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The Application of STEAM Education in CLIL--A Case Study of Halloween Jack-O'-Lantern

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Abstract

In recent years, there has been a promotion and emphasis on CLIL (Content and Language Integrated Learning) and STEAM (Science, Technology, Engineering, Arts, and Mathematics) education. The integration of interdisciplinary concepts and applications in English classrooms has brought new value and significance to English teaching. This study aims to investigate the students' perceptions by STEAM-Integrated CLIL instruction into English Classroom, a Halloween Jack-O-Lantern as an example. The participations were eight freshman students from different department in a university in central of Taiwan. Through a survey, the research aims to analyze different aspects of STEAM and assess the effectiveness of English learning outcomes. The results indicated that the students were satisfied with the application of STEAM education in CLIL instruction in English classroom.

Keywords: STEAM education, CLIL, English instruction

1. Introduction

1.1 Introduce the Problem

In Taiwan, most English classrooms are traditional teacher-centered, the class content is prepared by the teacher and often emphasizes the input of vocabulary, grammar, reading, and translation, with little focus on students' language output. Overemphasizing language forms while neglecting communicative abilities in the real life has resulted in Taiwanese students' low English proficiency. However, in response to the National Development Council's "Blueprint for Developing Taiwan into a Bilingual Nation" approved in December 2018 by Executive Yuan, which aims to make Taiwan a bilingual country by 2030, it seems a long way to go.

1.2 Explore Importance of the Problem

Everyone needs to be prepared for the complex world environment in order to master the critical thinking skills that are relevant to everyday life problems (Kennedy & Odell, 2014). Nowadays, STEAM education is considered to be a great solution for driving the world forward and acquiring integrated knowledge (Bakirci & Karisan, 2018). The importance of the study lies in its ability to foster interdisciplinary learning and promote critical thinking, problem-solving, creativity, and innovation among the students. By integrating science, technology, engineering, arts and mathematics into CLIL classroom, students can develop a deeper understanding of both content knowledge and language skills. The proposed approach not only enriches the students' learning experiences but also equips them with essential 21st century skills which are crucial for their future academic and professional success (National Research Council, 2012; Kelly & Knowles, 2016).

1.3 Describe Relevant Scholarship

1.3.1 Content and Language Integrated Learning (CLIL)

Content and Language Integrated Learning (CLIL) was first introduced by Finnish scholar David Marsh in 1994 (Coyle et al., 2010). It is an educational approach which combines the target language with specific subject knowledge, and is taught by teachers proficient in the second language or foreign language. In this approach, language itself is no longer the main learning objective, but rather a tool for facilitating learning and promoting cross-linguistic communication skills during the cognitive learning process (Coyle, 2018). CLIL is a teaching approach which uses language as a medium to teach academic subjects (Nikula, Dalton-Puffer & Garcia, 2013).

Taking English as an example, CLIL is not about learning English, but using English to learn different subjects. The dual goals of CLIL are to learn subject content while learning English. However, CLIL focuses more on learning content than language forms (Marsh, 2002). The 4Cs framework of CLIL contains 4 elements—content, communication, cognition, and culture (Figure 1). Content refers to the specific subject knowledge and learning materials of the target language. It utilizes language in authentic contexts to enhance students' understanding and mastery of domain knowledge or skills. It encourages the integration between the subject and the target language, while deepening students' impressions of the content learned. Communication refers to the learning and use of English. It focuses on the need to use language in real situations, and uses the target language to achieve communication with others. The purpose of human interaction and communication focuses on the interactivity in the learning environment. Cognition refers to the process of learning and thinking. It emphasizes students use different learning strategies to internalize and absorb subject knowledge and develop higher-level cognitive thinking concepts, such as comparison, analysis, judgement, reasoning, comprehensive application, creation and other activities. Culture refers to learners' understanding about their own culture and others. Culture refers to learning cultural identity and mutual respect through different cultural background contexts. It cultivates students' insight into diverse cultures and international understanding, further enabling them to be aware of local customs and indigenous cultural characteristics from both an internal and external perspective (Coyle et al., 2010).

