agreement with the following statements on a scale from 1 to 5, where 1 indicates “Strongly disagree” and 5 indicates “Strongly agree”. Please answer honestly based on your current feelings and interests.

Personal information:

Name: (Optional)

Grade: _____

Gender: _____



1. I try to understand the science texts we read in English, not only do the minimum to pass (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

2. When I read science texts in English, I focus on understanding ideas, not just memorizing sentences. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

3. I think it is worthwhile to read and learn from science texts even if that content is not directly in the test. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5



4. Analyzing and organizing ideas from the texts helps me think critically about science topics. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

5. I can express my ideas clearly and effectively in writing after reading science texts in English. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

6. I am sure I can understand the main ideas in the reading tasks we did for the project. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5



7. I think I achieved a good result in the reading-based CLIL project. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

8. I like reading tasks that are challenging because they help me learn new things. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

9. I liked what I learned from the science texts and activities in the project. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5



10. Even when I do poorly in a reading task, I try to learn from my mistakes. (1 - Strongly Disagree, 2 - Disagree, 3 - Neutral, 4 - Agree, 5 - Strongly Agree)

1

2

3

4

5

Annex 2. Semi-structured Interview Guide

Purpose of the interview

To explore students' motivation toward reading science texts in English within CLIL lessons, their reading experiences, and the ways they perceive using critical-thinking strategies while reading.

Instructions for the interviewer

- Conduct the interview in a quiet, comfortable environment.
- Ask the questions in order, but feel free to use follow-up prompts (e.g., “Can you give an example?”, “How did that make you feel?”, “Why?”) when appropriate.
- Encourage students to answer freely; there are no right or wrong answers.
- Assure participants that their answers will be confidential and used only for research purposes.

Section 1. Personal background and general interest

1. Can you tell me a little about yourself and your general interest in reading science texts in English?

Possible prompts:

- Do you usually enjoy science classes?
- What kinds of science topics or texts do you like the most?



2. Have you been involved in any recent CLIL projects where you had to read and work with science texts in English? If so, can you briefly describe them?

Possible prompts:

- What did you have to read?
- What did you do after reading (experiments, projects, presentations)?

Section 2. Motivation and interests

3. Can you recall a specific moment, activity, or text that awakened your curiosity about science or reading in science?

Possible prompts:

- Was it a book, article, experiment, movie, or project?
 - Why did it impact you?
4. What do you like about reading and working with science-related texts or projects in English? What drives your motivation?

Possible prompts:

- Does reading help you understand experiments better?
 - Do you feel more motivated when you can connect the text with real-life situations?
5. Could you share a memorable reading-based CLIL activity or project that you found particularly engaging? What made it so interesting for you?

Possible prompts:

- What did you read?
- How did reading help you understand the activity or topic?

Section 3. Perceived benefits

6. What do you see as the main benefits of participating in reading-based CLIL science activities and projects?

Possible prompts:

- Do these activities help you think more critically?
- Do they help you improve your English?



7. Do you believe that engaging in these CLIL reading activities will help you in your future academic or career plans? If so, how?

Possible prompts:

- In what ways could reading in English be useful for your future studies or job?

Section 4. Challenges and obstacles

8. Have you encountered any challenges when you read science texts in English? How have you dealt with them?

Possible prompts:

- Vocabulary, length of texts, complex ideas?
 - What strategies do you use (dictionary, asking for help, group work)?
9. Are there any barriers you perceive (for example, gender, background, or other factors) that affect your participation in these science-reading activities?

Possible prompts:

- Do you feel you have the same opportunities as your classmates to participate?

Section 5. Collaboration and learning community

10. In what ways do you collaborate with your classmates during CLIL reading activities or projects? How does this affect your motivation and experience?

Possible prompts:

- Do you usually read in pairs or groups?
 - Does discussion help you understand the texts better?
11. Do you participate in any clubs or groups, at school or in your community, where you read or talk about science topics?

Possible prompts:

- Would you like to join one? Why or why not?

