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Evaluating the Integration of Technical and Language Learning through CLIL-Based Cross-Curricular Writing for Marine Engineering Cadets

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ABSTRACT

In the paper examines the effect of cross-curricular writing activities in a CLIL programme on the writing skill of the marine engineering cadets. A quasi experimental design was used with 60 second-year cadets in a maritime academy over a 12-week semester. The experimental group participated in CLIL-based technical writing tasks, such as the "Incident Report Simulation," in which domain-specific content was combined with guided language learning. Pre- and post- tests were used to evaluate the change in writing competence and questionnaires as well as semi-structured interviews were employed to elicit qualitative data. Quantitative analysis showed a statistically significant improvement of 21.2 points (42.34%) in writing score, and supported increasing use of vocabulary, structural clarity and technical accuracy. The qualitative findings showed enhanced technical understanding, increased confidence in writing as well as high levels of engagement with digital instruments and peer feedback. Although there are challenges in reconciling technical precision and linguistic coherence in the process, the results support the educational value of CLIL-based cross-curricular writing as a pedagogical tool for reinforcing both technical and communicative skills in maritime academies.

Keywords: *CLIL, Cross-Curricular Writing, Marine Engineering Cadets, Technical Communication, Writing Skills, Maritime Education*

1. INTRODUCTION

The world shipping business, which is the basic part of the world trade and industry, they need technically qualified seafarers as well as English language competence because it is considered to be the medium of communication in the maritime field. "It is important that the language we are communicating in at sea is understood by all in order to maintain safety, efficiency and compliance with international regulations" (Simpson, 2017). Therefore, the teaching of language, along with specialization knowledge and professional skills, must be the focus for cadets' education. One potential pedagogical solution for this dual need is that of Content and Language Integrated Learning (CLIL). CLIL enables the co-learner of content and language, hence develops more integrated language and content learning than traditional content-based or language-based learning approaches which separate the two (Coyle et al., 2010). Particularly in maritime education, which demands precise understanding and use of technical communication, CLIL becomes an extremely useful tool for the integration of technical education and language. Studies suggests that CLIL promotes cognitive involvement as students need to process content in greater depth, along with giving students the possibility of viewing language learning in a meaningful context (Dalton-Puffer, 2011; Navarro-Pablo & García-Jiménez, 2019). Nevertheless, its application in maritime studies, including writing, is still not fully developed yet.

Cross-curricular writing, as a component of the CLIL approach to teaching and learning, aims to involve students in writing activities of a cross-disciplinary nature with the aim of facilitating the cognitive content of topics, at the same time bringing improvement in linguistic proficiency. With the advent of this method, there is evidence that students become better able to correlate in formation, think critically, assimilate evidence and articulate a coherent account (Linares et al., 2012). Cross-curricular writing tasks for cadets studying marine engineering, for example, might include writing technical reports, safety documentation and reflective journals that combine technical content with language development. Nonetheless, the

effectiveness of cross-curricular writing, especially how it can potentially develop writing skills among marine engineer cadets, has not been fully examined. This study seeks to redress this research gap by examining the effects of cross-curricular writing on the academic writing performance of marine engineer cadets, taking a CLIL approach. The study will analyse the level of technical and language based skills developed through these writing tasks and can offer guidance on how to successfully embed cross-curricular writing into maritime courses. Moreover, this study will incorporate cadets' and instructor' perceptions of cross-curricular writing in their training, thus providing a more holistic view of the pragmatic aspects of the classroom.

2. REVIEW OF LITERATURE

The importance of integrating Content and Language Integrated Learning (CLIL) into the maritime education could not be overemphasized due to the fact that industry needs graduates who are technically proficient and fluent in English needed for international communication. CLIL, that is, subject matter learning through language, has been found to be beneficial in various educational settings, including vocational and technical education, as it helps CLIL, that is, subject matter learning through language, has been found to be beneficial in various educational settings, including vocational and technical education, as it helps learners attend to the problem-solving process, problem presentation and representation, and the problem itself (Schwab et al., 2011). Studies have shown that CLIL promotes cognitive engagement, and forces learners to process content more deeply as they are learning language (Dalton-Puffer, 2011). In nautical degrees, in which English specialised language and accurate communication are essential, CLIL provides a twofold experience that enables cadets to develop the skills required for successful performance in a globalized context (Navarro-Pablo & García-Jiménez, 2019).

