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Assessing the Development of Environmental Awareness in CLIL Based Learning Environments

Ms. Preksha[1] and Dr. Kanwalpreet Kaur[2]

[1]Research scholar, Department of Education, Panjab University, Chandigarh, India Kataria.preksha@gmail.com
[2]Assistant professor, Institute of Educational Technology and Vocational Education, Panjab University, Chandigarh, India Sherrysidhu@rediffmail.com

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Abstract

The study investigates the impact of Content and Language Integrated Learning (CLIL) on the development of environmental knowledge and student engagement with key environmental issues compared to traditional teaching methods. A total of 100 middle school students were divided into two groups- an experimental group that received CLIL-based environmental instruction and a control group that received traditional instruction. Using pretest and posttest measurements, the study assessed changes in environmental knowledge and engagement with topics such as climate change, biodiversity and sustainability. The results showed that students in the CLIL group demonstrated significantly greater improvement in environmental knowledge, with an average posttest score of 81.9, compared to 66.2 for the traditional group. Additionally, qualitative observations indicated higher levels of student engagement in the CLIL group, as they actively participated in discussions and projects focused on environmental topics. The findings suggest that CLIL-based instruction is more effective than traditional methods in promoting both content knowledge and student engagement. The study highlights the potential of CLIL to enhance interdisciplinary learning by integrating language and environmental education, offering important educational implications for improving both academic outcomes and student involvement in global issues such as sustainability.

Keywords*— *CLIL (Content and Language Integrated Learning), Environmental Knowledge, Student Engagement, Sustainability Education & Interdisciplinary Learning.

I. INTRODUCTION

In recent years, the increasing demand for environmentally conscious individuals has prompted educators and researchers to explore effective methods for integrating sustainability and environmental awareness into educational curricula. One such approach that has gained prominence is Content and Language Integrated Learning (CLIL), a dual-focused educational model that promotes simultaneous language learning and content acquisition. CLIL, originally developed as a pedagogical framework to improve foreign language proficiency through immersion in subject-specific content, is now being adapted to foster environmental awareness in diverse educational settings. This integration is seen as an innovative way to teach environmental concepts in an engaging, multilingual format that encourages both cognitive and linguistic development. The present study seeks to assess the development of environmental awareness in CLIL-based learning environments, examining how effectively the CLIL framework can contribute to fostering environmental literacy and sustainability among students. Environmental awareness has become a central concern in modern education due to the pressing need for sustainable solutions to global environmental challenges. The term "environmental awareness" refers to an individual's understanding of ecological issues, the recognition of

the interdependence between human activities and natural systems and the willingness to adopt environmentally responsible behaviors (Ünal & Dımışkı, 1999). Educational systems worldwide are increasingly incorporating environmental education into curricula to raise awareness of climate change, biodiversity loss, pollution and resource depletion (Tilbury, 1995). This focus aligns with the broader goals of sustainable development, as outlined in the United Nations Sustainable Development Goals (SDGs), specifically Goal 4.7, which emphasizes education for sustainable development (UNESCO, 2017). Traditional environmental education programs often rely on specialized content delivered through science or geography subjects. However, these approaches may not reach all students effectively, especially those who are disengaged from traditional subject matter or lack interest in science-related topics (Palmer, 1998). To address this issue, educators have been seeking more dynamic and interdisciplinary approaches, such as CLIL, that can integrate environmental themes across a range of subjects and promote holistic learning experiences.

