Enhancing Chemistry Through Clil Didactic Unit: The Periodic Table Of The Elements

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Abstract:
This study investigates the impact of a proposal for applying Content and Language Integrated Learning (CLIL) approach for teaching chemistry on seventh graders in a private school, in which we as language teachers, not only teach language, but also, we must teach other subject areas as chemistry. The study aims to assess the effectiveness of the CLIL approach in enhancing students' comprehension of both chemistry concepts and English language skills. The research is motivated by improving students' needs in English as a foreign language. The objectives include design and apply fundamental principles of CLIL in chemistry class through the designing and application of a module or didactic unit about periodic table of elements in chemistry class. The following research questions are considered for this study; how does the implementation of CLIL affect students' understanding of the periodic table of the elements in chemistry class? And how does CLIL influence students' engagement and motivation in learning in chemistry class? The methodology used is action research, class observation notes and entry tests were considered for diagnosed students' language needs. It highlights the importance of improving technical vocabulary, the level of reading comprehension, as well as problems in sentence construction and overcoming difficulties in connecting ideas. Additionally, the study delves into the CLIL approach,
emphasizing its role in promoting language learning, intercultural skills, and a deeper understanding of subject matter.

Keywords: Bilingual, CLIL, chemistry class, motivation, language learning.

Resumen:
Este estudio investiga el impacto de una propuesta de la aplicación del enfoque de Aprendizaje Integrado de Contenidos y Lenguas Extranjeras (AICLE) para la enseñanza de la química en estudiantes de séptimo grado de un colegio privado, en el que nosotros, como profesores de idiomas tenemos que enseñar inglés y otras materias como química. El estudio pretende evaluar la eficacia del enfoque AICLE para mejorar la comprensión de los alumnos tanto de los conceptos de química como de las habilidades de la lengua en inglés. La investigación está motivada por la mejora de las necesidades de los estudiantes en inglés como lengua extranjera. Los objetivos incluyen diseñar y aplicar los principios fundamentales de AICLE en la clase de química a través del diseño de un módulo o unidad didáctica sobre la tabla periódica de los elementos en la clase de química en inglés. Para este estudio se plantean las siguientes preguntas de investigación: ¿cómo afecta la aplicación de AICLE a la comprensión de la tabla periódica de los elementos por parte de los estudiantes en la clase de química? ¿Y cómo influye AICLE en el compromiso y la motivación de los estudiantes para aprender en clase de química? La metodología utilizada es la de investigación-acción, se tuvieron en cuenta las notas de observación de clase y la prueba de entrada para diagnosticar las necesidades lingüísticas de los estudiantes. Se destaca la importancia de mejorar el nivel de vocabulario técnico, el nivel de comprensión de lectura, así como los problemas en la construcción de frases y lograr superar las dificultades para conectar ideas. Además, el estudio profundiza en el enfoque AICLE, destacando su papel en la promoción del aprendizaje del idioma, las habilidades interculturales y una comprensión más profunda de la asignatura.

Palabras clave: Bilingüismo, AICLE, clase de química, motivación, aprendizaje de idiomas.

1.Introduction

In the contemporary educational landscape, the integration of content and language has gained significant prominence as an innovative pedagogical approach. Content and Language Integrated Learning (CLIL) emerges as a methodology aiming to fuse subject-specific mastery with language skill development, using the foreign language as a tool for learning. The present research delves into the application of the CLIL approach through a didactic unit that explores the interplay between chemistry and English, with a focus on the periodic table, aiming to enrich the educational process and foster knowledge acquisition in both domains. According to the article by Mosquera Pérez (2022), CLIL can benefit the education system in Colombia by promoting the incorporation of content through English and contributing to a better understanding of how CLIL is being applied across different contexts in the national territory. Additionally, CLIL has the potential to enhance the overall field of English language education and benefit students. However, it is important to note that more research is needed to fully understand the impact of CLIL in Colombia (Mosquera Pérez, 2022, p. 7-8).

This investigation explores the integration of Content and Language Integrated Learning (CLIL) with language class in seventh-grade chemistry education, where the periodic table serves as a topic. The study aims to assess the effectiveness of the CLIL approach in enhancing students' comprehension of both chemistry concepts and English language skills.

