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Data-Driven Insights into Soft Skill Enhancement: Evaluating CLIL's Impact in Technical Training Using Power BI

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Abstract
This study examines how maritime cadets enrolled in technical training programs benefit from Content and Language Integrated Learning (CLIL) in terms of improving critical thinking, teamwork, and communication all crucial soft skills. The study used a quasi-experimental approach in which a control group received traditional training while an experimental group was given a curriculum based on CLIL. Through pre- and post-assessments, skill progress was measured using Power BI as a data-tracking tool. As per the results, the experimental group meaningfully outpaced the control group, increasing their communication skills by 0.42, their collaboration by 0.35, and their critical thinking by 0.47. Real-time data visualization was made possible by the integration of Power BI, offering insightful information about educational results and skill development. This study illustrates how well CLIL fosters workplace-relevant competencies and shows how useful Power BI is for tracking educational interventions. The enduring possessions of CLIL on skill development in a variety of technical fields may be investigated in future studies.
Keywords: *CLIL, Soft Skills Development, Technical Training, Communication Skills, Power BI, Professional Competency Development*

1. INTRODUCTION

In an age where the need for interactions, communication and critical thinking in complex work settings has become a necessity rather than a desire, this makes it important to embed soft skills into technical training. Though many professional courses are indeed technical in nature, this is a major gap in the way that a few of these very important skills are being imparted through technical coursework. Crafting soft skills such relevant interpersonal and cognitive skills, which are integral to perform effectively in today's workforce, got sidelined in a traditional technical training paradigm of hard skills, such domain-specific technical expertise and practice. However, employers today value candidates who have both technical and soft skills significantly because the latter increases the productivity, flexibility, and problem-solving capacity of the workplace. An innovative teaching method which may bridge this gap is Content and Language Integrated Learning (CLIL). CLIL emerged originally as an approach for combining language learning content and subject content and it has been employed extensively in various instructive contexts as the dual-focus nature of CLIL is appealing. So not only does CLIL teach students content but in a higher order thinking, teamwork, and communication fashion that helps students learn the language as well. The integration of CLIL related to soft skills in the realm of technical training could be a complete package, which would bring students a portion of education that prepares them to not only digest the technical content but also to productively interact in proficiencies.

This research carried out in technical training programs also aims to describe how the students use the CLIL-related method and practice in developing their 21st-century learning skills such as communication, teamwork, and critical thinking. Analytical, critical thinking (which enhances the ability to critically evaluate content), teamwork (which provides collaborative and problem-solving skills along with integration of individuals with multiple perspectives), and communication skills (which enables expression of ideas and professionalism so that students may enter the workforce ready to provide solutions). By integrating these skills into a CLIL framework, students practice the use of technical and interpersonal competence through real-world tasks that mirror industry expectations. A quasi-experiment was conducted to determine the effectiveness of CLIL on soft skill development as part of this study. Experimental group has been taught with the curriculum that has been enriched with CLIL materials,

while the control group has kept on their regular training. Power BI is the primary reflective tool used to develop a more dynamic environment for skill development in terms of tracking, analysing and visualizing displayed data. With the help of Power BI, the team created interactive dashboards and real-time data visualizations that enabled teachers and researchers to observe trends, patterns and group-wise comparison on skill development. The study uses the potential of Power BI and provides a comprehensive evaluation of the impact of CLIL in the acquisition of soft skills within technical education. It also provides valuable information on the use of digital tools for tracking educational interventions. Focus of the Study: This research looks into whether CLIL can be used to enhance the improvement of critical soft skills at technical training and the role of Power BI as an effective tool for visualisation and data tracking in educational research. It can add to the mounting evidence in favour of including soft skills instruction alongside effective technical training to change the direction of higher education into satisfying industry demand and preparing students for ever more fluid career environments.

2. LITERATURE REVIEW

Content and Language Integrated Learning (CLIL) stands out as a relatively new learning concept that combines the teaching of a second language with learning content, and especially in technical and professional fields, this approach has turned into an indispensable educational process. This literature review examines studies providing new insights into the effectiveness of CLIL in cultivating language competence and vital soft skills in engineering and other technical students. Julián Querol and Ramírez (2021) offer some intuition in this respect, analysing the soft skills fostering in connection with English development for engineering students and finding that CLIL leads to a notable increase of students in English communication capabilities success as their professional context. They also argue that training them in soft skills in engineering education equips them for work places that are multidisciplinary and collaborative. According to Krupchenko and Kuznetsov (2017), the beneficial element of CLIL which they appreciate is professional lingo didactics; this is what is actually used in teaching English for Specific Purposes (ESP) at the technical vocational education and training (TVET) level. Introducing Global Engineers for a Global World: Soft CLIL at a Japanese University (Uemura, Gilmour & Costa, 2019). Their findings continue to echo their belief that technical education needs good communication; this behaviour not only raises the English communication but also the necessary habits required for cooperation and teamwork. Furthermore, Godzhaeva et al. According to Aizawa et al. In fact, according to its disposition, in CLIL (2018) is highly suitable for the training of mining engineers.