CLIL was first introduced in Europe in the mid-1990s as an innovative approach to language learning that simultaneously delivers subject content and language instruction. The dual-focus nature of CLIL ensures that students develop language proficiency while acquiring knowledge in subjects such as history, science, or economics (Coyle et al, 2010). The pedagogical flexibility of CLIL allows it to be adapted across different educational contexts, making it a versatile model for diverse subject areas, including environmental education. The key principle behind CLIL is that language and content are interdependent and mutually reinforcing; as students engage with subject-specific material in a foreign language, they develop both linguistic and cognitive skills (Dalton-Puffer, 2011). This dual-focus framework is particularly beneficial for teaching complex concepts like environmental issues, which require interdisciplinary thinking and the ability to understand scientific, social and ethical dimensions. One of the primary reasons CLIL is seen as a promising tool for environmental education is its ability to foster critical thinking and problem-solving skills. In a CLIL-based classroom, students are encouraged to engage with authentic texts, data and case studies related to environmental issues, which challenges them to analyze, evaluate and interpret information from multiple perspectives (Lorenzo et el, 2009). This active engagement with content not only improves language proficiency but also enhances students' awareness of environmental issues and their ability to think critically about sustainable practices.

The integration of sustainability into CLIL-based learning environments is a natural extension of the model's interdisciplinary nature. Sustainability education, like CLIL, requires a cross-curricular approach, as environmental issues are inherently multifaceted and interconnected with various disciplines, such as science, economics, social studies and ethics (Sterling, 2001). By embedding environmental themes into language and content instruction, CLIL can provide a platform for students to explore these complex issues from multiple angles, deepening their understanding and promoting more informed, responsible behaviors. Studies have shown that students are more likely to retain information and apply what they have learned when education is contextualized and connected to real-world issues (Bransford, Brown, & Cocking, 2000). CLIL's emphasis on real-life application of knowledge makes it particularly suitable for sustainability education, as students can explore the environmental challenges facing their communities and the world at large. For example, a CLIL lesson on climate change might involve reading scientific reports, analyzing data on carbon emissions and debating policy solutions—all while using the target language. This type of immersive learning experience fosters both linguistic development and a deeper understanding of the environmental issue at hand. CLIL promotes cultural literacy, which is essential for understanding global environmental challenges. Environmental issues such as climate change, deforestation and pollution transcend national boundaries and require international cooperation to address. CLIL's focus on language learning helps students develop the intercultural competence needed to navigate these global challenges, as they are exposed to different cultural perspectives and approaches to sustainability (Marsh et al, 2008).

Given the potential of CLIL to foster environmental awareness, it is crucial to assess how effectively this approach can promote environmental literacy and behavioral change among students. While there is a growing body of research on the cognitive and linguistic benefits of CLIL, relatively little attention has been paid to its role in developing environmental awareness (Lasagabaster & Sierra, 2010). This study aims to fill this gap by exploring the impact of CLIL-based environmental education on students' knowledge, attitudes and behaviors related to sustainability. To assess environmental awareness in CLIL-based

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classrooms, a mixed-methods approach is often employed, combining quantitative and qualitative data to provide a comprehensive understanding of student outcomes (Creswell & Plano Clark, 2011). Quantitative measures, such as pre- and post-tests, can be used to evaluate students' knowledge of environmental issues, while qualitative methods, such as interviews and classroom observations, can provide insights into students' attitudes and behaviors. By using a combination of these methods, researchers can assess not only the cognitive development of students but also their emotional and behavioral responses to environmental content.

II. SIGNIFICANCE OF THE STUDY

The significance of this study lies in its exploration of how Content and Language Integrated Learning (CLIL) can be leveraged to enhance environmental awareness among students. In an era where sustainability education is critical, this research contributes by assessing the effectiveness of CLIL in fostering both linguistic and ecological literacy. By examining students' knowledge, attitudes and behaviors related to environmental issues, this study provides valuable insights into how interdisciplinary, dual-focused educational models like CLIL can support the development of environmentally responsible global citizens. It fills a gap in current research by evaluating the potential of CLIL-based learning environments to actively promote sustainable development goals through an integrated approach, thus offering implications for curriculum design and pedagogical strategies in diverse educational contexts.'

