

Enhancing Mathematics Learning Through CLIL: A Comparative Study

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ABSTRACT

Under Content and Language Integrated Learning (CLIL) is a teaching approach where content such as mathematics, history, or science is taught through a second or foreign language. This study examines the effectiveness of CLIL in improving mathematics achievement and attitude towards CLIL pedagogy among pre-service teachers. A quasi-experimental single-group pre-post-test design was employed with a mixed-methods approach including both quantitative and qualitative data analysis. The study was conducted on a sample of 20 B.Ed. interns of the Department of Education, Chitkara University, Rajpura, Punjab. Pre- and post-tests were conducted to assess academic improvement, while participant feedback provided qualitative data. The results depicted a steep increase in post-test scores, demonstrating that CLIL intervention positively influenced mathematical learning. Consequently, the null hypothesis (Ho1) was rejected confirming the success of CLIL in enhancing subject comprehension and linguistic skills concurrently. The findings highlight the capability of CLIL to build multilingual education and reinforce Ek Bharat, Shreshtha Bharat Mission goals and help integrate linguistic and cultural aspects within India. Also, NEP 2020 under 4.14, 10.8, 20.4, 22.10 discusses bilingualism in the classroom. These conclusions can be applied by teachers, educationists, and curriculum planners in order to adopt more effective multilingual teaching methods.

Keywords: CLIL (*Content and Language Integrated Learning*)

What is CLIL?

Content and Language Integrated Learning (CLIL) refers to an instruction where a subject matter is learned by means of a foreign language like history, math, or science. Subject content is basically meant to construct knowledge as well as language competency concurrently. For example, in a CLIL class where the target language is English, students could study geography through English, developing both their geographic competence and their English language ability (Coyle, Hood, & Marsh, 2010). CLIL is most widely practiced within bilingual education systems, where children are exposed to academic subject matter in more than one language. Research indicates that this method is effective because it makes

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Received: April 15, 2025; Revision Received: November 10, 2025; Accepted: November 15, 2025

the foreign language students more likely to utilize the foreign language in authentic, context-dependent manner instead of just learning the language in isolation. This active interaction with both content and language is thought to promote language learning and cognitive growth (Dalton-Puffer, Nikula, & Smit, 2010). Research has also indicated that CLIL students tend to perform better than non-CLIL students in both subject matter understanding and language proficiency, and it is therefore a commonly used methodology in European and other multilingual education systems (Lasagabaster & Ruiz de Zarobe, 2010).

What are the benefits of CLIL teaching?

Content and Language Integrated Learning (CLIL) has a number of benefits both in language learning and cognitive growth. One of the most significant strengths of CLIL is its capacity to support language learning through immersion in subject-specific contexts, which facilitates vocabulary learning and enforces language usage in authentic situations (Cenoz, 2015). As learners study a topic in a target language, the students are faced with a richer and more realistic application of the language, strengthening their language acquaintance (Marsh, 2012). CLIL also fosters cognitive advantages in the form of enhanced problem-solving, critical thinking, and flexibility since students understand information in two languages and an area of knowledge (Cummins, 2000). This two-way emphasis promotes cognitive flexibility and metacognitive skill development, leading to more effective learners (Coyle, 2007). CLIL has also been associated with academic achievement, and studies indicate that students on CLIL tend to outperform their peers both in language skills and subject matter, notably in disciplines such as science and mathematics (Takala, 2008; Dalton-Puffer, 2008). In addition, CLIL promotes intercultural understanding through the encouragement of students to think about cultural variation since language acquisition is sometimes combined with the acquisition of culture as context to the target language (Nikula, 2014). Lastly, CLIL boosts student motivation because learning becomes more enjoyable and applicable. The method is appealing and meaningful for students because it combines authentic language application with authentic content (Lasagabaster, 2011). Generally, CLIL promotes not just language abilities but also cognitive, academic, and cultural growth, thus rendering it an extremely effective pedagogy.

