Enhancing professional vocabulary acquisition through cognitive approaches in CLIL curricula

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Abstract

This study investigates the impact of cognitive strategies on professional vocabulary acquisition in CLIL curricula, employing a mixed-methods approach. Results from quantitative analysis, specifically an ANCOVA test, decisively reject the null hypothesis and reveal significant improvements in vocabulary proficiency due to targeted cognitive strategies. Thematic analysis of student feedback supports the efficacy of these strategies in creating interactive learning experiences. The Experimental Group (EG) consistently demonstrates enhanced vocabulary acquisition, particularly at advanced levels, while the Control Group (CG) shows stable proficiency with less progress. This divergence is attributed to the application of cognitive strategies by the EG. The study emphasises the importance of integrating cognitive strategies into CLIL curricula, highlighting customisation to address unique challenges. Future research should explore long-term effects on vocabulary retention, their applicability across diverse subjects, and effective methods for training educators to implement these strategies in various educational settings.

Questo studio indaga l'impatto delle strategie cognitive sull'acquisizione del vocabolario professionale nei curricoli CLIL, utilizzando un approccio misto. I risultati dell'analisi quantitativa, in particolare un test ANCOVA, respingono decisamente l'ipotesi nulla e rivelano miglioramenti significativi nella competenza lessicale grazie alle strategie cognitive mirate. L'analisi tematica dei feedback degli studenti supporta l'efficacia di tali strategie nella creazione di esperienze di apprendimento interattive. Il Gruppo Sperimentale (GS) dimostra costantemente un'acquisizione migliorata del vocabolario, soprattutto a livelli avanzati, mentre il Gruppo di Controllo (GC) mostra una competenza stabile con progressi minori. Questa divergenza è attribuita all'applicazione delle strategie cognitive da parte del GS. Lo studio sottolinea l'importanza dell'integrazione delle strategie cognitive nei curricoli CLIL, sottolineando la personalizzazione per affrontare sfide uniche. La ricerca futura dovrebbe esplorare gli effetti a lungo termine sulla ritenzione del vocabolario, la loro applicabilità in diverse materie e metodi efficaci per formare gli educatori nell'implementazione di queste strategie in vari contesti educativi.

Keywords: CLIL curricula; cognitive strategies; professional vocabulary; vocabulary acquisition

Parole chiave: curricoli CLIL; strategie cognitive; vocabolario professionale; acquisizione del vocabolario

1. Introduction

In the contemporary globalised landscape, proficiency in multiple languages is increasingly recognised as a valuable asset, facilitating engagement with diverse cultures, industries, and academic disciplines (Duarte et al., 2023; Nozhovnik et al., 2022). Among the pedagogical strategies developed to foster both linguistic competence and subject-specific knowledge, Content and Language Integrated Learning (CLIL) curricula hold a prominent position (Eslami & Geng, 2021). Alongside CLIL, various pedagogical strategies have been employed to facilitate language proficiency and subject-specific knowledge acquisition. These include immersive language programs, task-based language teaching, communicative language teaching, and technology-enhanced language learning tools (Budiman et al., 2023; East, 2015; Fang et al., 2022; Liu et al., 2023). Within this framework, the acquisition of professional vocabulary assumes a critical role, enabling students to navigate complex domains with linguistic precision and cognitive acumen (Memon et al., 2023). This involves not only understanding the specialized terminology of the L2 discipline but also comprehending the complex interplay, dynamics, and inherent obstacles within the domain.

Within the CLIL framework, the acquisition of professional vocabulary assumes a critical role, enabling students to navigate complex domains with linguistic precision and cognitive acumen (Memon et al., 2023). This involves not only understanding the specialized terminology of the L2 discipline but also comprehending the complex interplay, dynamics, and inherent obstacles within the domain. Proficiency in these aspects enables individuals to effectively communicate, problem-solve, and thrive in their professional environments, facilitating adept operation within multifaceted sectors characterized by diverse challenges, uncertainties, or interconnected elements.

Amidst the escalating demand for multilingual professionals, the urgent need to optimise vocabulary acquisition techniques within CLIL curricula becomes apparent (Filippi et al., 2020). However, a comprehensive examination of research in this domain reveals conspicuous gaps and challenges that warrant scholarly inquiry (Fajardo Dack et al., 2020). While traditional teaching methodologies have historically paved the path for language acquisition, the integration of cognitive approaches, rooted in cognitive psychology and neuroscience, emerges as a promising avenue to enhance the efficacy of vocabulary acquisition. This research was motivated by the recognition of the paramount significance of professional vocabulary acquisition within CLIL curricula and the curiosity surrounding the untapped potential of cognitive methodologies in this educational context. This study's approach was grounded in the belief that comprehending the cognitive processes underlying vocabulary acquisition can illuminate a pathway towards more effective pedagogical practices. This study employed empirical research to examine and analyse the specific research dilemma regarding how cognitive methodologies could be effectively implemented to optimise the acquisition of professional vocabulary within CLIL curricula, shedding light on strategies poised to benefit educators and learners alike.

2. Literature review

The literature highlights Content and Language Integrated Learning (CLIL) as a global educational approach grounded in sociocultural and cognitivist theories (Eslami & Geng, 2021; Gabillon, 2020). CLIL involves concurrent instruction of subject content and a second language, aiming for bilingual proficiency and deeper subject knowledge (Banegas, 2011; Coyle et al., 2010). In CLIL programs, vocabulary acquisition is crucial for mastering subject-specific language (Memon et al., 2023), emphasizing its paramount importance in enhancing language competence and subject comprehension.