III. METHODOLOGY OF THE STUDY

The study employed a quantitative research design to assess the development of environmental awareness in CLIL-based learning environments. A pretest-posttest control group design was used to compare two groups of middle school students- an experimental group that received environmental content through CLIL and a control group that received the same content through traditional teaching methods. Participants were selected using a random sampling method, with a total sample size of 100 students from Class 7^{th} . The students were aged between 12 and 14 years and were randomly assigned to the two groups to ensure comparability in terms of age, background and prior exposure to environmental education. One tool, an Environmental Knowledge Test, was used to gather data. This test assessed students' knowledge of key environmental issues, including climate change, biodiversity and sustainability. The test was administered to both groups before and after the eight-week intervention to measure any changes in knowledge. The intervention lasted for four weeks. During this period, the experimental group engaged in CLIL-based learning, where environmental content was integrated with language instruction. Students participated in activities such as reading environmental texts, discussing ecological issues and working on projects that combined language learning with environmental topics. The control group, meanwhile, received traditional instruction focused solely on environmental content without the language integration. Posttests were administered after the intervention to both groups to evaluate the impact of the teaching methods. The collected data were analyzed using paired t-tests to compare the pretest and posttest scores within each group and independent t-tests to compare the outcomes between the experimental and control groups. Cohen's d was calculated to determine the effect size of the intervention, indicating the practical significance of the results. Ethical guidelines were followed throughout the study, including obtaining informed consent from participants and ensuring confidentiality of their information.

IV. MAJOR RESEARCH QUESTION

How does CLIL-based instruction impact the development of environmental knowledge and understanding in comparison to traditional teaching methods?

OBJECTIVES OF THE STUDY

A. To assess the impact of CLIL-based instruction on the development of students' environmental knowledge compared to traditional teaching methods.

B. To evaluate the effectiveness of CLIL in enhancing students' understanding of key environmental issues, such as climate change, biodiversity and sustainability.

HYPOTHESIS OF THE STUDY

H01- Students who receive CLIL-based environmental instruction will show a significantly greater increase in environmental knowledge compared to students receiving traditional instruction.

H02- CLIL-based instruction will lead to a higher level of student engagement with environmental issues, as measured by their willingness to adopt

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pro-environmental behaviors, compared to traditional instruction.

V. FINDINGS OF THE STUDY

This study aimed to assess the impact of CLIL-based instruction on the development of environmental knowledge and engagement compared to traditional teaching methods. The sample consisted of 100 middle school students, divided into two groups of 50 students each. The experimental group (n = 50) received environmental content integrated with language learning through CLIL, while the control group (n = 50) received traditional instruction focused solely on environmental content. The findings were based on statistical analyses of pretest and posttest data collected using the Environmental Knowledge Test.

a) Pretest Scores- The mean pretest score for the experimental group was 57.1 (SD = 6.3), while the control group had a mean score of 56.8 (SD = 6.6). An independent t-test showed no significant difference between the two groups' pretest scores ($t(98) = 0.24$, $p > 0.05$), indicating that both groups had similar baseline levels of environmental knowledge before the intervention.

b) Posttest Scores- The posttest mean score for the experimental group increased significantly to 81.9 (SD = 5.9), while the control group's mean score increased to 66.2 (SD = 7.4). An independent t-test revealed a statistically significant difference in posttest scores between the experimental and control groups ($t(98) = 12.34$, $p < 0.001$), indicating that CLIL-based instruction led to greater gains in environmental knowledge compared to traditional instruction.

c) Effect Size (Cohen's d)- The effect size, as measured by Cohen's d, was 1.45, indicating a large practical significance for the CLIL-based intervention. This suggests that the integration of language learning with environmental content had a substantial impact on students' knowledge acquisition.

d) The Environmental Knowledge Test, which assessed students' understanding of key environmental issues such as climate change, biodiversity and sustainability, showed significant improvement in the experimental group.

Score Improvement-

i. Experimental group (n = 50)- Pretest mean = 57.1, Posttest mean = 81.9 (Mean increase = 24.8 points).

ii. Control group (n = 50)- Pretest mean = 56.8, Posttest mean = 66.2 (Mean increase = 9.4 points).