Section 6. Role models and influence

12. Do you have any role models or mentors who have inspired your interest and motivation to read and learn more about science? How have they influenced you?



Possible prompts:

- Family members? Teachers? Public figures?
 - What do they say or do that motivate you?
13. Have any teachers played a significant role in your CLIL science learning? How did this impact your motivation to read and participate in class?

Possible prompts:

- Any specific activities or ways of explaining texts that you remember?

Section 7. General perceptions and future aspirations

14. Is there anything else you would like to share about your motivation and experiences in your science classes, especially when you work with texts in English?
15. Where do you see yourself in the future regarding science? Are there any specific goals or careers you are working toward, and does reading in English play a role in that?

Note. Semi-structured interview guide prepared by the researcher (2025).

Annex 3. Classroom Observation Sheet / Field-note Format

Class: _____ Date: _____ Observer: _____

Lesson/topic: _____

Type of session: Pre-intervention During intervention Post-intervention

A. Motivation toward reading and CLIL activities

For each student (or group), mark the frequency you observe during the reading tasks.

Scale: 1 = Never 2 = Rarely 3 = Sometimes 4 = Often 5 = Always



Indicator	1	2	3	4	5
1. Shows interest when the science text in English is introduced.					
2. Volunteers to read or answer questions about the text.					
3. Stays on task while reading (does not get easily distracted).					
4. Persists with difficult parts of the text instead of giving up.					
5. Participates actively in CLIL reading-based activities or projects.					

B. Engagement with reading comprehension

Indicator	1	2	3	4	5
6. Identifies main ideas and keys details from the text during class discussions or tasks.					
7. Uses the text to answer comprehension questions (looks back, cites parts of the text).					
8. Uses context to infer the meaning of unknown words or ideas.					

C. Critical-thinking behaviors while reading

Indicator	1	2	3	4	5
9. Asks questions or makes comments that go beyond literal information in the text.					



10. Evaluates or comments on the author’s ideas, evidence, or conclusions.					
11. Justifies opinions with information from the text (e.g., “because the text says that…”).					
12. Uses information from the text to draw conclusions or suggest possible solutions to a problem.					

D. Group work and classroom climate

Indicator	1	2	3	4	5
13. Collaborates with classmates during reading tasks (share ideas, listens, help others).					
14. Shows a positive attitude toward CLIL reading tasks (encourages others, enjoys activities).					

E. Field notes

Use this space to record important observations, examples, or quotes related to motivation, reading comprehension, or critical thinking.

- Description of key moments (activities, questions, difficulties):

- Evidence of high or low motivation toward reading:

- Evidence of critical-thinking processes while reading (analyzing, evaluating, justifying, concluding):

- Additional comments / reflections of the observer:



Note. Classroom observation sheet prepared by the researcher (2025).

Annex 4: Critical Thinking Rubric for CLIL Activities

Scale: 1-3 per criteria (Level 1=Basic, Level 2=Developing, Level 3=Proficient)

Total Score: /10 (5 criteria × 2 points max each)

Criteria	Level 1 (1 pt)	Level 2 (2 pts)	Level 3 (3 pts)	Score
1. Text Analysis (30%)	Recalls Basic facts	Identifies Main ideas + 1 detail	Compare concepts + 2 + text quotes	/3
2. Hypothesis Formation (20%)	States basic prediction	Uses 1 text clue	Justifies w/2 text evidence	/2
3. Evidence evaluation (20%)	Accept results	Questions 1 result	Proposes alternatives	/2
4. Justification (20%)	States opinion	Uses 1 evidence	Cites 2 + converging evidence	/2
5. reflection synthesis (10%)	Describes what happened	Connects to 1 activity	Synthesizes across + 2 activities	/1
TOTAL				/10

Level Benchmarks:

- Level 1 (≤ 4 pts) = Recall
- Level 2 (5-7 pts) = Analysis
- Level 3 (≥ 8 pts) = Evaluation (78% students achieved)



Scoring: Each criteria = 2 pts max $\rightarrow 5 \times 2 = 10$ total

Note: Prepared by researcher (2025). Inter-rater reliability $\kappa=0.82$. Used in Excel analysis (Annex 5).