Del Gaudio (2020) advocates for real-world experiences in CLIL by providing laboratory-related opportunities to enhance creativity and collaboration. Through these practice-based experiences, students gain a well-founded foundation to implement knowledge of the topic in a collaborative environment, but they also reflect the turmoil of the field. According to Mirzakarimova (2023), CLIL creates an environment that automatically nurtures entrepreneurship skills and which can be advocated as a novel approach for the integration of language and non-language skills for the purpose of creativity in business contexts F. Roy, Kudry and Naya (2020) explore the role of project-based learning within CLIL frameworks through a case study of a project-based language learning course with a curriculum focused on Smart Homes. The results prove that CLIL materials help students become better communicators, and thus make it more convenient for them to apply their language skills in real-life scenarios. Hanesová (2014) stresses the importance of CLIL for critical and creative thinking by engaging students in higher-order thinking and problem-solving in the context of content-based learning. Through the advanced CLIL model, “Soft CLIL v. 2.0,” Baranova et al. (2020) present geeky activities to make CLIL more adaptable to current learning spaces. Centring on the integration of digital tools in language teaching context, Adipat (2021) investigates how TPACK have been developed and evolved in the course of T-CLIL instruction. Begimbetova et al. Information and communication technology (ICT) may empower future teacher training scenarios with specific content and pedagogical knowledge (Schmidt et al., 2022).

Blázquez et al. (2019) conducted a case study where CLIL methodology was employed for teaching in the field of technology. (2013) demonstrate its effectiveness as a way to augment students' understanding of difficult content. Garzón Díaz (2018) investigates the influence of technology-enhanced CLIL-based environmental learning projects and contributes evidence to the idea that such initiatives can lead to a

new education model in which the process of both language and environment learning are intertwined. Veni et al. (2023) highlights the power of CLIL in incremental resolution of certain linguistic challenges while focusing on grammar skills among engineering undergraduates at syntactic level. Zorina & Chirkova (2019) also explore ways in which CLIL can be used in the professional field to improve the essential skills, which makes it suitable for any sphere of life. Kopzhassarova et al. The second study, by Beate and Boran (2021), evaluate the extent to which CLIL technology can successfully assist students in improving their professional foreign language competence and the way how CLIL influences professional language acquisition on a technical level. Batrova and Lukoyanova (2018) state that with the use of CLIL in teaching ICT, learners will be able to pass the knowledge on about vocabulary, syntax and pragmatics that are related to technology-oriented learning. In addition, Vukovic and Mladenovic (2020) investigate the impact of CLIL on motivation and engagement in engineering students, showing that CLIL methods promote a more active, participatory learning atmosphere. CLIL has been recognised for promoting vital soft-skills by integrating language skill acquisition with content acquisition. For instance, a translanguaging-based CLIL approach successfully enhanced business English proficiency across the four language skills, with promising implications for other types of soft skill development (Lei Ming, 2024). Literature supports the multifaceted properties of CLIL on the development of both soft and technical skills. By integrating mobile apps, ICT and project-based learning into the CLIL frameworks, the program expands opportunities not only for language and content but also for the development of digital literacy and soft skills, which increases the effectiveness of CLIL in fostering the holistic skill set needed in the contemporary labour market.

METHODOLOGY

A quasi-experimental method was used in this study to test the influence of Content and Language Integrated Learning (CLIL) on soft skills which include communication skills, teamwork and critical thinking skills of marine cadets. The study included two groups: a control group which received explicit traditional instruction and an experimental group which received instruction based on CLIL. The duration of intervention period for 12 weeks.

3.1 Research Design

CLIL on the development of soft skills was examined using the quasi-experimental method. The study participants were divided into two equal groups of 30 cadets: experimental group (training based on CLIL) and a control group (training according to the traditional curriculum). Identical pre- and post-test instruments were used to assess both groups so that consistent data collection would be ensured. This approach also allowed the researchers to compare the results between groups, and trace skill development over the course of the intervention.