This review examines CLIL methodologies for vocabulary training, considering their strengths and weaknesses. Task-Based Language Teaching (TBLT) emerges as a prominent approach, embedding language learning in meaningful tasks to boost proficiency in content-specific terminology and language skills (Borshchovetska et al., 2022; Llinares & Dalton-Puffer, 2015). However, its successful implementation may require substantial teacher training, particularly challenging in CLIL contexts (Dalton-Puffer & Smit, 2013). Corpus-based instruction emphasizes authentic language usage but requires considerable resources (Li, 2021; Corino & Onesti, 2019). Concept mapping aids comprehension but needs effective guidance (Dias et al., 2017; Kinchin, 2014). While existing literature explores CLIL methods for vocabulary training, a notable gap remains in effectively utilizing cognitive strategies for professional vocabulary acquisition in CLIL classes.

The literature extensively explores CLIL methodologies for vocabulary training, revealing a research gap in integrating cognitive strategies for enhanced vocabulary acquisition. Cognitive strategies, crucial for language retention (Zarifi & Azizinezhad, 2020), include conventional practices such as repeated exposure, flashcards, chunking, self-assessment, and real-world application (Atsari, 2017). Dunlosky et al. (2013) propose dynamic strategies for L2 vocabulary training, including mindful practice, metacognition, serendipity learning, peer-generated glossary design, conceptual artifacts, cognitive load management, semantic mapping, and interleaved practices. These varied approaches optimise the learning experience, yet their application in CLIL curricula remains unexplored. This review emphasises vocabulary's critical role in CLIL, highlighting a lack of research on integrating cognitive strategies for vocabulary training in CLIL programmes.

As such, this study aimed to experimentally investigate the efficacy of precise cognitive strategies in enhancing the acquisition of professional vocabulary within the framework of CLIL curricula. This study sought to address three research questions which were as follows:

1. How do specific cognitive strategies impact the acquisition of professional vocabulary in CLIL curricula?

2. Are there variations in the effectiveness of different precise cognitive strategies for improving professional vocabulary acquisition in CLIL settings?

3. How do students perceive and respond to the incorporation of cognitive strategies in their CLIL vocabulary learning experiences?

The hypotheses of the study are as below:

Null Hypothesis (H_0): There will be no significant improvement in the acquisition and retention of professional vocabulary among CLIL students through the purposeful incorporation of cognitive strategies.

Alternative Hypothesis (H_1): The purposeful incorporation of cognitive strategies will lead to a significant improvement in the acquisition and retention of professional vocabulary among CLIL students.

3. Methodology

This study utilised a mixed-methods research design, incorporating pre-test-post-test experimental procedures with both quantitative and qualitative data collection and analysis (Tashakkori & Teddlie, 2010). Participants were divided into an experimental group (EG), receiving instruction with specific cognitive strategies, and a control group (CG), instructed using conventional CLIL methods without these strategies. The research involved four phases: pre-test assessment, experimental intervention, post-test assessment, and student feedback. The pre-test established a baseline for participants' professional vocabulary knowledge. The EG received targeted instruction with a spectrum of cognitive strategies, addressing memory, comprehension, collaboration, and cognitive load management. These strategies were chosen to align with university students' practical needs for professional vocabulary acquisition. Independent variables were specific cognitive strategies, and dependent

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variables included professional vocabulary acquisition, retention, CLIL curriculum performance, and EG students' perceptions. Control variables ensured study validity and reliability, encompassing prior vocabulary knowledge, teaching methodologies, exposure duration, and second language proficiency.

Intervention outline

The experiment was conducted as part of the module titled "Modelling, Information, and Communication Technologies in the Digital Economy," with a credit value of 2 ECTS credits (60 academic hours). This module was delivered to second-year students majoring in IT at the State University of Trade and Economics in Ukraine during the second semester, which took place from February to May 2023, with a follow-up test assessing retained vocabulary in September 2023. Figure 1 provides the visualised flow of the intervention. The training sessions in both EG and CG were based on a predesigned list of key vocabulary and concepts (see the list via this link: https://shorturl.at/bUXY1) which was split up into three levels such as introductory, intermediate, and advanced. The decision to categorise the vocabulary in this manner served several critical purposes. Firstly, it allowed for a more straightforward and transparent approach to assessment and progress tracking, providing a clear framework that both students and instructors could follow. Secondly, the tiered structure promoted a progressive learning model. Students began with fundamental concepts and methodically advanced to more complex topics. This ensured that students developed a robust foundation before tackling more challenging materials. Moreover, the categorisation of vocabulary into distinct levels offered a personalised learning experience. Students often came to the training sessions with varying levels of prior knowledge and learning paces. By categorising the vocabulary in this way, students could select the level that matched their current proficiency. This personalised approach significantly enhanced the effectiveness of the learning process. The list was examined and validated by three experts with PhD and Doctorate degrees in IT.
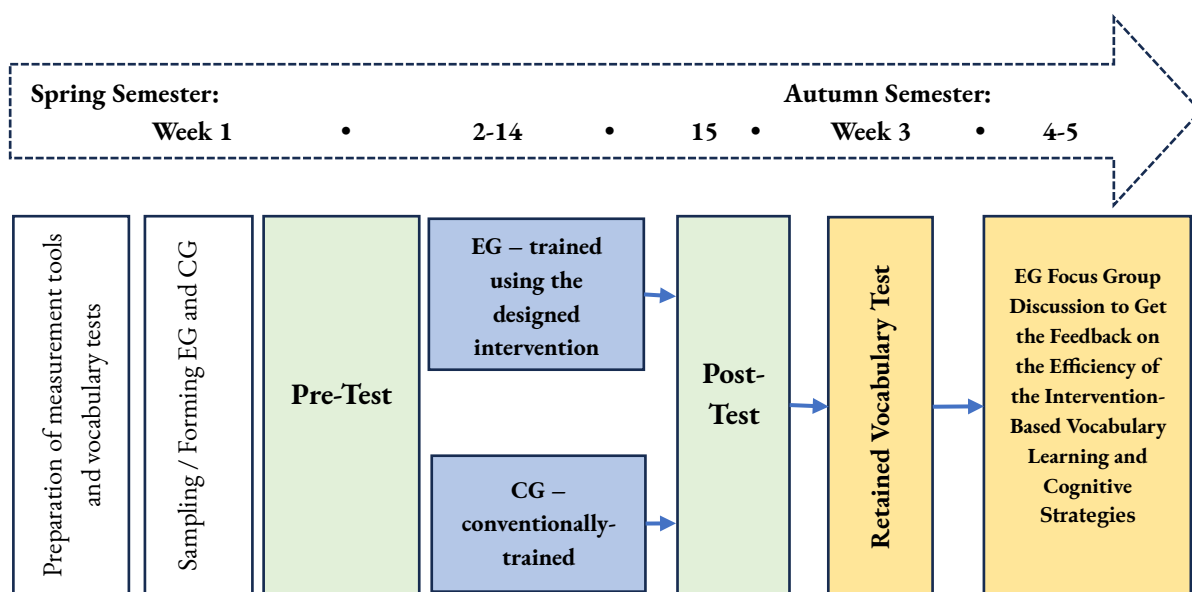