There is a consensus that cross-curricular writing, within the context of CLIL both supports general language growth and improves the social and academic outcomes. These pedagogic practices encompass interdisciplinary tasks which obligate learners to draw on, and express, their knowledge in a logical and connected fashion (Llinares, Morton, & Whittaker, 2012). In relation to maritime education, cross-disciplinary writing exercises such as technical reports, safety procedures, reflective writing and problem-based writing not only consolidate technical understandings but also offer contexts for real language use. This is key in training cadets for being able to communicate effectively in the maritime industry as clear and accurate writing is paramount for safety and compliance at international level (Sánchez-Hernández & Carrasco, 2020). Despite its acknowledged advantages, there is still a lack of studies that is dedicated to exploring cross-curricular writing practices in CLIL in technical and vocational education, in this case maritime education.

Effective writing is perhaps one of the most valuable skills to have for a maritime education. Authentic writing: writing based on personal experience Writing also plays a vital role in documenting procedures and reporting events, and an effective way of meeting compliance with international best practice (Simpson, 2017). However, curricular consequences of cross-curricular writing relative to developing the writing skills of marine engineer cadets with a highly specialized professional identity have not been extensively addressed in the literature. A recent investigation by García et al. (2023) encouraged the use of digital tools and platforms in CLIL cross curricular writing tasks. This use of technology is designed to enrich writing by offering interactive experiences, such as writing incident reports through simulation programs or creating digital portfolios of work across content areas. In addition to this, digital platforms enable peer review and collaborative writing, which is fundamental to train the teamwork and communicative skills demanded in maritime field (García et al., 2023). The results of the study indicate that technology-enhanced cross-curricular writing tasks enhance writing achievement and metalanguage knowledge of cadets, and there is a statistically significant difference between the two instruction models in terms of language proficiency. This study add value to the literature by filling the above gap and providing pragmatic implications for maritime academies planning to re-conceptualize curricula to meet industry requisitions. In general, although existing research highlights the advantages of CLIL and cross-curricular writing for improving both language and content learning simultaneously, there is still need for research to be conducted with a focus on the use of these approaches within maritime education. Integrating digital tools: The planned investigation of the integration of digital tools may have the potential to revolutionize the teaching of writing in a context of CLIL education for marine engineer cadets, and provide them with the necessary skills to meet the challenges of the today's global maritime industry.

3. METHODOLOGY

Quasi- experimental method was employed to evaluate the effect of cross-curricular writing activity in CLIL for the marine engineering cadets. Sixty second-year cadets were randomly assigned to two groups: the experimental group was taught technology integrated language writing practices, while the other one followed traditional course design over a 12-week period. Additionally, pre-and-post-tests assessed writing competence, and a structure- and vocabulary-quality rubric was used. Qualitative feedback was also obtained through a questionnaire and semi-structured interviews. We used SPSS for quantitative analysis and thematic analysis for interview answers.

CLIL-Based Activity: "Incident Report Simulation: Writing for Safety and Compliance".

As one of the most effective and context-sensitive tasks performed during the CLIL cross-curricular writing intervention, it

is possible to mention the "Incident Report Simulation: Writing for Safety and Compliance". The purpose of the exercise was to provide the mariners-in-training with authentic, real-world maritime content that would support both professional and language development objectives for marine engineering cadets.

Design and Implementation of the Activity

In this activity, cadets were to make decisions based on simulated incidents at sea, such as engine failures, fuel contamination, electrical failure, or safety violations. These situations were specifically chosen to simulate typical operational stresses that may be experienced by marine engineers on-board ship. The cadets must prepare complete incident reports, in line with International Maritime Organization (IMO) requirements and maritime communication procedures.

To assist Cadets three interlaced aspects were included in the practice:

Component	Description
Technical Element	Cadets studied technical manuals, standard operating procedures, and safety protocols related to the simulated incident. This reinforced their technical understanding of the incident scenario.
Language Support	A pre-writing session focused on essential technical vocabulary, the structure of formal reports, and language scaffolds. Model reports and structured templates were provided to guide writing.
Collaborative Dimension	Cadets initially wrote reports individually and then engaged in peer review using digital platforms such as Google Docs or Moodle forums. Peers provided feedback on both language accuracy and technical content.

The last reports were assessed based on rubrics measuring correct technical content, correct use of vocabulary, grammatical accuracy, report organisation, and communication of information. It was performed in the 4th and 8th week of the 12-week intervention, to enable iterative enhancement.

Impact on Learning Outcomes

This simulated exercise activity is designed to enhance cadets' capacity to write in a technical manner by using engaging and real life scenarios. Cadets participating in realistic reporting exercises showed improvements in:

Component	Description
Conceptual Knowledge	They transfered knowledge into application contexts, i.e., scenario-based writing, and their understanding of naval work became more efficient.
Language development	They employed tailored maritime lexis, formal register and report structuring and both linguistic accuracy and fluency were enhanced.
Engagement and Motivation	Students were more motivated when they saw that the task was relevant to the real world, and more willing to be responsible for their learning.