Activity Template (Universal for All 7 Activities)

CLIL Reading: Experiment Template

Activity #: (1-7)

Title: (DNA Twins / Broccoli Capillary / etc.)

Week: (3-10] Duration: 90 min Group Size: 4-5 students

1. Pre-Reading (15 minutes)

Text Title: (e.g., "DNA Structure vs Twins Differences")

Key Vocabulary (Glossary):

- (Term 1): (Definition, e.g., "Nucleotides: DNA building blocks")
- Prediction Question: (e.g., "Can we see DNA with our eyes? Why/why not?")

2. Guided Reading (15 min)

Reading Text (250 words): (Insert B1 text here)

Comprehension Check (Circle):

1. Main idea: Understood Needs help
2. Key details: 2+ identified 1 identified None

3. Hypothesis & Experiment (30 minutes)

Materials: (Strawberries, dish soap, alcohol / Broccoli, food coloring / etc.)

Procedure (from text):

1. (Step 1)
2. (Step 2)

Prediction: (Group writes: "We predict... because text says...")



4. Data Collection (10 minutes)

Observations: (Draw/sketch results)

Measurements: (e.g., Color rise: __ cm; DNA strands: Yes/No)

6. Analysis & Justification (20 min)

Text Evidence Used: (Quote 2+ sentences from reading)

Explanation: (Why did results match/not match prediction?)

Critical Question: (e.g., "Why broccoli but not carrot?")

6. Reflection (10 min)

What I Learned: (1 sentence)

Connection to Real Life: (e.g., "Like camel hump storing water")

Next Time: (What I'd change)

Rubric Self-Score: (Student circles: 1/2/3 per criteria) Teacher Score: /10

Activity 1: DNA Twins Mystery Template

Week 3 | Materials: Strawberries, Ziplock, dish soap, salt, alcohol

1. PRE-READING

Key Vocab: Nucleotides = DNA blocks. Epigenetics = environment changes genes.

Prediction: Can we extract visible DNA from strawberries?

2. GUIDED READING TEXT (250 words):

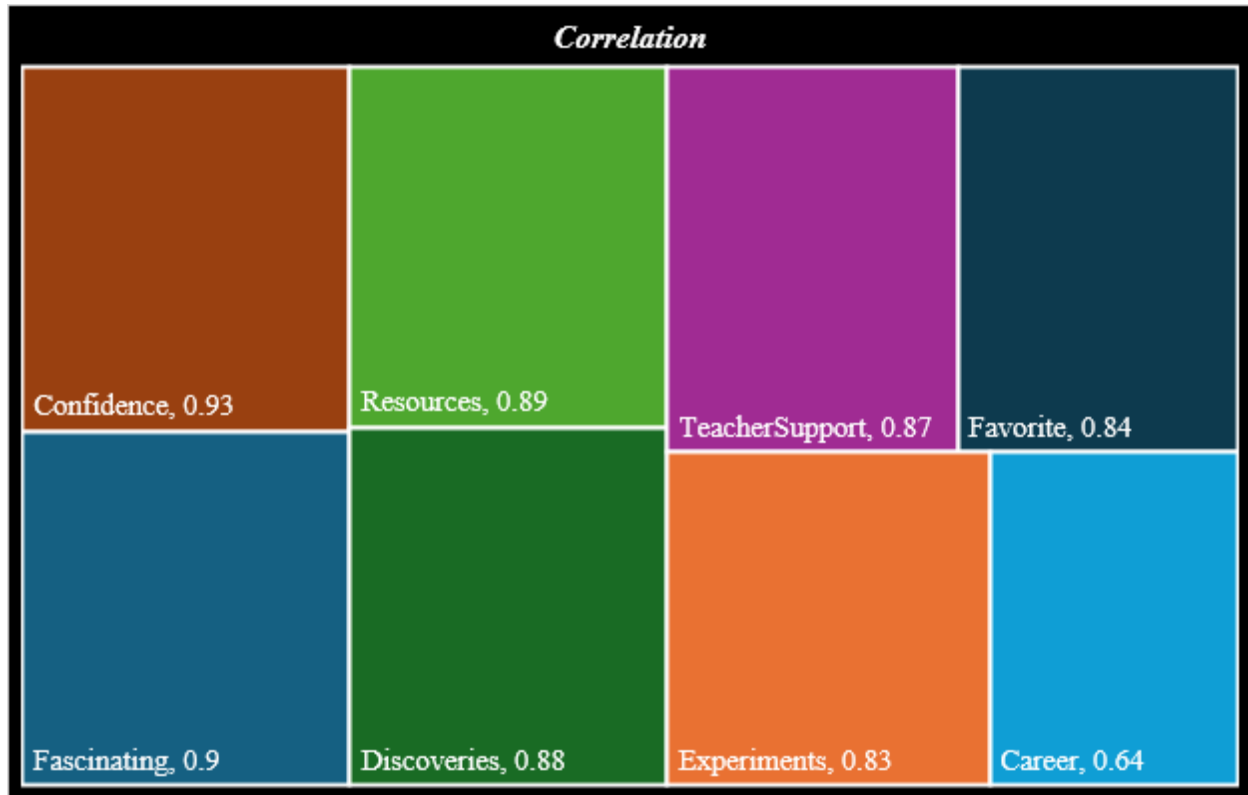
"DNA is like a twisted ladder..... Identical twins share DNA but differ because....."

