

# Intersections of Science Learning and Language Development within Scientific Argumentation: Implications for English Language Learners

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**Abstract:** This piece contends that engaging in scientific argumentation simultaneously promotes second language acquisition through purposeful and authentic use of English, supports development of science content knowledge, and facilitates socialization into science practices. We explore the learning opportunities embedded within argumentation using a sheltered English immersion science classroom example. Through this examination, we provide direction for designing learning environments for students that promote these types of learning experiences.

## Purpose

Understanding the dialogic aspects of classroom life is crucial to comprehending the opportunities for students to engage in science. Such engagement in science discourse is fundamental to accessing the science being taught, learned and practiced in the classroom (Kelly, 2007). Therefore exploring the tensions that arise in teaching and engaging in science discourse is important to ensuring equitable educational opportunities for all students, especially English language learners (ELLs). The sheltered English immersion (SEI) model is an approach used to address the science education of ELLs, in which the teacher attends to both content and language development objectives (Echevarria, Vogt & Short, 2008). The purpose of this piece is to highlight the ways that an SEI classroom can enhance discourse opportunities by promoting the intersection of science learning and second language (L2) development through argumentation. We discuss features of the SEI environment that promote these experiences and provide insight into ways to increase opportunities for ELLs to engage in science.

## Theoretical Framework

A sociocultural perspective on science learning promotes enculturating students into the practices of scientific communities, which includes attention to the uses of language in science (Anderson, 2007). Anderson argues that “scientists are participants in communities of practice with shared linguistic and social norms, values, and patterns of activity” (2007, p. 18). Consequently, an important task for science teachers is to explicitly teach and engage students within the social, linguistic, and cultural practices of science (Kelly, 2007). Similarly, the sociocultural view in second language acquisition (SLA) places emphasis on how learners become users of an L2 (Lantolf, 2000). Combining these views, this piece examines the ways ELLs use their evolving L2 to perform interactive and expressive tasks that are fundamental to science, specifically those associated with argumentation. Argumentation was chosen because it is heavily dialogic in nature (Jiménez-Aleixandre & Erduran, 2008), encouraging students to generate, critically evaluate, and use evidence to support claims (Osborne, 2010). Additionally, this practice lets ELLs use their developing L2 through multiple modalities in authentic and meaningful tasks (e.g. reading and analyzing arguments). Little prior research on science discourse and practice has focused on students who have been historically marginalized in science education, including ELLs (Kelly, 2007). As such, this conceptual piece explores the educational potential of argumentation for ELLs.

## Exploration of an Argumentation Classroom Example

We suggest that argumentation is simultaneously a science learning opportunity, a language development experience, and an authentic practice through which students can become enculturated into the scientific community. Our perspective focuses on the ways that these learning experiences mutually support and inform one another. Given space constraints, only one classroom example will be used to illustrate this concept, although the final poster will contain more examples across language modalities (e.g. writing and reading). The following interaction was captured in a middle school SEI science classroom, in which students were learning about how relevant supporting evidence makes an argument more persuasive via a card sorting activity (see Table 1).

In this example, the students use their developing L2 to explain their reasoning as to whether a particular card illustrates relevant evidence for a claim. When Sofia says she can’t accomplish this task well (end of turn 3) Eva helps her articulate her reasoning (first sentence in turn 4). Following this interaction, Sofia is able to explain her thought process for another card, having learned from her peer how to express her reasoning in English.

During this interaction, the students also deepen their understanding of the science content. Their language experience was supporting and reinforcing their growing understanding of antibiotics and bacteria, while the task provided an authentic purpose to use their L2. Additionally, these students became enculturated into a fundamental practice of scientists. When Eva pushes Sofia to explain her reasoning by asking “Why?” (turn 1) she demonstrates a key component of argumentation: persuasion. This example illustrates how interlaced these learning experiences are, as well as how these intersections further strengthen the other learning experiences’ outcomes.

Table 1: Transcript exemplifying learning opportunities within argumentation

Turn	Speaker	Transcript
1	Sofia	[Student chimes in and finishes reading aloud the card with the other student] –“make people very sick.” I think this here [Student points to irrelevant pile] because doesn’t support the claim.
2	Eva	Why?
3	Sofia	[Student rereads card] Because dice ( <i>it says</i> ) [student reads off card] “unfortunately not all bacteria are helpful, helpful. Harmful bacteria can invade the human microbiome through cuts, spoil food, microbiome through cut.” I think, yo no puedo hacer bien la cosa esta. ( <i>I can’t do this thing well</i> )
4	Eva	Okay, I think here is [Student points to cards in irrelevant pile] here are information because they are like not connecting in the claim because they don’t have any antibiotics and kills and bacteria [student points to cards in irrelevant pile], like B right? And here [student points to cards in the relevant evidence pile] they have, we have to see and read if they are [student points to claim card] antibiotics killing bacteria. And here this say [student points to card in relevant evidence pile] antibiotics kill bacteria, that’s why it’s here.

However, we do not propose that the mere inclusion of argumentation resulted in the students having these learning opportunities. In line with Berland’s (2011) work, we argue that multiple factors, such as the teacher’s role, were integral in enabling this triad of learning experiences. For instance, before beginning the card sort, the teacher instilled in her students the importance of articulating the “why” behind each card sort decision. The effect of this instructional strategy came across when Eva pushed Sofia to explain the reasoning behind her decision. Another teacher action, which is evident in Eva’s response to help Sofia, was the simplification of argumentation language. Before the card sort started the teacher made the language of the claim more accessible to her students by asking them, “If you had to say this claim in three words, what three words would you use?” Eva reminds Sofia of these salient words when advising her to read for “antibiotics”, “kills”, and “bacteria” (second sentence in turn 4).

## Implications for Education and Research

We argue that engagement in scientific argumentation presents numerous authentic opportunities for science and language learning not only to occur simultaneously, but also to strengthen and support one another’s development. However, a crucial aspect of such experiences is understanding effective supports for ELLs in using their developing language to access and engage in science learning through argumentation. Consequently, a task for future research will be to identify the key characteristics of the learning environment that promote these interactions.

## References

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