ELLs: Children Left Behind in Science Class

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English Language Learners: Children Left Behind in Science Class*

Abstract
This study was part of a larger study conducted in third grade classes to investigate how science can enhance ELLs’ literacy skills. This paper reports ancillary findings that emerged from a year of classroom observations related to the way classroom teachers deal with ELLs in the science classroom. The results indicate that mainstream teachers do not accommodate ELL students and that hands-on, inquiry learning was not provided in science classes. Our findings indicate that science education has been pushed aside in these classrooms due to No Child Left Behind state-mandated testing. The presenter will discuss recommendations for teacher education and professional development as well as further research.

Introduction
English language learners (ELLs) represent 9.3 percent of the US K-12 public school population (Solano-Flores & Trumbull, 2003). While enrollment of ELLs is likely to increase, also noted by educators is an academic performance disparity between ELLs and fully English proficient students (FEPs). There is not only a substantial achievement gap between FEPs and ELLs in science, but minority students also are less likely to be represented in science-related majors in higher education (August & Hakuta, 1997). However, science has been recognized as a critical subject for academic achievement and for the future careers of today’s students (Torres & Zeidler, 2001). If ELLs are behind FEPs in a subject that can lead to success in life, they not only lose out in school but in life as well. Thus, it is imperative to investigate how the achievement gap in science learning between FEPs and ELLs might be reduced. This study is part of a larger year-long study conducted in third grade science classes to investigate how reading and writing in science class enhance ELLs’ literacy skills. However, this report focuses upon ancillary findings related to the way teachers deal with ELLs in the science classroom that emerged from classroom observations.

Unique Needs of ELLs in Academic Settings
The most salient characteristics of ELLs is that they are in the process of developing English. Within two to three years upon arrival to the U.S., ELLs rapidly develop social English that allows them to carry daily conversations. However, they do not read and write as proficiently as FEPs and it takes ELLs up to seven years to be on grade level (Cummins, 1981). Though ELLs may have sufficient English to converse in social settings, this does not mean that they are capable of fully understanding content area learning, such as in their science class.

According to Krashen, (2003), language acquisition takes place when second language learners understand messages through comprehensible input. When a message is delivered in English that is slightly above their current level, ELLs understand the message and as a result their language acquisition process is expedited. Comprehensible input has significant implication for teaching ELLs, especially in the area of content learning. If ELLs do not understand their teachers’ explanations, they simply will not learn. However, a problem identified with regard to comprehensible input is that teachers’ speech often is not appropriate. Primarily, teachers speak too fast for ELLs to understand (Echevarria, Vogt, & Short, 2000). In order to reach their ELL students, mainstream teachers have to modify their speech when they are giving directions or explaining essential concepts related to lessons. They need to slow down their pace and clearly pronounce important words. Another recommended speech modification includes teachers’ avoidance of using idioms and slang terms that may be recognizable to FEPs but not ELLs.

Comprehensible input in content-area learning, however, is more than simply teachers’ appropriate speech. It also has to do with how teachers introduce topics and deliver lessons. That is, teachers should use diverse strategies to facilitate content learning and conceptual understanding by ELLs. Such
strategies include using visuals, realia, hands-on activities, even body language and gestures (Echevarria et al., 2000). Comprehensible input also has to do with scaffolding. Scaffolded instruction enables student transition from guided learning to independent learning. For example, teachers need to model language or a target behavior so that ELLs clearly understand what task is expected of them. Students, in turn, can complete the task.

**Professional Development for Mainstream Teachers**

There are many conditions of learning that have to be met in order for educators to reduce the achievement gap between FEPs and ELLs. At the very least, success will depend upon teachers’ preparedness. If teachers do not know how to accommodate ELLs in their content classes, such as science, ELLs will not be able to understand instruction and their lack of learning will be reflected in measured achievement.