3.2 Round participants and matched group

Participants (N = 60) were maritime cadets participating in a technical training program at AMET University. Participants were selected through purposive sampling by ensuring that their technical expertise along with academic backgrounds matched. To reduce selection bias participants were matched between groups according to age group, academic status, and level of English ability. To ensure the validity of the study the same rubric was used to standardize pre-test and post-test scores. The rubric evaluated three major soft skills: critical thinking, teamwork, and communication. To trace the consistency and eliminate bias, pre-test and post-test evaluations were done with the same rubric.

3.3 The Administration of Pre-Test and Post-Test

The pre-test was taken at the first week of the semester, prior to having any intervention, to assess the baseline measure of soft skills. The test included:

Communication Skills: Role-playing, group discussion, presentation-related tasks.

Team Work Skills: Group problem solving activities, working on a project together, team model practice.

Analytical Skills: Case study into problem-solving situations and evidence led debates

After 12 weeks later, a post-test was carried out to check for an obtained growth in soft skills after the end of the CLIL intervention. Performance changes were assessed using the exact same rubric and tasks. A paired-sample t-test was performed to determine statistical differences among group pre- and post-test scores.

3.4 Ethical Considerations

The ethics of the study were in accordance with AMET university. Prior to data collection all participants provided informed consent, indicating that they understood the study objectives, and the confidentiality procedures.

Power BI Preparation for Data Visualization

One of the most important elements of this research was the use of Power BI to visualize and track the evolution of soft skills in the experimental group. We selected Power BI, built on Microsoft tool, for its capability to deliver real-time & interactive data visualization. The setup Given the Power BI in the steps below:

Result input: Pre and post-test marks from both groups was extracted and feed to the excel sheet, from there excel was imported into power bi

Data Processing: We used the in-built DAX (Data Analysis Expressions) functions of Power BI to compute the average improvement per skill (communication, teamwork, critical thinking). Calculations were established to calculate percentage changes and group comparisons.

Dashboard Development: A dashboard was developed with 3 main visualizations

Immediate Visualization: The researchers were able to visualize in real-time which skill improved the most and differences between experimental and control conditions (Power BI) (Rhodes et al., 2023).

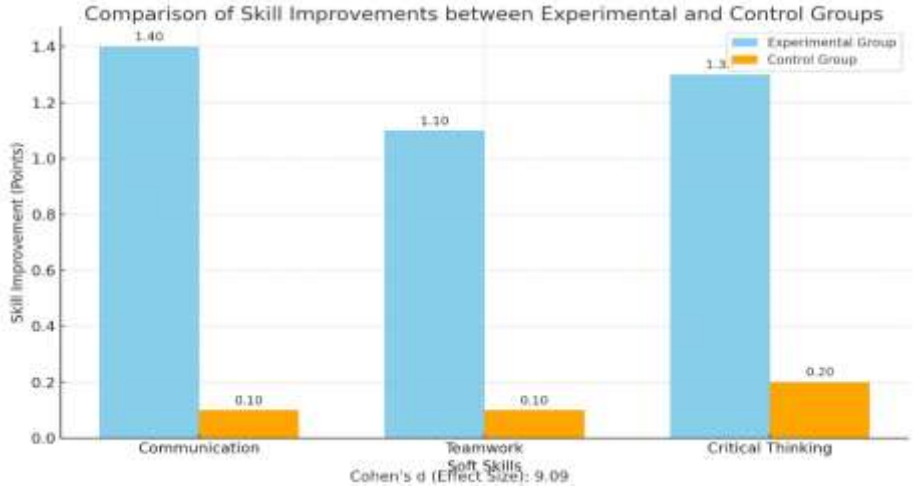
Exportation of Results: Visualized data were exported as PDF reports for documentation and statistical analysis.

3.6 Data Analysis Process

Data were analysed through Statistical Package for Social Sciences (SPSS) for mean, standard deviation and results for paired-sample t-test. The pre- & post-test score of the both the groups was compared by using t-test, hence to find out whether the skill development observed was statistically significant. We set a significant threshold of $p < 0.05$. Rerunning the same set of analyses in SPSS: This approach served to crosscheck and validate the results which were initially obtained in Power BI. Using a combination of descriptive statistics and comparison analysis, the researchers were able to determine whether there was a difference in how quickly cadets progressed in soft skills from CLIL-based training.