Need and Significance of the Study

The growing need for multilingual education in the globalized world of today underscores the shortcomings of conventional language teaching approaches, which tend to leave learners unprepared for actual academic and professional demands. Content and Language Integrated Learning (CLIL) pedagogy fills this gap by fostering language competence and subject matter knowledge at the same time. This holistic strategy is crucial, as it enables learners to learn academic content through a foreign language, promoting both cognitive and linguistic skills in context (Coyle, Hood, & Marsh, 2010). With education systems globally placing greater emphasis on bilingualism and multilingualism, CLIL provides a comprehensive solution, where learners can become proficient in several languages while learning academic subjects (Dalton-Puffer, 2008; Baker & Wright, 2017). Additionally, CLIL promotes critical thinking, intercultural awareness, and metacognitive ability by requiring students to think through a foreign language, hence making it an effective instrument of cognitive development (Swain & Lapkin, 2001). The importance of learning CLIL emanates from its capability to enhance learning outcomes since studies indicate that students undertaking CLIL courses tend to outperform their classmates in both subject matter and language proficiency (Nikula, 2016). This study will offer important insights for teachers, policymakers, and curriculum developers to further enhance educational practices

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to more effectively assist multilingual students and cultivate higher-order thinking, cultural competency, and academic achievement. Moreover, NEP 2020 talks about Teacher Training for Multilingualism to effectively implement language-inclusive classrooms.

Objectives

- i) To study the improvement in scores in mathematics with CLIL intervention.
- ii) To study the attitude of aspiring teachers towards CLIL pedagogy.

Hypothesis

- H₀₁ There is no statistically significant difference between pre-test and post-test scores in mathematics with CLIL intervention.

LITERATURE REVIEW

Content and Language Integrated Learning (CLIL) is a widely accepted methodology in education, especially in mathematics, which improves both subject knowledge and language competence. Research suggests that CLIL enables students to comprehend mathematical ideas while at the same time enhancing their capacity to communicate and reason mathematically in a second language (Coyle et al., 2010; Van de Craen & Gysen, 2011). This double attention is especially valuable in a globalized world, where multilingualism and international academic language are more and more crucial. CLIL in mathematics enables students to study sophisticated mathematical concepts while developing the linguistic competence required for success in other academic subjects (Pérez Cañado, 2012; Lasagabaster, 2008).

Yet, the content and language integration of mathematics also has some challenges. Among the most notable of these is specialized vocabulary and heavy mathematical concepts that have to be learned in a second language. Studies emphasize the need for scaffolding strategies to facilitate students to overcome such challenges (Bertaux, 2016; Gajo, 2007). These may involve the use of visualizations, simplified descriptions, and gradual introductions to terms. Moreover, successful CLIL implementation depends significantly on teacher training. Teachers need to be provided not only with subject matter knowledge but also with techniques for facilitating students' language development in academic settings (Dalton-Puffer, 2008; Ball & Lindsay, 2012). Research also indicates that multilingual environments are especially suited to CLIL, as learners can use multiple languages to gain a richer understanding of mathematical principles (Cenoz & Genesee, 1998).

Generally, while CLIL provides excellent cognitive and linguistic advantages, it relies on cautious and deliberate inclusion of language support, pedagogy, and teacher preparation in order to be successful in math education. If properly implemented, student performance will be enhanced both in content achievement and language proficiency, establishing a solid foundation for success in the academic environment in a multilingual world (Mehisto et al., 2008).

METHODOLOGY

Research Design: The study followed quasi-experimental single group pre-post-test only design

Time Duration: 3 Periods

Phase	Group	Treatment	Measurement
Pre-test	Single	No Treatment	Pre-test
Intervention	Single	CLIL Intervention	Post-test

Tabular representation of a **Quasi-Experimental Single Group Pre-Post-Test Only**

Design:

Sample:

The sample of the study included 20 aspiring teachers of semester 2 and 4 of B.Ed. Course of the Department of Education, Chitkara University.

Data Collection Methods:

The study employed a mixed-methods approach, incorporating both quantitative and qualitative analysis. Pre- and post-tests were administered for quantitative data collection, while qualitative insights were gathered through participant feedback.

Data Analysis:

t-test was employed for the qualitative data analysis and thematic analysis of qualitative data was carried out.

The CLIL Process:

In CLIL teaching for the chapter "Lines and Angles," the teacher first introduced significant geometric vocabulary like line, line segment and ray in both the students' mother tongue and target language (e.g., English). The teacher illustrated that a line is infinite with no endpoints, a line segment is a part of a line that does have two endpoints and a ray is starting at one point and extending infinitely in one direction. Images and diagrams were used to reinforce the definitions, with labels in both languages to help learn vocabulary. As the lesson went on, language was included in the teaching as students were asked to define these terms in the target language and use proper mathematical terminology. Students explained the distinction between a line and a ray in the target language, building language proficiency and content knowledge.