Figure 1. Visualised flow of the intervention

The specific topics, content, and cognitive strategies employed in delivering the module are detailed in Table 1.

Table 1. Topics, content, and cognitive strategies used to deliver the module

#	Topic	Content	Cognitive Strategies
1	The concept of data, information, and information flows	Understanding data fundamentals	Mindful Vocabulary Practice, Conceptual Artifacts, Peer-Generated Glossary Design
2	Databases	Introduction to databases	Flashcards, Metacognition, Chunking, Peer-Generated Glossary Design
3	Digitalisation of economy	Transition to a digital economy	Conceptual Artifacts, Real-World Application, Peer-Generated Glossary Design
4	The concept of an information system and its components	Components of information systems	Semantic Mapping, Mindful Vocabulary Practice, Peer-Generated Glossary Design
5	Types of management information systems in the digital economy	Exploring information system types	Conceptual Artifacts, Cognitive Load Management, Interleaved Practices
6	Modelling and forecasting of socioeconomic processes and systems	Learning about modelling and forecasting	Interleaved Practices, Metacognition, Concept Mapping
7	The role of the study of the digital economy, modelling, analytics, and information	Understanding the role of the digital economy	Metacognition, Self-Assessment, Vocabulary Challenges
8	Theory, design, development, and application	Theory and practical applications	Conceptual Artifacts, Real-World Application, Cognitive Load Management
9	Risks in the digital economy	Identifying risks in the digital economy	Serendipity Learning, Metacognition, Concept Mapping
10	Computer and mathematical modelling	Mathematical modelling techniques	Cognitive load management, Chunking, Self-Assessment
11	Decision-making models and methods	Understanding decision-making models	Mindful vocabulary, Interleaved Practices, Conceptual Artifacts
12	Computer mathematics	Exploring computer mathematics	Self-assessment, Flashcards, Vocabulary Challenges

Both lecturers for the EG and CG were supposed to deliver the module simultaneously, covering similar topics and content. However, the EG lecturer was tasked with incorporating the cognitive strategies outlined in Table 1 to facilitate vocabulary training. Each training session was designed by the EG lecturer using the provided training session template (refer to Appendix A). The choice of cognitive strategies within a single session could vary depending on the session's duration and objectives. It was of paramount importance to strike a balance and not overwhelm the session with an excessive number of strategies, as this could potentially hinder the learning process. Instead, the lecturer was encouraged to focus on a select few key strategies that were relevant to the session's learning objectives.

To assess students' immediate vocabulary acquisition progress, both EG and CG lecturers administered vocabulary and key concepts quizzes at the beginning and end of each training session. Sample quizzes can be found

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here: see the examples via this link: https://forms.gle/ByWsHq44Ays7n3cJ6 (the "warm-up" quiz sample) and https://forms.gle/AXoegMz7B6qDjHzF7 (the wrap-up quiz sample). To maintain consistency and minimize potential biases between the experimental group (EG) and the control group (CG), identical quizzes and procedures were used. The difference between the number of words students knew before the training and after the session was calculated to measure one-session progress in vocabulary learning. Results from both groups (EG and CG) were compared. To evaluate students' progress in retaining vocabulary over time, a vocabulary retention progress test was administered in both EG and CG after every three completed topics. The results were compared. Counterbalancing was also implemented to control for potential order effects. This involved administering the vocabulary quiz before the training in some sessions and after in others, thus ensuring that observed improvements were not solely due to quiz familiarity or fatigue. Validity and reliability of the vocabulary proficiency tests were ensured through a validation procedure, piloting, and the application of DIF and DTF analysis methods.