Value of this task was confirmed by cadet responses in post-task interviews. Shipping writing the incident report also helped me learn how to write clearly in real life. I am now more confident writing out tech documents using English. The incorporation of digital feedback mechanisms also enhanced the learning experience by encouraging collaboration and reflective writing.

Relevance to CLIL Framework

One such CLIL-friendly activity is the Incident Report Simulation activity, which is a demonstration of content, communication, cognition, and culture. The reason that cadets learned about merchant shipping was not simply to increase the knowledge in their heads, but language facilitated the building of knowledge and enabled it to circulate in professional networks. This integrated approach enabled students to respond to the communicative needs of the waterborne industry, for which, in fact, the particular accuracy and precision of the language may be equally critical.

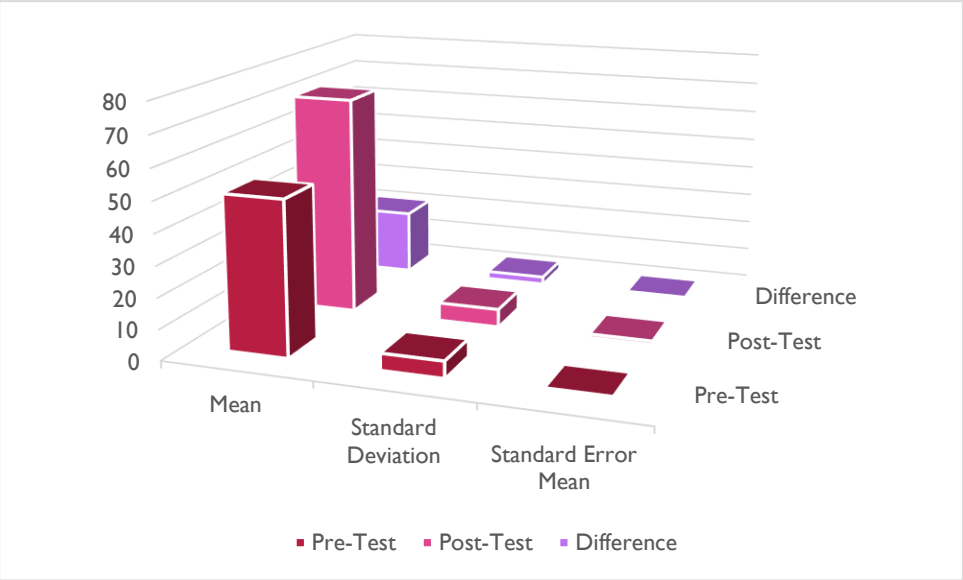
Results and Discussion: Simulation of Incident Report and Writing Performance

In order to assess the effectiveness of the CLIL-based "Incident Report Simulation" activity in terms of enhancing the writing skills of the marine engineering cadets, a pre-test and post-test were carried out through the application of a technical writing rubric which evaluated the clarity, technical accuracy, vocabulary, coherence, and organisation of the texts. The data were quantitatively analyzed with SPSS (Paired Samples t-Test) and also corroborated by qualitative feedback obtained through interviews with cadets and observations.

SPSS Score Analysis

The experimental group (N = 30), which completed the Incident Report Simulation as part of the 12-week CLIL intervention, demonstrated a **significant improvement** in writing scores:

Test	Mean	Standard Deviation	Standard Error Mean
Pre-Test	50.1	5.41	0.99
Post-Test	71.3	5.87	1.07
Difference	21.2	2.48	0.45



The data reported in Table 4 indicate a remarkable enhancement in the writing ability of the marine engineering cadets after they were subjected to the CLIL-based exercise 'Incident Report Simulation; Writing for Safety and Compliance'. The average pre-test score was 50.1, which represented cadets' mean performance on the technical writing pre-test prior to the intervention. With a standard deviation of 5.41, individual scores vary moderately, and with a standard error mean of 0.99, the quality of the estimate of group-based performance is reasonably good. Average post-test scores post-intervention spiked to 71.3, representing an impressive increase in writing quality. There was a slight increase in the standard deviation to 5.87 (slightly wider spread of scores), but not for much of the group. The 1.07 mean SE on the other hand still evidenced that the mean score still is a good representative of the group proficiency after the activity.

The difference between the pre-test and post-test average scores was 21.2 points, or an improvement of 42.34% on writing proficiency. Such a large increase was significantly reliable whose standard deviation was 2.48, SE was 0.45, suggesting that the gain was less varied, and the result was stable. These results indicate that Incident Report Simulation was very successful in improving the technical–linguistic aspects of cadets' writing. The results support that the combination of the technical content and language teaching in the CLIL approach has good influence on the education, especially on professional field-specific communication abilities that are needed for maritime industry.