For educators to reduce the achievement gap between FEPs and ELLs, they need to become skilled in differentiating instruction (Tomlinson, 1995). Differentiated instruction is a concept-focused approach to planning so that a lesson is taught to a class while meeting students’ individual needs. Differentiating instruction means offering tiered sense-making activities for content learning to address differences among students’ learning profiles, readiness levels, and interests. The goal of such instruction is that all students understand the major ideas involved in particular content. Teachers continuously assess student learning and provide support when additional information or guidance is needed.

**Inquiry-based Science Learning**

The nature of science itself involves a process of investigation. Bruner (1960) describes inquiry as the process of discovery where students find solutions to problems through scientific investigation. Taba’s (1971) inductive model allows students to organize and categorize data and hypothesize about the accuracy of their decisions. Inquiry-based teaching allows teachers and students to investigate and hypothesize about the natural world and to use the data that they have accumulated as evidence. Through inquiry-based teaching students’ natural curiosity and interest become a motivating factor in classroom instruction.

Inquiry teaching is not using a cook-book lab from a textbook. It is more closely associated with the constructivist perspective where investigation allows for student-generated hypotheses and solutions (Bentley, Ebert, and Ebert, 2000). The dynamic nature of science is brought to life by inquiry-based instruction. The major national curriculum reform projects of the last decade, including the National Research Council’s National Science Education Standards (NRC, 1996) and the American Association for the Advancement of Science’s Project 2061 (AAAS, 1993) strongly endorse the inquiry-approach. In fact, the National Science Education Standards holds that inquiry is the central strategy for teaching science (NRC, 1996, p. 2, 105). Inductivist teaching is consistent with differentiated instruction in that in both approaches the teacher works more as a guide or facilitator of learning than as a dispenser of information.

**The Study**

The current study was conducted in two third grade science classes in a rural area in a southeastern state of the U.S. Due to the area’s agricultural economy, the Hispanic population has been steadily growing. The school used as the research site has a larger percentage of Hispanic students than other districts in the state. Two classroom teachers in the school volunteered to participate in the study. Teacher Participant 1 had five ELLs in her class while Participant 2 had three. One of the latter teacher’s ELLs moved to a different state after the first semester. All ELLs were Hispanic. Of the 8 ELLs, three of them were beginner ELLs whose English is limited, which indicates the 30th percentile or lower on the
national norm of the IDEA Proficiency Test (IPT) given to ELLs. The IPT tests are given to ELLs in the beginning and end of each academic year.

While this study was originally planned to observe science classes each day of the week, in this school science is only taught every two weeks, alternating with social studies. That is, math is taught every day but science is taught daily for two weeks, then teachers switch to social studies for the next two weeks. Further, science and social studies are taught during the last time period of the school day. The rationale behind this end-of-day least-favorable instructional time slot shared between science and social studies is that, under the No Child Left Behind Act (NCLB), science test scores are not critical for the state report card. NCLB stipulates that states assess reading and math every year from 3rd through 8th grade, and a science assessment is not mandated until 2007.

Three kinds of data were collected by a trained research assistant: classroom observations, a teacher instructional behavioral checklist used at each observation, and students’ schoolwork. The names used below are pseudonyms.

Findings
This study was originally conducted to investigate how explicit reading and writing strategies can enhance ELLs’ science learning. However, this article discusses the ancillary findings that were not part of the original study design yet emerged as important aspects to teaching ELLs in science class.

The most serious problem identified from the study was that, despite the provision of a strategy handbook and discussion of strategies for working with ELLs, the participating teachers struggled to implement the strategies discussed in the weekly meeting where the authors and research assistant met for two hours. At the meeting, first, the authors reviewed the previous lesson based on the observation script to highlight positive aspects of the lesson and to suggest ways to improve the lesson for the future. The participating teachers explained (or sometimes defended) why the lesson did or did not go as planned. Second, the authors offered specific strategies for the following week’s lesson based on previewing the upcoming curriculum content before the weekly meeting. In addition, the authors also demonstrated a hands-on science activity so that the teachers could observe the procedures as well as the results of the activity. The authors also suggested ways to differentiate the lesson for accommodating CLD students. Nevertheless, one of the two teachers never succeeded. This teacher was particularly resistant to change her instructional behaviors: She would say, “It is very hard to teach all students. I’m doing as best as I can.”