Sampling

A convenience sampling technique was used to form the experimental group (EG) and control group (CG), comprising second-year students enrolled in the Information Technologies course at the State University of Trade and Economics in Ukraine. To ensure statistical significance, the optimal sample size was calculated, determining that a representative sample of 49 individuals was appropriate, given a 95% confidence level and a 5% margin of error. The EG included 24 students (19 males aged 19-20 and 5 females aged 19-20), while the CG comprised 25 students (21 males aged 19-20 and 4 females aged 19-21). Both groups demonstrated homogeneity, as confirmed by the calculation of students' Grade Point Average (GPA) in English and their placement test results. A random sampling technique was employed to select 12 participants for the EG focus group discussion, consisting of 9 male and 3 female students.

Data collection and analysis

The data collection process spanned several time points, beginning with the pre-experiment stage, followed by post-treatment assessment, a three-month follow-up after the intervention, and input gathered through focus group discussions with randomly selected EG students. This study employed two comparable vocabulary proficiency tests (VPT) alongside a cognitive strategies assessment to facilitate pre- and post-treatment measurements. Additionally, a retained vocabulary knowledge test, akin to the vocabulary proficiency evaluation, was conducted to gauge vocabulary retention three months post-intervention. Each of the vocabulary proficiency tests encompassed 70 items, spanning different topics within the module and covering a range of vocabulary levels. Notably, the Differential Item Functioning (DIF) analysis revealed that certain test items displayed statistically significant differences in their functioning, with p-values ranging between 0.003 and 0.02, across the pre-test, post-test, and retained vocabulary proficiency evaluations. However, the Differential Test Functioning (DTF) analysis indicated minimal overall variance for all test sections, with values ranging from 0.04 to 0.06, remaining below the threshold of 0.07. This proves that the DTF effect had a negligible impact on the assessments (Nugent, 2017).

The Cognitive Strategies Assessment (CSA) tool, accessible through this link: (https://forms.gle/6ov-gnm5488ib7CHg9), was employed to enhance the test-retest reliability and overall consistency of our study. It encompassed 23 items designed to gather quantitative data and investigate the application of cognitive strategies in vocabulary learning by students. To ensure its effectiveness, the CSA tool underwent a rigorous review for

both face and content validity. The content validity index for this tool was calculated at an impressive .915, alongside Fleiss's Kappa coefficient of .473. Furthermore, the reliability of the CSA tool was established through Cronbach's α, which demonstrated a high level of consistency with a value of 0.907. These values for validity and reliability assessment showed the tool's suitability and effectiveness in evaluating how students utilise cognitive strategies in their vocabulary acquisition processes.

The ANCOVA test was employed to determine the significant impact of incorporating cognitive strategies (independent variable) on the acquisition and retention of professional vocabulary (dependent variables). This analysis controlled for initial vocabulary proficiency (covariate). Given the use of multiple cognitive strategies (independent variables) and the goal of assessing their combined effect on vocabulary acquisition (multiple dependent variables), ANCOVA was the suitable statistical method. The *jamovi* computer software (Version 2.2.5) was used to analyse the statistical data drawn from the vocabulary proficiency tests and CSA tool.

To address the third research question, which explored students' perspectives and experiences resulting from the integration of cognitive strategies into vocabulary learning within the CLIL curriculum, a live-administered focus group discussion was conducted based on the survey questionnaire presented in Appendix B. This survey was designed with a cross-sectional approach and comprised fourteen survey questions, incorporating a combination of open-ended inquiries and Likert scale-based queries. This methodology was deliberately chosen to extract comprehensive insights into students' thoughts, experiences, and perceptions, enabling a more in-depth and exploratory data analysis. The survey questionnaire underwent a thorough expert validation process and exhibited strong face and content validity, indicated by an Item-Level Content Validity Index (IL-CVI) of .904 and a Fleiss's Kappa coefficient of .513. These results affirm the questionnaire's reliability and suitability for rigorous statistical analysis.

Both the Cognitive Strategies Assessment (CSA) and the focus group discussion survey questionnaire demonstrated a consensus among experts, aligning with the findings presented by Yusoff (2019) and further validating their reliability and appropriateness for statistical utilisation within the scope of this study.

To analyse the data collected from the discussions, this research team members followed a two-step process and combined both quantitative and qualitative analytical methods. One team member was responsible for transcribing the discussions, a task facilitated by the Otter App (Otter, 2020). The other team member employed Dedoose qualitative analysis software (SocioCultural Research Consultants, 2023) to systematically categorise and code the responses. For the Likert scale-based questions, it was conducted quantitative analysis to distinguish the central tendencies in students' responses. This approach allowed to quantify and understand the prevailing sentiments and attitudes expressed in the survey. In parallel, the qualitative analysis was conducted based on the open-ended responses, identifying recurrent themes, key concepts, and emerging patterns within the data. This qualitative analysis enriched our understanding of the nuanced perspectives and experiences shared by the participants.

The analysis was enhanced through the implementation of triangulation, a method employed to bolster the validity and reliability of the findings. This was achieved by scrutinising data collected at various time points during the study, which encompassed test scores and students' responses. This approach involved evaluating both convergent and divergent data to ensure a comprehensive and well-rounded examination of the subject matter of the research.

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Ethical considerations

Before engaging in the CSA survey and focus group discussion, participants received clear information about the voluntary nature of their involvement and the confidentiality measures in place to protect their responses. Participants willingly consented to the use of their responses in academic publications. To safeguard privacy and confidentiality, all data collected were accurately handled, and any personally identifiable information was anonymised before being shared or published.