The literature review examines languages learning and CLIL Approach. CLIL, which stands for "Content and Language Integrated Learning," is an educational approach that has become increasingly popular worldwide. With CLIL, students not only acquire knowledge about a specific subject but also do so in a second language, typically English. This pedagogical approach has become a valuable tool for promoting language learning and the development of intercultural skills. In a CLIL environment, students not only learn the subject matter itself, such as mathematics, social studies, or history, but they also do so in the context of a foreign language. This provides them with the opportunity to improve their language skills while gaining fundamental knowledge in a wide range of fields. This approach not only focuses on the acquisition of academic knowledge and skills but also promotes communication and collaboration in a multicultural context.

Students should be familiar with technical vocabulary related to the periodic table, such as the names of chemical elements, symbols, groups, and periods. The teacher can provide a vocabulary list before the class and engage in activities to practice pronunciation and meaning. The teacher can help students build clear and coherent sentences using the learned vocabulary. This could involve teaching relevant grammatical structures and providing examples of how to use vocabulary in meaningful contexts.

The legal framework for teaching Chemistry includes the DBAs for seventh graders. Here there are some of them that are going to be considered for the didactic unit design.

- Recognize and describe the structure of the periodic table, its organization, and the relationship between elements. The text provides a list of strategies that teachers can use to help students develop this understanding.

- Students should be able to understand explanations and discussions that take place in class. This could include practicing active listening, note-taking, and asking clarifying questions. The periodic table itself is a visual representation of chemical elements. It is crucial for students to understand how to interpret it and how it is organized. The teacher can use visual resources like graphics and diagrams to facilitate understanding. MEN (2016). Derechos Básicos de Aprendizaje en Química.

There are some language needs for applying CLIL, for example in vocabulary using: The DBA in chemistry requires students to be familiar with a variety of technical vocabulary, such as the names of chemical elements, symbols, groups, and periods. The teacher can help students learn this vocabulary by providing a list of terms before the class, using visuals and hands-on activities, and providing opportunities for students to practice using the terms. Grammar: The DBA in chemistry also requires students to be able to use the correct grammar structures to construct sentences about chemistry. The teacher can help students with this by providing explicit instruction on grammar rules, providing opportunities for students to practice using the rules, and providing feedback on students' work. Reading comprehension: The DBA in chemistry requires students to be able to read and understand texts about chemistry. The teacher can help students with this by providing leveled texts, providing opportunities for students to practice reading comprehension strategies, and providing feedback on students' work. Writing: The DBA in chemistry also requires students to be able to write about chemistry concisely. The teacher can help students with this by providing explicit instruction on writing skills, providing opportunities for students to practice writing, and providing feedback on students' work. Speaking: The DBA in chemistry also requires students to be able to speak about chemistry in a confident and fluent way. The teacher can help students with this by providing opportunities for students to practice speaking in class, providing feedback on students' speaking, and organizing debates or discussions. (Smith, 2023, p. 10).

2. Methodology

A qualitative approach is applied based on an action research method; observation and planning are the first step. This research is descriptive, an observation period was made by looking at the strengths and weaknesses of the students. An entry test was applied, and a design material will be implemented. The model action research recognized a situation or issue in the participants; in this case the problem identified was low level of comprehension and the necessity of improving technical vocabulary, as well as problems in sentence construction and overcoming difficulties in connecting ideas in English as a foreign language learning. The idea of action research is to present changes about the difficulties

of the students. In this way, the teacher starts planning and performing a strategy to make improvements in students comprehension skills.