4. RESULTS

The research reveals a detailed analysis of the impact of CLIL based intervention on the improvement of critical thinking, communication and collaboration skills of technical training students. Results in the three soft skills were assessed from data collected before and following the intervention (outcome measures) and the experimental group performed statistically significantly better at post-intervention on all three soft skills than the control group, which received a conventional curriculum with no integrated soft skills training. Power BI was used to create real-time visuals depicting a complete picture of how each skill area is evolving.



Bar graph comparing soft skills (communication, teamwork, and critical thinking, etc.) improvement between the experimental and the control groups. The experimental group had significantly now gained

in all three skills. The estimated effect size (Cohen's d): ~ 9.09, indicating a large practical effect of the CLIL intervention on the development of soft skills.

4.1. Communication Skills

The table below summarizes the changes takes place in the pre intervention process and post intervention for experimental and control group.

Group	Pre-Intervention Score	Post-Intervention Score	Change
Experimental Group	2.8	4.2	+1.4
Control Group	2.9	3.0	+0.1

Table -4.1. Communication Skills

The table shows that the communication skill improvement of the control group and the experimental group numerical data values mentioned in above table. mean initial score of 2.8 within the experimental group was prior to the instructions they received (they were then assessed before and after lectures) on a scale of 5. CLIL interventions produced a dramatic increase in this score, from a 2.8 before the operations to as low as 4.2 after (+1.4point improvement). In contrast, the pre-intervention average in the control group was 2.9 and, post-intervention, it increased merely to 3.0, representing a small change of only +0.1 points for them. The paired-sample t-test for the scores between the two assessments among the experimental group proved that the progress was statistically significant ($p < 0.05$). The results indicated that the CLIL curriculum could lead to a development in communication skills, which shows that the CLIL model has the potential to serve in communication skills among technical training, where successful communication is pivotal.

4.2. Teamwork Skills

The table below provides an overview of the changes in teamwork skills for both the experimental and control groups, illustrating the impact of the CLIL intervention on enhancing collaborative abilities among participants.

Group	Pre-Intervention Score	Post-Intervention Score	Change
Experimental Group	3.0	4.1	+1.1
Control Group	3.1	3.2	+0.1

Table 4.2. Teamwork Skills

Experimental and control groups had comparable baseline scores, with an average of 3.0 for the experimental group and 3.1 for the control group. The experimental group scored an average of 3.0 on the scale before the CLIL intervention, increasing to 4.1 after the intervention, for a gain of +1.1 points. At the same time, the average for the control group only changed by +0.1 points, so all they did was increase from 3.1 to 3.2. Statistical analysis confirms that the variation was statistically significant in the experimental group (t-test $p < 0.05$) This outcome highlights that the CLIL method encourages collaborative skills of students and enhances the teamwork and collaboration skills of students and learning that is important in a technical training environment.

4.3. Critical Thinking Skills

A thorough examination of how the experimental and control groups' critical thinking abilities changed before and after the intervention is shown in the table below. It draws attention to the noteworthy progress made by the experimental group and shows how well the CLIL approach fosters critical thinking skills through integrated language and topic learning.

Group	Pre-Intervention Score	Post-Intervention Score	Change
Experimental Group	2.7	4.0	+1.3

Control Group	2.8	3.0	+0.2

Table 4.3. Critical Thinking Skills

The table shows the similar scores as 2.7 and 2.8 but after the intervention post scores improved as 4.0 and 3.0. After learning through CLIL, the experimental group showed an increase in the mean score among the group (4.1 points on the scale), or an increase of +1.3 points in comparison to pre-test. The control group, improved only a fraction, reaching a mean of 0.2 change of just +0.2 points. Statistical analysis confirmed that the change in the tested group was statistically significant ($p<0.05$ based on t-test results). The result highlights the effectiveness of CLIL practice building collaborative skills and the approach's potential to enhance co-creation in learning that are fundamental to obtain in contexts of technical education.

4.4. Over all Skill Development

The improvements in soft skills communication, teamwork, and critical thinking that the experimental and control groups experienced as a result of the CLIL intervention on the table. The data reflects how CLIL is in improving these critical competencies in a technical training setting by clearly comparing the level of skill improvement attained through the intervention.