4. Results

The study decisively rejected the null hypothesis (H_0) through an ANCOVA test, signifying that, after accurately accounting for pre-test scores, the intervention (Programme) exerted a substantial and statistically significant positive influence on post-test scores. This robustly supported the notion that the intervention was effective in enhancing post-test performance when compared to the control group. Moreover, the effect size, which stood at a relatively large value of 0.44, bolstered the practical importance of the intervention's impact.

Table 2. Results based on ANCOVA test performed before and after the intervention

ANCOVA – Post-test	Sum of Squares	df	Mean Square	F	p	η^2	ω^2
Overall model	163073	2	81536.3	8010.4	<.001		
Pretest	162426	1	162426.4	15972.6	<.001	0.990	0.990
Programme	646	1	646.2	63.5	<.001	0.44	0.42
Residuals	956	94	10.2				

A two-factor Analysis of Covariance (ANCOVA) was conducted to examine the effect of the intervention (Programme to train students to use the specific cognitive strategies to acquire professional vocabulary within CLIL curricula) on post-test scores while controlling for pretest scores drawn from the vocabulary proficiency tests (VPT) and cognitive strategies assessment (CSA) tool. As can be seen in Table 2, the overall model was statistically significant, $F(2, 94) = 8010.4, p < .001$. This suggests that there were significant differences in post-test scores among the groups. Controlling for pretest scores in the VPT and CSA, the intervention (Programme) had a significant effect on post-test scores, $F(1, 94) = 63.5, p < .001$.

The effect size ($\eta^2 = 0.44$) was relatively large, indicating a substantial impact of the intervention. Pre-test scores had a substantial influence on post-test scores, $F(1, 94) = 15972.6, p < .001$, and accounted for most of the variance ($\eta^2 = 0.990$). Overall, the analysis revealed that the intervention (Programme) significantly improved post-test scores, even when controlling for pretest scores, and the effect size indicated a substantial practical significance of the intervention.

4.1 Differential efficacy of specific cognitive strategies in enhancing professional vocabulary acquisition in CLIL settings

Statistical analysis of the wrap-up quizzes conducted after each training session revealed variations in the effectiveness of specific cognitive strategies. Notably, certain techniques, including mindful vocabulary practice, conceptual artifacts, concept mapping, peer-generated glossary design, real-world application, cognitive load management, and interleaved practices, demonstrated higher efficiency in facilitating vocabulary acquisition.

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These techniques were particularly impactful in accelerating the acquisition of advanced vocabulary items, leading to a notable increase in the percentage of key vocabulary items learned within a single training session. The provided data in Figure 2, illustrates the progression of vocabulary acquisition in the Experimental Group (EG) and the Control Group (CG) across multiple weeks. The data demonstrates the percentage (averaged and rounded) of key vocabulary items acquired for introductory, intermediate, and advanced vocabulary categories in both groups over a 14-week period.
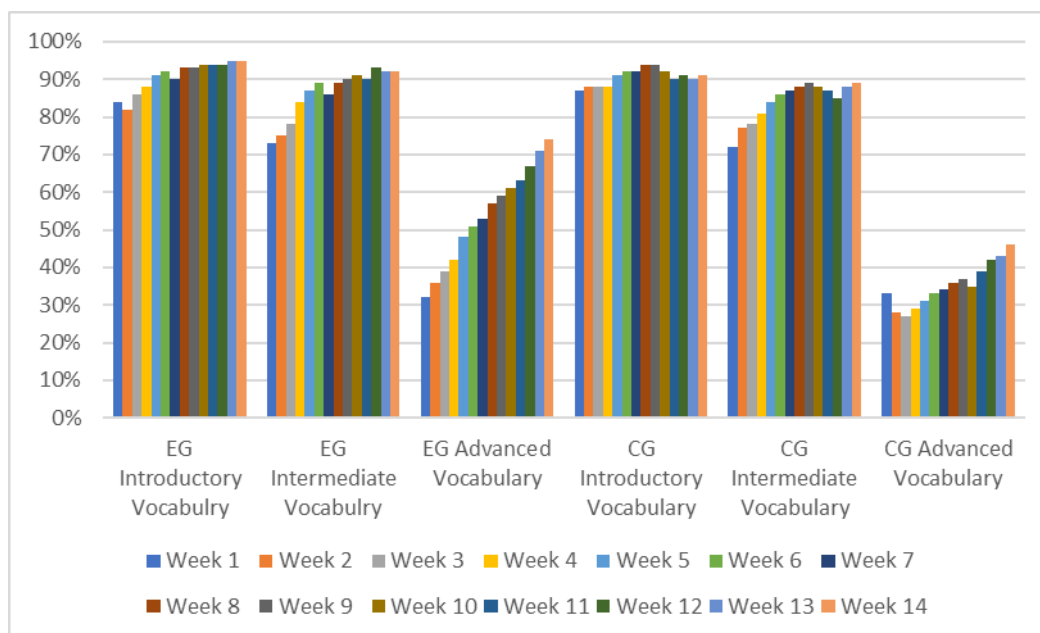
Figure 2. Dynamics of key vocabulary acquisition based on wrap-up quiz results
(averaged and rounded percentages)