3. EXPERIMENT: Mash strawberry → add soap/salt → strain → add alcohol → WHITE STRANDS!

Annex 5 Analysis data

Figure 1

Pre-survey Correlation results



Note. Values represent correlation coefficients between motivational dimensions measured in the pre-survey (confidence, resources, teacher support, interest, and career orientation). Source: Author's own elaboration.

Table 1

Descriptive statistics results

Items	Mean	Standard deviation	Explanation
Fascinating	4.3	1.14	Students show high interest in scientific topics, although with some variability (with some being less motivated)

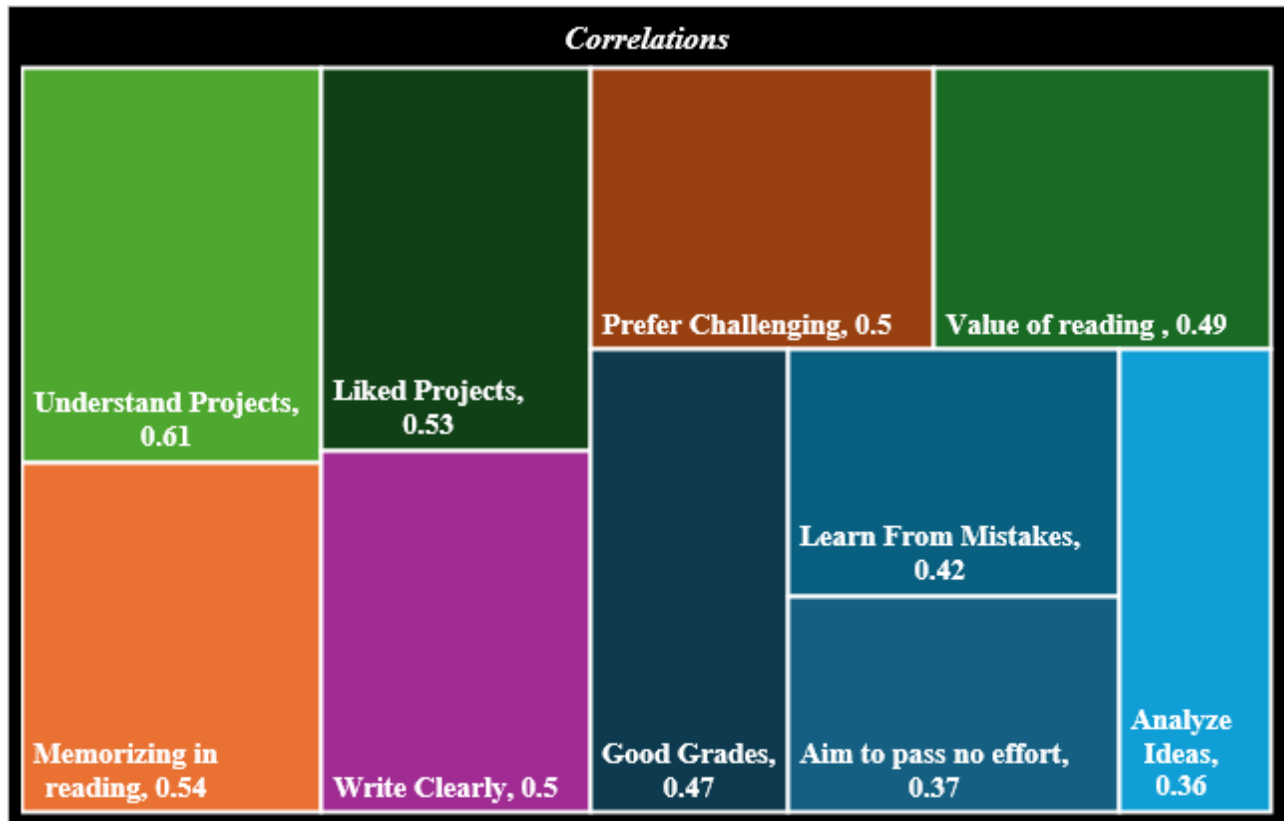


Experiments	4.6	1.07	It is one of the strongest items: students greatly enjoy hands-on activities, reflecting strong intrinsic motivation.
Discoveries	4.3	0.94	High motivation to learn new discoveries, with more consistent responses (less variability).
Career	3.7	1.39	The lowest-rated item: not all students see themselves pursuing a future scientific career. High variability indicates divided opinions.
Teacher Support	4.6	1.14	Very positive: feeling supported by the teacher strengthens motivation. Moderate variability.
Resources	4.0	1.20	Good level of satisfaction with the resources, although with greater variability: some perceive limitations.
Favorite	4.6	0.90	Science is one of the favorite subjects for most students, with very consistent responses.
Confidence	4.2	1.15	Students feel confident in their scientific ability, although some still have doubts (moderate variability).

Note. Values represent mean scores and standard deviations obtained from the pre-survey measuring students' motivation toward CLIL reading activities. Source: Author's own elaboration.