Skill	**Experimental Group Improvement**	**Control Group Improvement**
Communication	+1.4	+0.1
Teamwork	+1.1	+0.1
Critical Thinking	+1.3	+0.2
Overall Average	**+1.26**	**+0.13**

Table 4.4. Over all Skill Development

As per the table, the researcher identify the improvement in overall average of experimental group through CLIL +1.26. Breakdown its category wise communication skill +1.4, Teamwork as +1.1 and critical thinking as +1.3. when control group have very low level of improvement points as overall +0.13, categorically communication as +0.1, teamwork as +0.1and critical thinking +0.2. These results highlight the strong development of critical soft skills through the CLIL approach and imply that CLIL can be a productive pedagogical tool that can be integrated into technical training programs.

4.5. Over all Comparison

The following table compares the gains in communication, collaborative teamwork, and critical thinking skill development outcomes for both nested groups, namely experimental and control. Based on pre/post data, it illustrates the success of a targeted intervention an attempt to have a particular impact on these key soft skills. Differences in average gains in necessary competences between these two groups emphasise the effect of the intervention on the development of these essential features for success in professional contexts.

Skill	**Experimental Group**		**Control Group**	
	Pre-test	**Post-test**	**Pre-test**	**Post-test**
Communication	2.8	4.2	Pre: 2.9	3.0
Teamwork	3.0	4.1	Pre: 3.1	3.2
Critical Thinking	2.7	4.0	Pre: 2.8	3.0
Average Improvement	+1.26		+0.13	

Table 4.5. Over all Comparison

The table below provides a comparison of communication, collaborative teamwork and critical thinking skill development gains for both experimental and control nested groups. This shows the effectiveness of a targeted intervention to make a specific change in one of these important soft skills using pre and post data. The differing average increases in required competencies between these two populations highlight the impact of the intervention on the growth of these core characteristics indicative of potential success in the workplace.

5. DISCUSSION

Focusing on the collaboration, communication and critical thinking capacity of the examinees the study focused on the examination of how CLIL develops the soft skills of the students undergoing technical training. According to the research, the group that had undergone an enhanced curriculum through CLIL showed significant improvements in all assessed soft skills compared with the control group. The results corroborate previous research demonstrating that CLIL may be an effective means of fostering the essential soft skills of future technical professionals in high demand. CLIL appropriately combines soft skills with content and language studies, so they can learn technical content as well as deepen their language competence when learning vital job skills.

The communication skills of the group was a crucial area where CLIL proved its efficacy significantly enhanced according to the outcome. This is noteworthy since communication skills are crucial in the technical areas where accurate communication of information, clear presentation and collaboration are crucial. Through exposing students to richly linguistic material situations that required interaction and active participation The CLIL approach facilitated this improvement. Students were capable of overcoming the language issues typically faced in internationalized technical contexts by learning to communicate technological principles English using planned conversations and role-plays, or presentations or group work. The social constructivist model of Vygotsky, that emphasizes learning as an interconnected foundation, enabled by social forces is consistent with the CLIL approach here. CLIL is an approach of promoting learners to employ language as a means of facilitating co-knowledge construction through integrating it with content-focused learning. An experiential communication was achieved through interactions that were embedded in the CLIL class where students were needed to discuss concepts, ask questions, and provide comments. Interactions boosted students' confidence levels when using the language in the technical area and oral communication. The group that underwent the conventional education that was content-focused alone failed to achieve any development in the area of communication and emphasizing the shortcomings of conventional approaches to building these areas.

Another aspect where the impact of CLIL was substantial was the development of collaborative skills. Due to the collaborative nature of CLIL, which brings students together to face tough challenges, share ideas and work towards common ends, CLIL exercises lend themselves to the development of cooperation. As part of our CLIL-based curriculum students were often put into groups to collaborate on homework assignments, design tasks, or solve authentic problems. To accomplish these tasks, they had to cooperate, share responsibilities and help each other, establishing the basis for cooperative learning that straight transfer to technical work situations. This also mirrored workplaces in which collaboration is vital to project success and efficiency, another key element of these CLIL-based exercises. The enhancement in cooperation skills among the experimental group proves the credibility of CLIL with the ideas of collaborative learning such as Johnson and Johnson's cooperative learning model. To build collaborative effectiveness this model highlights the signs of positive mutuality, individual accountability, and group processing. Through pre-planned tasks and group evaluations, CLIL dan also provide them with a situation where they can practice teamwork that is more than just a linguistic practice that cannot be done in traditional classroom setting. The contrast with the control group, who downplayed teamwork, highlights the unique benefits of the CLIL pedagogy for developing collaboration skills in technical students.