In Figure 2, the data reveals notable trends in vocabulary acquisition for both the Experimental Group (EG) and Control Group (CG) over 14 weeks. As for the introductory vocabulary, EG students initiated the study with a strong grasp of introductory vocabulary, starting at 84% proficiency. Their performance consistently improved throughout the 14 weeks, culminating in an impressive 95% proficiency. In contrast, CG students began with an already high 87% proficiency in introductory vocabulary, with proficiency levels remaining stable and ending at 91%. Regarding the intermediate vocabulary, EG students entered the study with a 73% proficiency in intermediate vocabulary. Over time, they demonstrated steady progress, with minor variations in proficiency from week to week. By the end of the study, they had significantly improved to achieve a commendable 92% proficiency. Similarly, CG students began with a 72% proficiency in intermediate vocabulary. Their proficiency remained relatively stable, showing slight fluctuations, and reached 89% proficiency by the study's conclusion. Concerning the advanced vocabulary, EG students initially exhibited a 32% proficiency in advanced vocabulary. However, their acquisition rate showed considerable improvement as the study advanced, with occasional minor fluctuations. Ultimately, they accomplished a noteworthy 74% proficiency by the end of the 14 weeks. In contrast, CG students began with a 33% proficiency in advanced vocabulary. Their acquisition rate also exhibited gradual improvement with some fluctuations. By the study's end, they reached a 46% proficiency in advanced vocabulary.

The data consistently shows the EG's clear superiority in all vocabulary categories (Introductory, Intermediate, and Advanced), confirming the positive impact of the intervention on vocabulary acquisition. EG students consistently demonstrated improved vocabulary acquisition across all proficiency levels, with the most significant gains in advanced vocabulary. In contrast, CG students maintained relatively stable proficiency levels with less notable improvement, particularly in advanced vocabulary. These results highlight the substantial impact of cognitive strategies in the EG, especially in advanced vocabulary. The consistent improvement in EG performance affirms the intervention's success and its efficacy in enhancing vocabulary acquisition.

4.2 Results drawn from the retained vocabulary test

The test results presented in Figure 3 highlighted that the EG outperformed the CG in terms of vocabulary retention. Specifically, in the top category (90 - 100 ECTS grades), the EG had 6 students (25%) compared to just 1 student (4%) in the CG. Moreover, the EG had a greater number of students in the 81 - 89 ECTS category (12 students (50%) in the EG vs. 8 (33%) in the CG). In contrast, the CG had more students in the 71 - 80 ECTS category (12 students (50%) in the CG vs. 4 (17%) in the EG) and the 61 - 70 ECTS category (3 students (13%) in the CG vs. 2 (8%) in the EG). The data in Figure 3 suggests that the intervention had a positive effect on vocabulary retention, as evidenced by the higher number of EG students achieving higher ECTS credits in comparison to the CG. This indicates that the cognitive strategies and techniques employed in the EG contributed to better vocabulary retention compared to the control group.
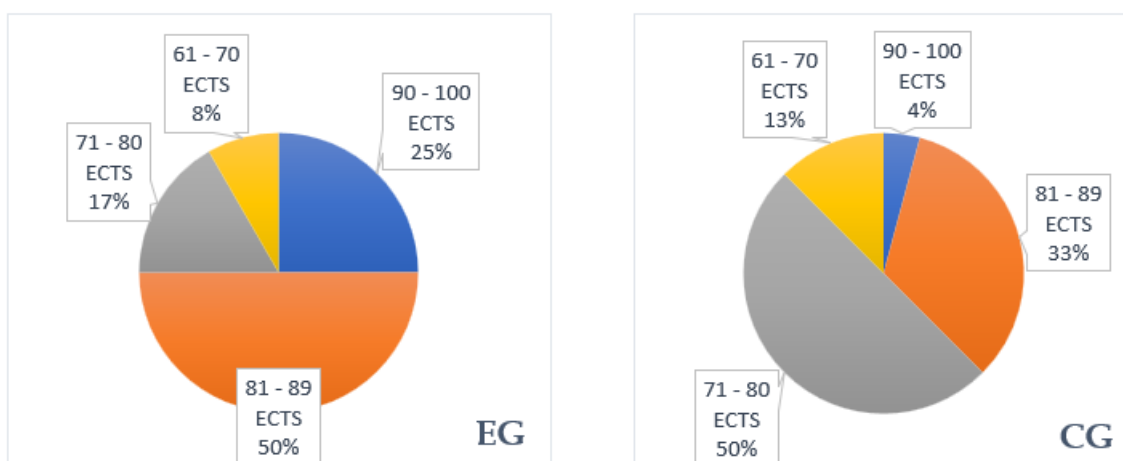

Figure 3. Results from the retained vocabulary test in the EG and CG

This analysis provides insights into the effectiveness of the intervention, highlighting the positive impact on long-term vocabulary retention in CLIL settings. The higher number of EG students achieving the top ECTS grades underscores the significance of implementing cognitive strategies in vocabulary learning.

4.3 Students' perceptions and responses to the integration of cognitive strategies in CLIL vocabulary learning experiences

This section provides a thematic summary of student responses from the Student Feedback Survey on Vocabulary Learning and Cognitive Strategies, conducted during the focus group discussion. When discussing pre-

intervention expectations, students expressed generally positive outlooks, anticipating some improvement in vocabulary (9 out of 12 students). However, uncertainty about the extent of improvement was noted among 2 students. A significant majority (10 out of 12 students) held optimistic expectations, firmly believing in the substantial impact of cognitive strategies.