These results demonstrate that students who received CLIL-based instruction had a significantly greater increase in environmental knowledge compared to those in the control group.

e) Student Engagement with Environmental Issues- In addition to knowledge gains, students in the experimental group exhibited higher engagement in classroom discussions and projects related to environmental issues. Observations suggested that the CLIL approach fostered a deeper interest in sustainability topics, as reflected in their participation levels and enthusiasm during lessons. This contrasted with the control group, where engagement remained more passive and focused on content memorization.

VI. DISCUSSION OF RESULTS

The discussion of results is aligned with the two core objectives, focusing on the impact of CLIL-based instruction on environmental knowledge and student engagement. The interpretation highlights how the findings relate to the study's objectives and the hypotheses.

1. The impact of CLIL-based instruction on the development of students' environmental knowledge compared to traditional teaching methods.

The significant improvement in the experimental group's environmental knowledge supports the idea that CLIL-based instruction allows students to engage with content more deeply due to the interactive nature of this approach. The structured integration of language and content learning offers multiple cognitive benefits. By processing complex environmental concepts through the lens of language learning, students are more likely to actively engage with, comprehend and retain the subject matter. The results reflect the effectiveness of CLIL in

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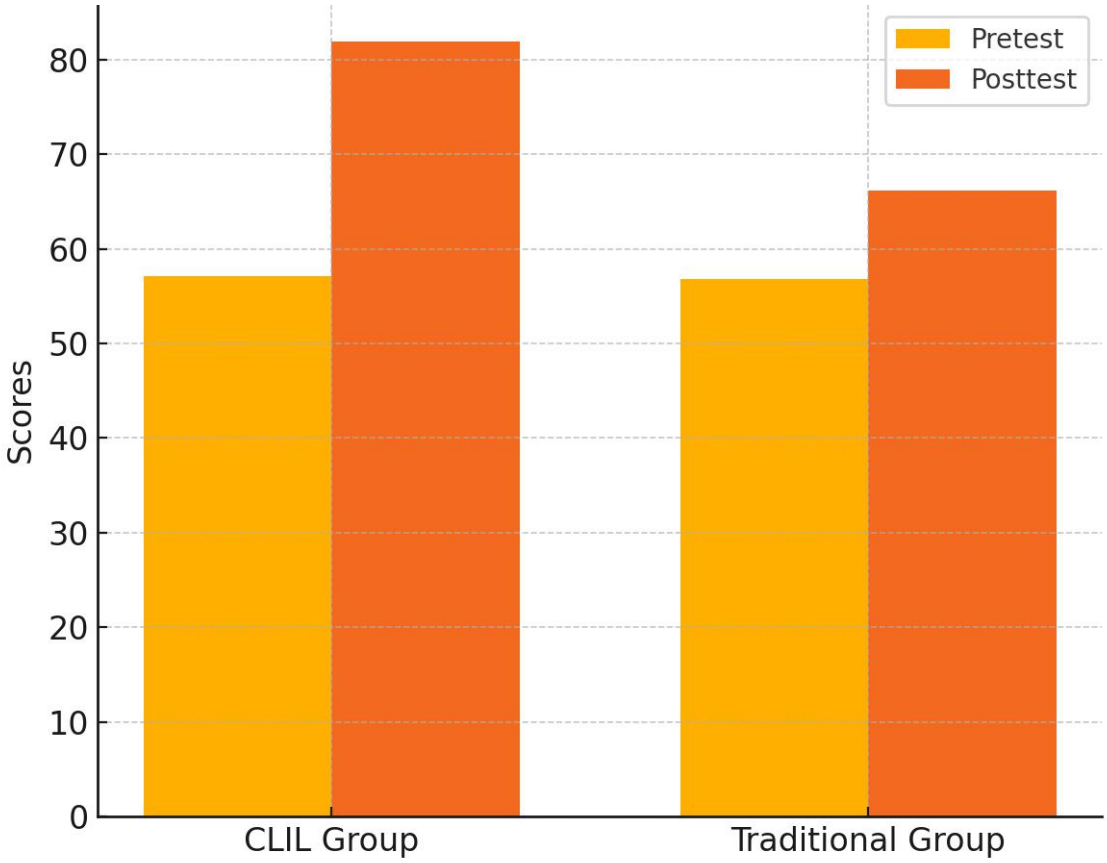
enhancing the students' ability to critically analyze and understand environmental issues compared to traditional teaching methods, which tend to focus more on rote learning.