Students profile: Students of this research are five seventh graders from Sierra Morena, between 12 and 15 years old who live in a rural community located in Bogota. Most of them come from low-income families and must work to help their parents support their families. I describe them as engagement guys who really want to learn even despite their difficulties. In this research study, the names of all participants have been changed to protect their identity. This is a standard practice in research involving students, as it is important to safeguard their privacy and confidentiality. They are: María is a 14-year-old girl who lives on

a small farm with her family. She is a hardworking and responsible student, and she is always willing to help her classmates. She loves to read and write, and she dreams of becoming a writer. Sofía is a 13-year-old girl who lives in a popular neighborhood in the city. She is an outgoing and sociable student, and she enjoys participating in extracurricular activities. She is passionate about music and dreams of becoming a singer. Ana is a 12-year-old girl who lives in an indigenous community. She is a curious and creative student, and she enjoys learning about different cultures. She is passionate about art and dreams of becoming an artist. Isabel is a 15-year-old girl who lives in a rural hamlet. She is a responsible and hardworking student, and she is always willing to help others. She loves nature and dreams of becoming a biologist. Juan is a 13-year-old boy who lives in a marginalized neighborhood. He is a hardworking and responsible student, and he is always willing to help his classmates. He loves soccer and dreams of becoming a professional soccer player.

Pedagogical proposal: the didactic unit about periodic table of elements in chemistry class is designed based on CLIL approach, the following didactic unit structure is adapted from Boccacci and Farino (2017).

Unit Title: The periodic table of the elements
Topic: Organization of periodic table- Periodic properties of the elements Subject area: Chemistry Language: English
Language level: A1
Target students: Ages 12-15 –7th grade in secondary school Time: 18 hours

Objectives:

a. Subject objectives:

- to be able to identify the various blocks and main families of elements.
- the periodic properties of the elements
- main features of the groups of elements
- to be able to relate the properties of the elements to their locations in the periodic table.
- to use electron configurations of atoms to classify elements in the periodic table.

- content specific vocabulary

b. Language skills:

- LISTENING represents a normal input activity, vital for language learning
- READING using meaningful material is the main source of input
- SPEAKING focuses on fluency. Accuracy is seen as subordinate. Vocabulary range
- WRITING is a series of lexical activities through which grammar is recycled. Grammar
- and vocabulary accuracy; orthographic control (spelling and punctuation). To be able to:compare the different groups of elements
- recognize the chemical elements in everyday-life objects
- recognize the features of the elements based on their position in the periodic table Ex. The number of electrons in the outer shell with the group number and the number of shells with the period number.
- distinguish between metals, non-metals
- collect info from different sources, analyses and elaborate them in a personal way Previous Knowledge: Students should have prior knowledge on:
- The atomic structure
- Protons, neutrons, electrons
- Valence electrons
- Electronic shells
- Electronic structure
- Relative atomic mass
- Atomic (proton) number
- Ionic charge
- Octet rule
  Learning
  Outcomes
- At the end of the lesson, students should be able to:
- Describe the Periodic Table as an arrangement of the elements in order of increasing proton (atomic number).
- Describe the relationship between Group number (number of valence electrons) and Period number (number of electron shells).
- Explain the similarities between elements in the same group of the Periodic Table in terms of their electronic structure.
- Describe the change from metallic to non-metallic character from left to right across a period in the Periodic Table.
- Describe the relationship between group number, number of valence electrons and metallic/non-metallic character.

Resources:

Textbook, Powerpoint, Lesson Notes, Youtube videos,
Whiteboard/blackboard, and Visualizer. Final product: didact video with group work prepared by the students.
Methodology, classroom activities

- Teacher's lesson
- Cooperative learning

Evaluation criteria both for language and content:
The students should be able:

- to understand and use properly scientific terminology
- to demonstrate knowledge and understanding of the topic
- to organize and present information clearly in appropriate forms.

3. Pedagogical implications

This approach can help students use the target language in meaningful situations, increase their participation, collaboration, and socialization, and develop language and intercultural awareness. We as language teachers can foster collaboration and interdisciplinary work among teachers, creating opportunities to develop professional relationships.

4. Conclusions

The integration of the CLIL approach in teaching chemistry through the periodic table has shown promising results in enhancing both content and language learning among seventh-grade students. Students exhibited improved comprehension of chemistry concepts, enhanced language skills, and greater engagement in the learning process. However, challenges related to access to technology and resources in certain contexts must be considered for effective CLIL implementation. Further research is needed to explore the scalability of this approach in diverse educational settings

5. References

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