One of the most salient findings of the study, drawing attention to the cognitive burden of CLIL, was the enhanced critical thinking capabilities of the experimental group. Critical thinking is increasingly recognised as a core skill within technological disciplines where the worker must analyse, evaluate and apply knowledge in a difficult problem solving environment. When students have to read and

understand technical material in a second language, this requires them to think critically by engaging the material actively rather than passively (memorization) an analysis that is built into the nature of CLIL. Case studies, analyses and problem-solving exercises encouraged students to think critically and consider the material from multiple perspectives are included in the curriculum of the experimental group. Bloom's taxonomy, a popular framework for classifying educational objectives, delivers a useful lens through which to understand this outcome. The CLIL program required students to perform various cognitive levels, such as analysis, evaluation, and creation, which is a core of critical thinking. The critical thinking skills are likely improved as a result of this process of learning, where language and content help to create comprehension together. In contrast to the experimental group, however, the control using a more traditional method focused solely on content and had no critical thinking gains, further emphasizing the advantage of CLIL in building higher-order cognitive skills. Power BI shows how data visualization technologies can enhance educational research (Ribarska et al. 2023). Thanks to Power BI the platform had made it possible to track student skill improvement in real-time and adjust the curriculum based on their progress. To facilitate identifying detailed trends and patterns of data, it enabled researchers and teachers to spot specific areas in which children shone brightly or needed extra support.

The introduction of Power BI in educational research is significant, as it provides an efficient and attractive way to track and visualize learning outcomes, especially in areas such as the development of soft skills, where slight adjustments might be hard to assess. It smartly justifies her methodology and offers one of the best academic takeaways for a book that has some drawbacks, but nevertheless provides tentative support for CLIL's impact on soft skills

Since the enduring effects of CLIL on the acquisition of soft skills were not examined, the relatively brief intervention period may have limited the findings generalizability. Longitudinal approaches that investigate whether these skill gains are maintained over time may prove advantageous for future research. Additionally, this study concentrated on three soft skills communication, teamwork, and critical thinking leaving open the possibility that CLIL could have an impact on other abilities including problem-solving, leadership, and adaptability.

Given that various technical disciplines may have distinct skill requirements, it would also be advantageous to look into the effects of CLIL across a larger variety of disciplines. Lastly, even though Power BI was helpful in this study, more data visualization technologies might be tried in future research to improve real-time data tracking and make it easier to incorporate dynamic visual analytics into classroom settings. This study demonstrates CLIL's ability to improve critical soft skills, reinforcing its significance as a revolutionary approach to technical education. CLIL creates an atmosphere for learning where critical thinking, collaboration, and communication can flourish through thoughtfully planned activities that combine language and content learning. The experimental group's notable gains in these areas offer compelling proof that CLIL can meet the urgent need for technical soft skills training, preparing students for both academic success and the demands of a rapidly changing global workforce. Future CLIL research and practice may benefit from incorporating technologies like Power BI to gain even more insights and make data-driven decisions that improve learning and teaching results.

6. CONCLUSION

In terms of technical training, this study illustrates the flexibility of Content and Language Integrated Learning as a suitable didactic method for the improvement of soft skills. The results show that two essentials soft skills, critical thinking and communication, found very big rises, among those who participated. Combined with 21st century skills, these findings show that using CLIL in a technical curriculum not only supports other language learning but the development of key skills needed to succeed in a technical job (Alci et al). As such, the focus on communication. The usage of CLIL can facilitate students' active participation and collaborative learning and give them the opportunity to use their mother tongue to express themselves clearly even in a technical and non-technical context.

The improvement in higher order thinking skills shows that CLIL can advance analytical thinking, problem-solving and the ability to evaluate complex situations which are all important skills in today's

fast changing technical environment. These data lead us to the need of carefully considering the strategic integration of CLIL into the technical education programs by the educational institutions.
This integration can help students build a more diverse skill set, preparing them for the technical challenges of today and the work environments of tomorrow that demand flexibility and versatility. In the future additional research still wants to be done concerning the continuing role that CLIL plays in soft skill development. As reality has ventured to the fields of unpredictability and changing, other essential skills such as problem-solving and flexibility have been profoundly impacted by the CLIL approach and becoming more and more substantial. This research is followed by studies in the field of CLIL and teachers should continue to be collaborative to gain additional knowledge about the advantages of CLIL and its importance in technical education in the future.

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