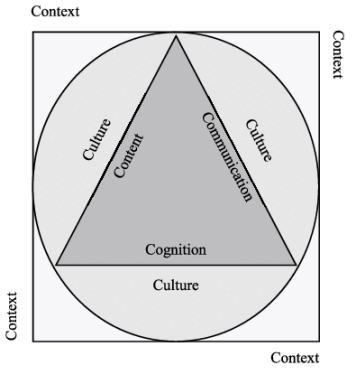

Figure 1. The 4Cs Framework of CLIL

1.3.2 STEAM Education

STEAM education originated in the United States. The concept of STEAM education was introduced by the National Science Board in the United States in 1986. It combines the learning domains of S (science), T (technology), E (engineering), A (arts) and M (mathematics) into an interdisciplinary teaching framework. Educators recognize the importance of the practices of designing, prototypes, modeling or finding solutions to problem (Hogan & Down, 2016). The promotion of STEAM education utilizes an integrated approach to interdisciplinary hands-on activities. Using an interdisciplinary approach, teachers guide students into the integrated field of science, technology, engineering, arts, and mathematics (Aguilera & Ortiz-Revilla, 2021; Hu, 2022). Different from traditional teaching methods, STEAM education prioritizes learner-centered and aims to address educational challenges and cultivate students with competencies in science, technology, engineering, arts, and mathematics and other related skills (Lin, 2016; Lin, 2022; Kuenzi, 2008; Hom, 2014; Byee, 2010). It improves students' ability in learning process, such as critical thinking, problem-solving, creativity, communication, and collaboration. The majority STEAM studies have been conducted in several countries, an STEAM teaching procedure is analyzed by Yeng (2018) (Figure 2). The first step of the teaching procedure is to find out problems in real life. Most of the problems discovered are observed by teachers and then guided to students for exploration, forming inquiry topics. Second, what was found, the topic, can be continuously worked on until the completion of the activities. In the step, students are inspired to develop a positive learning motivation, creation, experimentation, iterative design and embody their learning attitude. Third, problem-solving are the objectives of the activity process. When students meet the problems while doing the activities, they must solve the problems by communicate to others collaboratively. Finally, students will perform their outcome after the completion of the process.

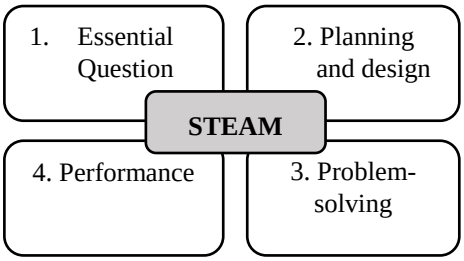

Figure 2. STEAM teaching procedure

1.4 Their Correspondence to Research Design and Research Questions

Even though many studies have been conducted and probed that CLIL is an effective method to improve students' English ability, students still lack of survival skills. CLIL and STEAM education are complementary and mutually supportive educational approaches. For example, both emphasize interdisciplinary learning and integration. CLIL combines subject content with language learning (Karimi, Lotfi, & Biria, 2017), while STEAM education integrates science, technology, engineering, arts, and mathematics to cultivate students' critical thinking and problem-solving abilities (Becker & Park, 2011). For instance, the core for the approaches is problem-based learning. In CLIL, students learning English and subject content by solving real-world problems. In STEAM education, students foster problem-solving and creativity through questioning, exploring solutions, and engaging in design projects (Bell, 2010); especially, art aids in cultivating and practicing creative thinking, prompts students to express their understanding of learning materials by exploring various possibilities, and to seek multiple solutions for complex problems (Chou, Yang & Luo, 2022). Moreover, they both encourage students' active participation and learner autonomy. In CLIL, student are actively involved in applying English and subject knowledge and independently solving problems (Coyle et. Al, 2010). In STEAM education, students develop skills through hands-on experimentation, design, and actively engage in project-based processes. Finally, they aim to cultivate students' 21st-centure core competencies (Kuenzi, 2008; Hom, 2014). Authentic learning (Yang & Baldwin, 2020) helps the students to be prepared for future career and enhance their practical skills (Kelley & Knowles, 2016; Bertrand & Namukasa, 2022). Accordingly, the study focuses on the implementation of how STEAM education to CLIL, the research question addressed to guide the study was:

What are Taiwanese students' perceptions of the application of STEAM education in CLIL?

2. Method

2.1 Participants

This study was conducted at a university in central of Taiwan. The participants were 8 students from General English class, a selective course from General Education which was taught in Fall Semester in the 2023 Academic Year. All students were freshmen and from different majors. None of them majored in English. Most of the students' English proficiency was at the beginning level. The Instructor was an English teacher from Department of Applied Languages with a doctoral degree in TESOL (Teachers of English to Speakers of other Languages) from the United States. All students were addressed by code name (Table 1).

Table 1. Students' code names

Participant	Code name	Participant	Code name	Participant	Code name	Participant	Code name
S1	Amy	S3	Emma	S5	William	S7	Eva
S2	Jessica	S4	Alan	S6	James	S8	Peter

2.2 Instruments

CLIL (Content and Language Integrated Learning) and STEAM education were be the instruments for the study.

2.3 Procedures

Integrated Yeng's (2018) STEAM teaching procedure into CLIL 4Cs, the teaching procedure was shown as below:

(1) Essential question: The class started by asking the question--How much do you know about Halloween? Through its history to what people do for the day, the students decided to do Jack-O-Lantern after discussion in class. Culture issue such as Jack-O-Lantern, one of 4Cs framework, is always good in an English classroom.

(2) Planning and design and problem-solving: Students needed to search relative information from the Internet. For example, what kind of materials or tools were needed. What were the steps of carving a Jack-O-Lantern? What shapes and patterns they want to show on their Jack-O-Lantern? In this stage, students collected related knowledge (content and cognition) and discuss all kinds of questions (communication) in order to solve the problems they faced.

(3) Performance: Sharing their works to each other in class.

2.4 STEAM Analysis of Jack-O-Lantern

In the pumpkin carving activity, 5 aspects of STEAM can be conducted as follows (Table 2):

(1) Science: Students can learn about the biological properties of pumpkins, such as the growth process, seed germination and the structure of the plant.