4. QUALITATIVE OBSERVATIONS

Besides the quantitative indicators, data collected from semi-structured interviews emphasized several issues that shaped the discussion.

Sl. No.	Theme	Supporting Quotes	Frequency
1	Enhanced Technical Understanding	"Writing the report helped me better understand engine failure procedures."	22/30
2	Improved Technical Vocabulary	"I learned how to use terms like 'lubrication system failure' correctly in writing."	20/30
3	Increased Writing Confidence	"I was afraid to write before, but this	18/30

		simulation made me confident."	
4	Relevance to Real-World Practice	"Now I know how to write a report like we'll need to do on board."	25/30
5	Peer Learning and Feedback	"The peer review helped me correct my grammar and learn new phrases."	19/30

Deep learning was encouraged as the simulation grounded learning in an authentic situation imitating actual maritime duties. Cadets mentioned that their knowledge of IMO compliance language, the exact use of maritime vocabulary, and their confidence to use English for official communication increased. Peer review and digital platforms (Moodle forums, shared Google Docs) contributed collaborative and reflective dimensions to the learning.

5. DISCUSSION

The dramatic rise in writing scores after students had completed the Incident Report Simulation exercise is convincing proof of the pedagogical benefits of coupling technical and language content within a naturalistic, task-driven context. Through involving the cadets in the drafting of real reports from realistic maritime scenarios, the task served as a means of not only learning to apply engineering/technical understanding but also the learning of especialized lexical terms essential to professional maritime communication. This twofold emphasis on content and language echoes closely the tenets of CLIL, especially as described in Coyle et al's (2010) 4Cs framework. (2010). In this context, Content is defined as "marine engineering systems science deepening through the writing of reports" of cadets, whereas Communication corresponds to the cadets' using English as a tool for realistic professional reporting, the Cognition includes "judgement in a particular situation" were cadets synthesis and apply wisdom and Culture implies cadets' accustomedness to "overseas communication standards of the maritime community" and "reporting format" widely used for recording at sea.

The integration of digital resources, including social platforms for peer feedback and document sharing, added to the authenticity of the learning experience. Through the use of these tools, cadets participated in meaningful peer review, revised drafts based on feedback, and reflected on their writing process, making it a cooperative and student-centered activity. This is consistent with the observations of García et al. (2023), who argued that the incorporation of digital tools in CLIL classrooms stimulates writing skills, enhances engagement, and boosts learner motivation. The dynamic nature of the online environment allowed cadets to take control of their learning, developed their capability to undertake technical communication and key 21st century competencies of digital literacy and collaboration.

Nevertheless, despite overall positive results, some difficulties were encountered. A subgroup of the students (ten out of 30) reported challenges to avoiding technical inaccuracy at the cost of linguistic clarity. These students struggled with the need to be correctly technical engineers on the one hand, and logical, grammatically correct English speakers on the other. This problem underscores the need for more language scaffolding such as guided practice, vocabulary assistance, and model text, particularly for lower-proficiency students. In addition, specific technical genres analysis within workshops could assist students to improve in gaining confidence with the correct use of technical language while they follow formal writing conventions in reports; e.g. incident reports, logbook reports and maintenance summaries. Tackling these challenges in the next versions of the activity will guarantee that all cadets are able to take advantage of and gain proficiency through CLIL-influenced interventions in order to learn the types of communication skills mentioned by the industry for successful participation in maritime world. This study ensures the Incident Report Simulation used in the ERT has been an effective tool for improving the writing performance and writing selfefficacy of cadets and is considered a best-practice CLIL activity in maritime education. Follow-up can provide more scaffolding for struggling learners while maintaining the support of digital platforms for peer feedback and formative assessment.

6. CONCLUSION

The implementation of cross-discipline writing activities in the CLIL environment greatly improved the writing skills and technical communication competence of the marine engineering cadets. Rooted in real-life maritime incidents, the 'Incident Report Simulation' helped to effectively connect the two domains of knowledge of technical terminology and language use, achieving demonstrable improvements in the understanding of the content, accuracy of vocabulary use, and writing of reports. The average improvement of 21.2 points for writing scores, as well as positive feedback from cadets, indicates the promise of CLIL-driven practice for advancing cognitive engagement with and application of professional language. In addition, the integration of digital technologies and peer support promoted interactive learning and enhanced participant engagement. Although some cadets struggled to hold the balance between technical accuracy and linguistic 'making sense', the former of these particular difficulties in particular can be overcome through more focused scaff ouding and genre-based writing support. In all, this research confirms that CLIL-grounded writing pedagogy can serve as a viable and effective means of boosting learners' preparation for both academic and career purposes in the maritime context.

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