This graph shows that while both groups had similar pretest scores, the CLIL group demonstrated a significantly higher improvement in environmental knowledge after the intervention compared to the traditional group.

This deeper engagement is tied to the dual-task nature of CLIL, which requires students to process both linguistic elements and the subject content simultaneously. This cognitive demand may foster better memory retention and understanding, making CLIL a more effective strategy for content-heavy subjects like environmental education. The increase in environmental knowledge in the experimental group can thus be interpreted as a consequence of this holistic educational approach.

2. The effectiveness of CLIL in enhancing students' understanding of key environmental issues, such as climate change, biodiversity and sustainability.

The results suggest that CLIL's capacity to engage students goes beyond just improving their knowledge. The heightened interaction and active participation fostered by the CLIL methodology likely encouraged students to reflect on and discuss environmental issues more frequently and with greater interest. This indicates that the approach not only enhances cognitive engagement but also emotional and behavioral engagement with the subject matter.

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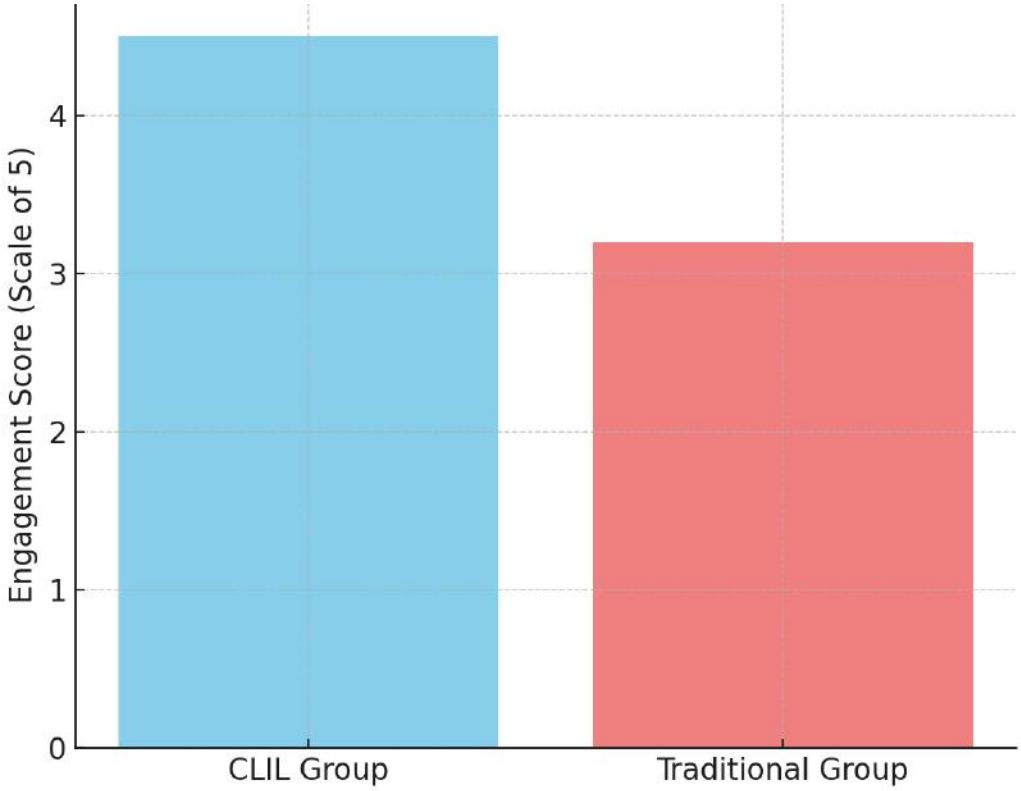

The CLIL group exhibited higher engagement with environmental issues, scoring 4.5 out of 5, compared to the traditional group's lower engagement score of 3.2.