(2) Technology: Students can use different carving tools and equipment such as knives, pliers, etc. They can learn how to use these tools to create a variety of shapes and patterns.

(3) Engineering: Students were required to design and plan their works. They might encounter some technical challenges and need to find a solution to the problem.

(4) Arts: Pumpkin carving is an artistic activity. Students can be creative and design unique patterns and expressions. They can use elements such as color, shape, and texture to create a variety of visual effects.

(5) Mathematics: Students needed to consider mathematical concepts such as size, proportion, and symmetry when carving pumpkins. They could measure the size of the pumpkin, design the proportions of the pattern, and ensure symmetry, etc.

Table 2. Jack-O-Lantern works in STEAM

	
Jack-O-Lantern performance in Technology	Jack-O-Lantern performance in Engineering

Jack-O-Lantern performance in Arts

Jack-O-Lantern performance in Mathematics

Final performance

Final performance

2.5 Data Analyses

The study aims to students' perception of the application of STEAM education in CLIL in order to determine whether it was significantly correlated with their improvement in English ability. The data were collected from the survey, Application of STEAM Education in CLIL, adapted from Chang (2005) and examined by using descriptive analysis.

3. Discussion

Key findings from the survey were as follows: All of the students prefer the application of STEAM education in CLIL to the Traditional instruction because the instruction made English more enjoyable. As Jessica mentioned that:

"Doing something in class is much more interesting than listening to teacher's lecture."

James also pointed out:

"I feel sleepy in English class, because I no understand what teacher say. And English class is always boring."

In addition, all students agreed that they had more opportunity to interact with the teacher and classmates in class. They all agreed that the application of STEAM education in CLIL instruction helped them use English as a communication tool. Emma said,

"I begin to realize that English is a communication tool, not a learning subject."

Amy mentioned:

"This is the first time I can speak English in class and out of class. Even though my English is not good, I think the class learning by doing is good."

Peter stated:

"I was embarrassed when I speak to others in English at the beginning in the class. But exchange information with classmates give me more opportunity to practice English."

William said:

"I sometimes speak Chinese because I didn't know how to express in English. But I learn."

7 students agreed collaborative interactions within the group in the application of STEAM education in CLIL instruction improved their English comprehension. 4 students said they had learned new sentence pattern better by the application of STEAM education in CLIL instruction to communicate instead of using dills or repetition. As Eva mentioned:

"When the whole class was doing activity, it was fun. Time flies. After class, we still working on the project. Everyone has different duty. "

2 students mentioned they didn't feel tense and nervous in the application of STEAM education in CLIL class. Students all agreed they would like to take another STEAM education in CLIL class in the future because the instruction had changed their perspective on learning English. Alan pointed out:

"I really like the class. Even though I know Halloween, but I didn't know what people do on the holiday. Through the class, I not only understand the history of Halloween, and experienced making a Jack-O-Lantern."

4. Conclusions

Cultural experiences such as Halloween Jack-O-Lantern are perfect integrated in a STEAM education in CLIL classroom. Firstly, the class design involves multiple subject areas such as science (understanding the biological characteristics and growth process of pumpkins), technology (using carving tools for creation), engineering (designing innovative pumpkin carving forms), arts (expressing creativity through carving), and mathematics (measurement and proportion). Students integrate these subject areas in practice, enabling them to comprehensively develop their skills and abilities. Secondly, it provides an enriching cultural experience opportunity. For example, Halloween is a holiday with a right cultural background, and while designing and carving pumpkins, students can learn about the origins, traditions, and symbols of Halloween. By participating in the activity, student can gain a deeper understanding of the differences and diversity among different cultures. Furthermore, the class design provides an opportunity for English learning. Student have the opportunity to communicate in English while collaborating with peers and teachers, sharing ideas and design concepts. This language environment not only helps them improve their English communication skills but also strengthens their learning of technical vocabulary and subject knowledge in the STEAM. At the same time, this activity also provides an opportunity for language learning. Students have the opportunity to communicate in English while collaborating with peers and teachers, sharing ideas and design concepts. This language environment not only helps them improve their English communication skills but also strengthens their learning of technical vocabulary and subject knowledge in the STEAM field. In conclusion, the study of application of STEAM education in CLIL instruction—A case study of Halloween Jack-O-Lantern not only provides plenty of opportunities for subject learning but also enhances students' creativity, collaborative spirit, and cultural understanding.

5. Recommendations

In the curriculum and instructional design of English teachers, the focus of teaching is not only limited to understanding content but can also incorporate more learning tasks that involve the use of English for communication. It emphasizes the cultivation of students' communication skills with others as the primary goal. In addition, in today's teaching field, there is an abundance of CLIL teaching and STEAM education resources available, but there is a lack of specific guidelines for implementation. This poses a challenge for teachers in terms of instructional design and assessing students' levels. Therefore, it is recommended that teachers continuously enhance their expertise in diverse teaching methods and flexibly utilize instructional techniques to improve the overall effectiveness of CLIL and STEAM education curriculum. Based on the above recommendations, these can serve as references for English teachers in the teaching field and for relevant researchers.

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