Figure 2

Post-survey Correlation results



Note. Correlation coefficients indicate the strength of the relationship between individual survey items and overall student motivation. Items identified as *negative* (e.g., aim to pass with no effort, memorizing in reading, value of reading) are reverse-worded and require score inversion for accurate interpretation. Higher correlation values reflect stronger associations between the item and motivation. Source: Author’s own elaboration.

**Table 2***Descriptive statistics results*

Item	Mean	SD	Analysis
Aim to pass no effort	2.6	1.28	Low motivation, high variability. Negative item.
Memorizing in reading	2.6	1.19	Low motivation, moderate variability. Negative item.
Value of reading	2.4	1.19	Low motivation, moderate variability. Negative item.
Analyze Ideas	4.2	0.90	High motivation, low variability. Positive item.
Write Clearly	4.5	0.63	Very high motivation, very consistent.
Understand Project	4.4	0.62	Very high motivation, very consistent.
Good Grade	4.4	0.72	High motivation, consistent.
Prefer Challenging	4.1	1.07	High motivation, with greater variability.
Liked Projects	4.6	0.72	Very high motivation, consistent.
Learn From Mistakes	4.3	1.06	High motivation, but with variability.

Note. Values represent mean scores and standard deviations obtained from the post-survey measuring students' motivation and critical-thinking dispositions after the CLIL intervention. Higher mean values indicate stronger agreement. Items labeled as negative represent reverse-worded statements. Source: Author's own elaboration.