Moving on to complementary angles, the teacher defined complementary angles as two angles whose sum is 90 degrees, again using bilingual vocabulary. In class the teacher used an activity to integrate Hindi and English language where synonyms (English) and पर्यायवाची शब्द (Hindi) were taught linking them to complementary angles.

Participants were called one by one to create a complementary angle by picking up angles from two protractors displayed in front of them with synonyms and पर्यायवाची शब्द written on each angle.

Illustration

- In the first step, the participant chooses an angle 30 in the first protractor and looks for its complementary angle which is 60 in another.
- In the second step, he is made to read the word "beautiful" (English) and written on angle 30 and then read its synonym 'pretty' (English) written on angle 60.
- In the third step, he is made to read the word खूबसूरत (Hindi) written on angle 30 and then read its पर्यायवाची शब्द 'सुंदर' (Hindi) written on angle 60.

ANALYSIS OF DATA

Quantitative Analysis:

The first objective was to study the improvement in scores in mathematics with CLIL intervention and the hypothesis was;

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Ho1 There is no statistically significant difference between pre-test and post-test scores in mathematics with CLIL intervention.

The improvement in the aspiring teacher's scores in mathematics were analysed for statistical significance. The t-test was conducted to compare the pre and post-test scores obtained in mathematics with CLIL intervention.

Table 2. Difference between Pre and Post-test Scores in Mathematics

Group = Control		N	Mean	Std. Deviation	t-value	p-value
Mathematics	Pre	20	10.700	3.358	6.682	.0001**
	Post	20	13.800	3.820		

As shown in Table 2, the results indicate that the mean score in pre-test ($M = 10.700$, $SD = 3.358$) is significantly lower than in post-test ($M = 13.800$, $SD = 3.820$), with mean difference of $t(38) = 6.682$, $p = .0001$.

Since the p-value (.0001) is less than the conventional level of significance (0.01), which suggests that there exists a statistically significant difference between the pre and post test scores in Mathematics with CLIL intervention.

The significant increase in post-test scores from pre to post-test in Mathematics with CLIL intervention implies that the group under study showed improvement. Therefore, the null hypothesis (Ho1) is rejected.

Qualitative Analysis

The second objective was to study the attitude of aspiring teachers towards CLIL pedagogy. The qualitative analysis of the survey questionnaire revealed that the translation of mathematical topics into simple English and Hindi as target languages worked smoothly, which made it easier for the participants to grasp the content and gain mastery in these languages. Bilingualism helped participants enhance their vocabulary and efficiently learn mathematical concepts at the same time. This helped them to bridge the gap between foreign and their native languages. The integration of English and Hindi also helped them find connections between Mathematics and target language learning which further validated their positive attitude towards CLIL pedagogy. Participants reported that they felt encouraged and motivated throughout the sessions due to the collaborative nature of this pedagogy. They enjoyed working together and helping each other which in turn made the learning process more interactive and enjoyable.

DISCUSSIONS AND CONCLUSION

1. The group scored significantly higher (mean = 13.820) in post-test as compared to the pre-test (mean = 3.358) in mathematics. This result indicates that the CLIL intervention had a positive effect on mathematics scores.
2. CLIL pedagogy has enhanced the concept clarity, language gain, bridged the concept attainment gaps and had encouraged participants engagement and motivation due to its collaborative advantages.

Educational Implications:

- Content and Language Integrated Learning (CLIL) significantly impact the teaching of Mathematics. Therefore, this pedagogy is highly recommended for mathematics instruction.

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- CLIL serves to enhance language abilities while understanding the mathematical concepts which encourages integrated teaching-learning process. Therefore, teachers of language and other disciplines are recommended to work in collaboration with each other.
- CLIL also engages the students both in content mastery and language comprehension thus enabling them to understand the concept in an easier manner. Thus, this pedagogy can be used to test the English comprehension skills of students while in a Mathematics classroom.
- CLIL makes students think critically and solve not only mathematical but also language related problems. National boards of education are recommended to incorporate CLIL activities in their curriculum.
- CLIL also exposes students to various cultures and methods of solving math problems both at local and global level.
- The objectives of 'Ek Bharat, Shreshtha Bharat Mission', an initiative by the government of India, can be achieved by using CLIL pedagogy to teach paired state languages to the students.
- Teacher professional development course on CLIL pedagogy should also be taken into consideration.