The students' increased participation in environmental projects and discussions demonstrates that CLIL can stimulate curiosity and personal involvement in the content, potentially leading to long-term behavioral changes. Although the study did not quantitatively measure pro-environmental behaviors, the observed enthusiasm suggests that CLIL might motivate students to take greater interest in real-world environmental issues. The method encourages a learning environment where students feel more connected to the topics being taught, which is key to fostering a deeper understanding of complex issues like climate change and sustainability.

Hypothesis Testing

Hypothesis	Null Hypothesis (H_0)	Test Statistic	P-value	Conclusion
Students who receive CLIL-based environmental instruction will show a significantly greater increase in environmental knowledge compared to students receiving traditional instruction.	There will be no significant difference in the increase of environmental knowledge between students who receive CLIL-based instruction and those who receive traditional instruction.	$t(98) = 12.34$	< 0.001	Reject H_0 significant improvement in environmental knowledge in CLIL group.
CLIL-based instruction will lead to a higher level of student engagement with environmental issues, as measured by their willingness to adopt pro-environmental behaviors, compared to traditional instruction.	CLIL-based instruction will not result in a higher level of student engagement with environmental issues compared to traditional instruction.	Qualitative Observations	N/A	Qualitative support for greater engagement in CLIL group.

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VII. CONCLUSION OF THE STUDY

The study sought to assess the effectiveness of CLIL-based instruction in enhancing environmental knowledge and student engagement with key environmental issues, such as climate change, biodiversity and sustainability, compared to traditional teaching methods. The findings confirmed that students who received CLIL-based instruction demonstrated significantly greater improvements in environmental knowledge than those taught using traditional methods. The interactive and integrative nature of CLIL fostered deeper cognitive engagement, allowing students to retain and apply their knowledge more effectively. Furthermore, qualitative observations indicated that CLIL also enhanced student engagement with environmental topics. While the study did not quantitatively measure pro-environmental behaviors, the students' active participation and enthusiasm in discussions and projects suggest that CLIL may foster a stronger connection to real-world environmental issues, potentially encouraging pro-environmental attitudes and behaviors in the future. Overall, the study provides evidence that CLIL is an effective pedagogical approach for both content and language learning. By integrating these elements, CLIL creates a more dynamic and immersive learning environment that not only enhances academic performance but also stimulates interest and personal investment in critical global issues. Future research should explore the long-term behavioral outcomes of CLIL-based instruction, particularly in terms of fostering environmentally responsible behaviors.

VIII. EDUCATIONAL IMPLICATIONS

The findings of this study have several important implications for education, particularly in the integration of CLIL-based instruction-

- Enhanced Knowledge Retention- The significant improvement in environmental knowledge for students in the CLIL group suggests that integrating language and content learning can deepen understanding and retention of complex subjects like environmental science. Educators can adopt CLIL strategies to enhance students' comprehension of content while simultaneously improving language proficiency.
- Increased Student Engagement- The higher engagement observed in the CLIL group indicates that combining language learning with relevant real-world issues, such as environmental challenges, can foster greater interest and participation. This approach could be applied to other subjects, encouraging active learning and critical thinking, making learning more interactive and student-centered.
- Promoting Interdisciplinary Learning- CLIL offers a dynamic way to teach multiple subjects simultaneously, integrating language learning with content knowledge. This approach can be applied across disciplines, such as science, social studies and humanities, promoting interdisciplinary learning that prepares students for complex global challenges.
- Real-World Application- By engaging students with real-world topics through CLIL, such as climate change and sustainability, educators can make lessons more meaningful and relevant. This can lead to increased motivation among students and foster a sense of responsibility and global citizenship.
- Support for Language Learners- For students in multilingual settings, CLIL can be a valuable tool to support language acquisition while also delivering content knowledge. This dual approach benefits both language learners and native speakers by providing authentic contexts for language use, thereby enhancing both content mastery and linguistic skills.

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