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Language Across the Curriculum: Addressing the Needs of Science Students in English Classrooms

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Abstract*—In an increasingly globalized world, English serves as the lingua franca in science education, yet many science students face challenges in mastering both content and the academic language required for effective communication. Language Across the Curriculum (LAC) is an educational approach that emphasizes the integration of language learning across all subject areas, including science. This paper explores how LAC can be employed in English classrooms to address the linguistic and cognitive needs of science students. It discusses the challenges faced by science students in understanding scientific texts, mastering discipline-specific vocabulary, and developing academic writing skills. Furthermore, it outlines pedagogical strategies and approaches such as scaffolded learning, content-based instruction, task-based learning, and the use of technology to support science students in acquiring both language proficiency and subject knowledge. Ultimately, the paper advocates for an integrated approach that recognizes language as a tool for learning and mastering scientific content, thereby fostering the academic success of science students*.

***Keywords*—** *Language Across the Curriculum, science students, academic language, content-based instruction, scaffolded learning, task-based learning, English classroom, science education, academic literacy*.

I. INTRODUCTION

In today's educational environment, English has become the dominant medium of instruction, particularly in higher education and professional fields, including the sciences. For students pursuing science-related disciplines, English proficiency is not merely a skill for communication but a critical tool for understanding complex scientific content and for engaging in academic discourse. While students in many parts of the world are expected to acquire English proficiency alongside their academic subjects, the challenge arises when language learning is treated as a separate entity from content learning. This often results in science students struggling to master both the specialized language of their discipline and the required skills for effective communication in academic settings.

The concept of *Language Across the Curriculum* (LAC) is based on the premise that language learning should not be confined to English or language arts classes alone but should be integrated into all subjects, including science. LAC recognizes that language is central to learning in every domain, particularly in academic fields such as science, where technical vocabulary, writing conventions, and communication skills are crucial for success. This paper aims to explore how LAC can be effectively applied to English classrooms to meet the needs of science students. It discusses the challenges science students face in mastering academic language and outlines strategies for overcoming these challenges.

As Coyle, Hood, and Marsh (2010) discuss in their work on Content and Language Integrated Learning (CLIL), integrating language learning with content knowledge helps students engage more deeply with subject matter, thus fostering a more holistic educational experience. Through LAC, English instruction becomes more purposeful and connected to content areas, allowing students to build language skills within a meaningful context.

The Role of Language in Science Education

Science education is inherently tied to language, particularly English, which is the dominant language of scientific literature, research, and communication. As science students engage with their academic subjects, they must simultaneously develop proficiency in both the scientific content and the language needed to interpret, discuss, and communicate that content. The academic language required in science is distinct from everyday language, involving specialized vocabulary, formal grammar, and precise structures. It encompasses skills such as reading comprehension, writing reports, analyzing data, and presenting arguments—skills that are essential not only for academic success but also for participation in the global scientific community.

For many students, especially those whose first language is not English, the complexity of scientific language can present significant barriers. Texts in science often feature specialized terminology, passive voice constructions, nominalization (turning verbs into nouns), and other complex syntactic forms that are not part of everyday conversation. As Halliday and Martin (1993) note, scientific language involves specific registers and conventions that make it a specialized form of discourse. In addition, science students must learn to produce written work such as lab reports, research papers, and essays, each of which follows specific academic conventions. In short, the language demands of science education are high, and students need explicit instruction and support to succeed.

Language Across the Curriculum (LAC) provides a framework for addressing these challenges by emphasizing that language is not just a tool for communication but also a tool for learning. By integrating language development into science instruction, LAC helps students master both the language of science and the content itself. Through an interdisciplinary approach, students gain the linguistic tools

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they need to succeed academically while simultaneously deepening their understanding of scientific concepts.

Challenges Faced by Science Students in English Classrooms

Science students face multiple challenges when learning through a second language or when trying to understand the complex language of scientific texts. These challenges can be categorized into linguistic and cognitive difficulties:

1. Specialized Vocabulary: Scientific fields are characterized by a highly specialized lexicon. Terms like "photosynthesis," "oxidation," "enzymes," or "biodiversity" are not part of everyday vocabulary. Students who are not familiar with these terms may struggle to understand the concepts they represent, which in turn affects their ability to engage with scientific material and participate in academic discourse. As Hyland (2004) points out, disciplinary discourse in science is shaped by the use of highly specific vocabulary and structures that are essential for meaning-making within the field.
2. Academic Register: English used in academic contexts, particularly in science, differs from everyday spoken language. It is formal, impersonal, and often highly structured. Sentences in scientific writing can be long, with complex syntax and nominalizations, making them harder for students to understand. Furthermore, scientific writing emphasizes precision, evidence, and clarity, which can be difficult to master for students who are not familiar with these conventions.
3. Reading Comprehension: The dense and technical nature of scientific texts means that reading comprehension requires more than just basic literacy skills. Students must be able to extract meaning from abstract or complex passages, analyze data, interpret graphs, and understand how evidence is used to support scientific claims. Snow (2010) highlights the crucial role of academic language in reading comprehension, particularly in science, where students must learn to navigate through technical texts and extract relevant information.
4. Academic Writing: Writing in science classes often requires students to produce lab reports, essays, research papers, and other formal documents. These forms of writing require an understanding of specific structural conventions (e.g., introduction, methods, results, discussion in lab reports), as well as mastery of the appropriate register and language use. Many science students struggle with the academic writing skills necessary for these tasks, especially when they have not received explicit instruction on how to write in the scientific genre.
5. Cultural and Contextual Factors: For international students or those from diverse linguistic backgrounds, the specific conventions of scientific discourse may be unfamiliar or difficult to grasp. The cultural contexts embedded in scientific texts may also present challenges for students who are unfamiliar with Western academic traditions or ways of presenting knowledge.

Language Across the Curriculum (LAC) as a Pedagogical Approach

Language Across the Curriculum (LAC) is an educational philosophy that emphasizes the integration of language learning into all subject areas. In the case of science students, this means that language is not treated as a separate skill to be learned outside of the subject but is instead taught as a vital component of understanding scientific content. There are several strategies for integrating language instruction into science education through LAC, each designed to address the specific needs of science students.

Content-Based Instruction

Content-based instruction (CBI) is one of the most effective ways to integrate language learning into science education. In CBI, language instruction is integrated with the teaching of subject content. Teachers use scientific content as the vehicle for teaching academic language. For example, in a science class, students may be asked to read a scientific article, identify key vocabulary, and analyze how the author presents evidence and arguments. Through these activities, students simultaneously develop their understanding of the content and their academic language skills.

As Coyle, Hood, and Marsh (2010) explain, this approach allows students to develop both their academic language and their understanding of the subject matter in an authentic and meaningful context. In this approach, the science teacher focuses on explaining key scientific concepts while highlighting the language structures and vocabulary needed to understand and express those concepts. This allows students to see the relevance of language learning to their academic pursuits and promotes the development of both content knowledge and linguistic skills.

Scaffolded Learning

Scaffolding refers to the provision of temporary support to help students move from their current level of understanding to a higher level. In the context of LAC, scaffolding involves providing language support for students as they engage with complex scientific texts and tasks. For example, teachers might pre-teach key vocabulary before a lesson, provide graphic organizers to help students structure their writing, or offer sentence starters to guide students in producing academic responses. As students become more proficient in both content and language, the level of support can be gradually reduced.

This approach ensures that students are not overwhelmed by the challenges of learning both language and content simultaneously. Scaffolding allows students to build their language skills in a supportive, step-by-step manner, ultimately leading to greater independence and mastery.

Task-Based Learning

Task-based learning (TBL) is an instructional approach that uses real-world tasks as the basis for learning. In science education, these tasks could involve activities such as designing experiments, analyzing scientific data, or presenting research findings. These tasks require students to use language in meaningful ways, while also engaging with scientific

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concepts. TBL allows students to practice academic language in authentic, content-based contexts, which can be highly motivating and effective.

For example, students might be asked to write a lab report, conduct a peer review of a scientific article, or collaborate in a group to solve a scientific problem. By engaging in these tasks, students develop their ability to communicate scientifically while also reinforcing their understanding of the content.

Use of Technology

Technology plays an increasingly important role in supporting science students in English classrooms. Online tools and resources, such as digital glossaries, interactive simulations, and educational platforms, can provide students with additional support as they learn both science and language. For example, vocabulary-building apps or platforms that offer interactive science experiments can help students visualize scientific concepts and reinforce language acquisition in an engaging and accessible way.

Additionally, technology can facilitate collaborative learning and peer interaction, which are essential for language development. Students can work together on projects, share resources, and give feedback to one another through online platforms, thereby improving both their scientific and language skills in an interactive environment.

II. CONCLUSION

The integration of language and content learning is essential for the academic success of science students, particularly those learning in English as a second language. Language Across the Curriculum (LAC) provides an effective pedagogical framework for addressing the linguistic needs of science students by embedding language instruction within content learning. Through strategies such as content-based instruction, scaffolded learning, task-based learning, and the use of technology, science students can develop the academic language skills necessary to understand complex scientific concepts and communicate effectively within their discipline. By emphasizing the role of language in learning science, LAC fosters both academic and linguistic development, ensuring that science students are equipped with the tools they need to succeed in their studies and future careers.

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