A commendable rating of 4 out of 5 was assigned by a majority of students (11 out of 12) for the effectiveness of cognitive strategies. Notably, mindful vocabulary practice, conceptual artifacts, peer-generated glossary design, interleaved practices, and real-world application were consistently praised as the most beneficial. Three respondents found the concept mapping strategy somewhat intricate, impacting its usage. Overall, the application of cognitive strategies was depicted as enhancing interactivity and fostering a more enjoyable learning experience. Exemplary student responses include:

> "I thought the cognitive strategies worked really well—I'd give them a solid 4 out of 5".
> "I really liked mindful vocabulary practice, conceptual artifacts, peer-generated glossary design, and real-world application. They made learning vocabulary more interesting and easier to remember".
> "I gotta admit, concept mapping was a bit confusing for me, so I didn't use it much".

Examining students' test preparation methods revealed a diverse array, including note review and flashcard usage. The majority (8 out of 12 students) attributed test success to the facilitative effects of cognitive strategies in enhancing vocabulary retention. While student performance exhibited variations, a substantial portion (10 out of 12 students) categorized their performance as 'Good.' In suggesting improvements, students recommended increased interactive group activities for fortified vocabulary comprehension. Some students noted challenges related to the intervention's pace, suggesting occasional rush. Expressing overall contentment, the majority (11 out of 12 students) assigned a favourable rating of 4 out of 5 to the program. Furthermore, there was a unanimous willingness to recommend the use of cognitive strategies in vocabulary training, underscoring their endorsement. In additional comments, students stressed the significance of employing a diverse array of cognitive strategies, valuing their versatility for an engaging learning process.

5. Discussion

The present study aims to evaluate the efficacy of targeted cognitive strategies in enhancing the acquisition of professional vocabulary within CLIL curricula. This research addresses the specific challenges and opportunities within the CLIL context, introducing a novel dimension by instructing students in tailored cognitive strategies for vocabulary acquisition. The findings contribute not only to effective teaching strategies within CLIL but also have broader implications for language education and vocabulary acquisition, particularly in multilingual educational settings.

The results of this study reveal several crucial findings that underscore the value of integrating cognitive strategies into CLIL vocabulary learning experiences. First and foremost, the application of specific cognitive strategies tailored to vocabulary acquisition within the CLIL context demonstrated a substantial and positive impact on vocabulary proficiency. The Experimental Group (EG) outperformed the Control Group (CG) across all categories of vocabulary proficiency (Introductory, Intermediate, and Advanced) throughout the 14-week study period. This performance improvement was particularly noteworthy in advanced vocabulary, indicating that the intervention had the most pronounced effect on this challenging category. These findings emphasise

the effectiveness of cognitive strategies in elevating vocabulary acquisition to higher proficiency levels. The retained vocabulary test results further validated the efficacy of the intervention. A greater percentage of students in the EG achieved higher ECTS grades, indicating that cognitive strategies contributed significantly to vocabulary retention. This not only reinforces the practical benefits of the intervention but also underscores the long-term impact of cognitive strategies on vocabulary retention. Second, the thematic analysis of student responses highlighted their positive perceptions and experiences with cognitive strategies. Students had optimistic expectations about the intervention's impact on vocabulary improvement, reinforcing their receptivity to this approach. Their feedback revealed that the cognitive strategies employed in the intervention were deemed highly effective, particularly strategies like mindful vocabulary practice, conceptual artifacts, peer-generated glossary design, interleaved practices, and real-world application.

The key findings of this study align with and extend existing literature on language acquisition and cognitive strategies (Hayashi, 2019; Tapia & Duñabeitia, 2021). Previous research has emphasised the importance of using active and engaging learning techniques to enhance vocabulary acquisition (Borshchovetska et al., 2022; Karousou & Nerantzaki, 2020; Pellicer-Sánchez, 2020). The strong positive response from students to strategies resonates with established research that highlights the effectiveness of these techniques in vocabulary learning (Bošnjak Terzić & Pavičić Takač, 2020; Mukoroli, 2011; Naeimi & Foo, 2015; Susanto, 2017). This alignment between our findings and existing literature strengthens the validity of our results. Furthermore, this study adds a novel dimension to the CLIL context, aligning with emerging research that underscores the need for tailored approaches within CLIL programmes (Hemmi & Banegas, 2021). As CLIL settings become increasingly prevalent worldwide, there is growing interest in optimising these programmes (Darvin et al., 202; Woźniak, 2017). The use of cognitive strategies explicitly designed for CLIL settings is a promising step in this direction. Our research supports the notion that CLIL programmes can benefit significantly from innovative, tailored strategies, aligning with the broader vision of optimising multilingual educational settings. The study contributes a novel dimension to the CLIL context, aligning with emerging research that emphasises the need for tailored approaches within CLIL programmes.

6. Conclusion

The study conclusively rejected the null hypothesis (H_0) using an ANCOVA test, indicating that targeted cognitive strategies exert a significant and positive influence on vocabulary proficiency, with crucial efficacy in advancing vocabulary acquisition. Thematic analysis of student feedback confirmed the efficacy of these strategies, emphasising their role in fostering interactive and engaging learning experiences. Notably, the Experimental Group (EG) consistently demonstrated substantial improvements in vocabulary acquisition across all proficiency levels, with the most pronounced advancements occurring in advanced vocabulary. In contrast, the Control Group (CG) generally maintained relatively stable proficiency levels, with less pronounced growth, particularly in advanced vocabulary. These differential outcomes can be attributed to the implementation of cognitive strategies by the EG students. This research underscores the vital role of integrating cognitive strategies within CLIL curricula as a means to enhance vocabulary acquisition. Furthermore, it highlights the importance of tailoring these strategies to address the unique challenges within CLIL settings. Further research is necessary to explore the long-term effects of cognitive strategies on vocabulary retention and their impact on different subject areas within the CLIL framework. Additionally, investigating the most effective methods for training educators in the implementation of these strategies and their scalability in diverse educational settings could yield valuable insights.