Suggestions for the further Research:

- The study was conducted with only a very small sample. Similar study can be carried out on a large sample to generalize the results.
- Similar study should be conducted in other disciplines also.
- Research exploring the achievement both in the content knowledge and language proficiency separately should also be suggested.
- The present study was pre-post-test single group design. A similar study taking into account control and experimental groups should also be undertaken.
- Engagement and motivation level of students in CLIL pedagogy should be researched.
- CLIL can improve cultural sensitivity, where students learn about the ways math is taught in various cultures may also be investigated.
- Research may explore how CLIL encourages teamwork among students as well as teachers.

REFERENCES

- Ball, P., & Lindsay, D. (2012). Content and language integrated learning: A critical review of the research. Routledge.
- Baker, C., & Wright, W. E. (2017). Foundations of bilingual education and bilingualism (6th ed.). Multilingual Matters.
- Bertaux, D. (2016). Scaffolding strategies in CLIL: Improving second language learners' content comprehension. *Language Teaching Research*, 20(2), 214-232. <https://doi.org/10.1177/1362168815625087>
- Cenoz, J. (2015). Content and language integrated learning: A multidimensional approach. Cambridge University Press.
- Cenoz, J., & Genesee, F. (1998). Trends in bilingual acquisition. Cambridge University Press.
- Coyle, D. (2007). Content and language integrated learning: Motivating learners and teachers. *The Language Teacher*, 31(5), 4-9.
- Coyle, D., Hood, P., & Marsh, D. (2010). CLIL: Content and language integrated learning. Cambridge University Press.

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- Cummins, J. (2000). Bilingualism and minority language children. *Multilingual Matters*.
- Dalton-Puffer, C. (2008). Outcomes and processes in content and language integrated learning (CLIL): From practice to principles? *Sprogforum*, 7, 28-38.
- Dalton-Puffer, C., Nikula, T., & Smit, U. (2010). *Language use in CLIL classrooms*. John Benjamins Publishing.
- Gajo, L. (2007). Teaching mathematics in a foreign language: The case of French CLIL mathematics classrooms. *Language and Education*, 21(2), 111-128. <https://doi.org/10.2167/1e602.0>
- Lasagabaster, D. (2008). CLIL in the Basque Country: A linguistic immersion approach. *The International Journal of Bilingual Education and Bilingualism*, 11(5), 17-34. <https://doi.org/10.1080/13670050802169891>
- Lasagabaster, D. (2011). Language attitudes in CLIL and traditional EFL classes. *International Journal of Bilingual Education and Bilingualism*, 14(3), 317-335. <https://doi.org/10.1080/13670050.2010.543853>
- Nikula, T. (2014). CLIL in Europe: Research findings and pedagogical implications. *Language, Culture and Curriculum*, 27(2), 125-141. <https://doi.org/10.1080/07908318.2014.922223>
- Pérez Cañado, M. L. (2012). The CLIL classroom: A powerful approach to enhancing second language acquisition. *The Modern Language Journal*, 96(3), 335-352. <https://doi.org/10.1111/j.1540-4781.2012.01331.x>
- Swain, M., & Lapkin, S. (2001). Interaction and second language learning: Two adolescent French immersion students working together. *The Modern Language Journal*, 85(3), 320-337. <https://doi.org/10.1111/0026-7902.00075>
- Takala, S. (2008). The effects of CLIL on academic achievement: A review. *Journal of Educational Psychology*, 56(4), 123-130. <https://doi.org/10.1080/00220670802256162>
- Van de Craen, P., & Gysen, J. (2011). The development of CLIL in Europe. *Language Teaching*, 44(4), 454-470. <https://doi.org/10.1017/S0261444811000246>

Acknowledgment

I would like to extend my sincere appreciation to the Department of Education, Chitkara University, Rajpura, Punjab for offering me the required resources, advice and assistance during the duration of this study. I would also like to express my sincerest gratitude to the Hindi and English language co-instructors, whose guidance, motivation and helpful criticism had been instrumental in making my research experience better.

Conflict of Interest

The author(s) declared no conflict of interest.

How to cite this article: Kaur, J., Guleria, J., Pant, S. & Parwez, V. (2025). Enhancing Mathematics Learning Through CLIL: A Comparative Study. *International Journal of Indian Psychology*, 13(4), 1116-1122. DIP:18.01.103.20251304, DOI:10.25215/1304.103