7. Recommendations

Researchers and practitioners in the field of CLIL and vocabulary acquisition can consider the following actionable recommendations:

- Researchers should continue to explore and develop specific cognitive strategies tailored to vocabulary acquisition within CLIL contexts. Researchers should conduct longitudinal studies to investigate the long-term effects of cognitive strategies on vocabulary retention in CLIL settings. Researchers should collaborate across disciplines to explore the impact of cognitive strategies on various subject areas within the CLIL framework.
- Practitioners should integrate these strategies into CLIL curricula to enhance vocabulary learning. Practitioners and educational institutions should consider implementing teacher training programmes to equip educators with the skills and knowledge required to effectively integrate cognitive strategies into their teaching practices. Both researchers and practitioners should examine the scalability and adaptability of cognitive strategies to diverse educational settings.

8. Limitations

While this study provides valuable insights into the effectiveness of cognitive strategies in CLIL vocabulary acquisition, several limitations should be acknowledged. These were as outlined: (a) The study was conducted in a single educational institution, which may have unique characteristics and practices that influenced the results. Variability in CLIL program designs and contexts should be considered in future research; (b) The study did not have control over external factors that could influence vocabulary acquisition, such as students' prior language proficiency, motivation, or exposure to the target language outside the classroom; (c) The cognitive strategy intervention required additional resources, including instructional materials and time for teacher training. Implementing such strategies in resource-constrained educational settings may be challenging.

Acknowledgments

Appendices

Appendix A. Training session plan template for lecturers

(Customisation of this template is encouraged to align it with the specific topic and objectives of your English training session. Lecturers are expected to tailor the cognitive strategies to meet the unique needs of their students and the content of the training session)
Topic: [Specify the topic or theme of the lesson]
Objective: [Clearly state the learning objectives for the lesson]
Materials: [List any materials or resources needed for the lesson]
Duration: 90 minutes
Cognitive Strategies: [Specify which cognitive strategies you'll incorporate into the lesson]
Procedure:

1. Introduction (5 minutes):
- Greet students and introduce the topic.
- Activate prior knowledge related to the topic using a pre-designed vocabulary quiz.
- State the learning objectives for the lesson.

2. Vocabulary Practice (15 minutes):
- Use mindful vocabulary practice to engage students in focused vocabulary activities.
- Incorporate flashcards for visual learning.

3. Reading/Listening Activity (15 minutes):
- Introduce a reading or listening activity related to the topic.
- Encourage metacognition by asking students to reflect on their reading/listening strategies.

4. Discussion (10 minutes):
- Facilitate a class discussion on the reading/listening material.
- Encourage students to chunk complex ideas into manageable parts.

5. Conceptual Understanding (10 minutes):
- Use conceptual artifacts to help students grasp key concepts.
- Encourage students to create their own visual representations.

6. Cognitive Load Management (10 minutes):
- Teach strategies for managing cognitive load during complex tasks.
- Implement interleaved practices to reinforce multiple concepts.

7. Semantic Mapping (10 minutes):
- Have students create semantic maps to visualise word relationships.
- Discuss the importance of word usage within context.

8. Review and Assessment (10 minutes):
- Review key vocabulary and concepts covered in the lesson.
- Assess student understanding through a 5-minute quiz.

9. Conclusion (5 minutes):
- Summarise the main points of the lesson.
- Discuss how cognitive strategies were applied and their benefits.

10. Homework/Extension (if applicable) [Specify any homework or extension activities for students to complete outside of class]:
- Assign homework or extension activities related to the lesson.

11. Assessment: [Decide how student understanding will be assessed, e.g., through quizzes, class participation, or assignments]

Appendix B. Student feedback survey on vocabulary learning and cognitive strategies

Section 1: Pre-Intervention Expectations

1. What were your expectations regarding vocabulary improvement before the intervention?
2. Did you have any specific expectations from the cognitive strategies used in the intervention?

Section 2: Intervention feedback

1. On a scale of 1-5, how effective did you find the cognitive strategies used in the intervention for improving vocabulary? (1 = Not Effective, 5 = Very Effective)
2. Which specific cognitive strategies did you find most helpful, and why?
3. Were there any cognitive strategies that you found less helpful or confusing? Please explain.
4. Did the use of cognitive strategies enhance your overall learning experience? How?

Section 3: Retained vocabulary test

1. How did you prepare for the retained vocabulary test?
2. Did you find that the cognitive strategies used during the intervention helped you retain vocabulary for the test?
3. What was your overall performance on the retained vocabulary test? (Provide options like Excellent, Good, Average, Poor, Failed)

Section 4: Suggestions and Improvements

1. Do you have any suggestions for improving the vocabulary acquisition process or the use of cognitive strategies in future sessions?
2. Were there any challenges or issues you faced during the intervention or the retained vocabulary test that you'd like to address?

Section 5: Overall experience

1. How satisfied were you with the intervention and vocabulary learning process? (1 = Very Dissatisfied, 5 = Very Satisfied)
2. Would you recommend the use of cognitive strategies in vocabulary training to other students?

Section 6: Additional comments

1. Is there anything else you would like to share about your experience with vocabulary learning and the intervention?

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