No Comprehensible Input
The first problem that was found with the instruction provided by the two teachers was that comprehensible input was not provided, either through appropriate speech or use of supplemental material. Much of the time the ELLs with limited English proficiency could not follow their teacher’s directions. As a result ELLs were at a loss in class, not knowing what to do. Among their coping strategies was to wait until their peers completed the assigned work and then copy from them. In addition, if their Hispanic peers did not explain what was expected of them in Spanish, beginner ELLs would not know what to do, as this excerpt shows:

Tienes que escribir que es lo que sabes de los animales, si viven en el agua… (You have to write what you know about animals, if they live in the water…).

Or ELLs asked the observer in Spanish:
Dónde los escribo (Where do I write them)?
Secondly, the teachers would read the science textbook to the class at such a pace that the observer often found that ELLs were not engaged, i.e., they were gazing at the chalkboard or looking around the room while they were instructed to read along with the teacher. The teachers regularly centered their lesson on paragraphs in the textbook. Yet ELLs did not know what paragraph or page to read because they could not follow what was being read to them. The teachers read paragraphs that were well beyond the ELLs’ current English level.

Thirdly, the teachers did not explain the key concepts clearly using simpler expressions. They simply reproduced the exact same language used in the text.

**Surface-level learning**

It was found that neither teacher had her students engaged in in-depth learning. The superficial lessons were characterized by a lack of students asking ‘why’ or ‘how’ questions and teachers accepting surface-level responses. The following is an excerpt of the interaction which took place in a wrap-up at the end of the science class. The teacher asked:

T: I need someone to tell me what they (sic) learned today. Sandy (an ELL), can you tell me something you learned?
S: population
T: Good! Today, you just have math homework.

This was the teacher’s conclusion of the class. The ELL’s answer cannot be taken as her understanding of the lesson introduced. Rather it was a mere repetition of the vocabulary word she had heard, because ‘population’ was part of the lesson vocabulary. To assess the ELL’s understanding of the concept, the teacher should have responded differently to the student’s answer, probing to find out whether she actually learned the important concepts related to population, community and ecosystem. An appropriate probing question might have been, “Maria, can you tell me why you think the size of a population affects an ecosystem?”

Also many of the instructional activities we observed in the classroom were not closely linked. Some of them appeared to be a time-filler or disjointed at best. The teacher showed a video entitled ‘Cycles on Earth and in Space’ that dealt with how dams control floods and another about weather in Arizona. There was no introduction about the content of the video or any pre-viewing activities. The following questions were asked to the students after they viewed the video:

T: Let’s have a quick review before we go home. What planet do we live on?
All students (All): Earth!
T: What continent do we live on?
All: North America!
T: What country?
All: (students answer the name of the state.)
T: Whoa! Let’s think about that again, what country?
All: Oh! United States! America!
T: Now what state?
All: (students answered correctly)

**No Hands-on, No-inquiry Method Used in Science**

The science instruction observed in the third grade classrooms did not take a hands-on or inquiry approach. Throughout the year the teachers heavily relied on textbook information and science was taught with textbooks supplemented though lectures. The participating teachers did not provide hands-on activities and few supplemental materials, such as models, visuals or realia were utilized. For
example, in teaching the rocks and minerals unit, the teacher did not have sample rocks for students to study.

The lessons had a traditional design, emphasizing vocabulary learning and textbook reading, in contrast to inductive or inquiry teaching, which researchers consider to be critical for science concept development. Further, one teacher relied heavily on external rewards for student performance, such as stickers and Sponge Bob cards. The excessive use of external rewards to capture and sustain students’ attention seriously limits educational opportunities that would lead to in-depth understanding of the scientific concepts.

No Direct Interaction with ELLs with Low English Proficiency

It was noted that during the entire academic year, one of the participating teachers did not interact with ELLs who had low English proficiency. There were many classes in which there was a complete absence of verbal communication between the teacher and the ELLs with the lowest English proficiency. The teachers did interact with some ELLs, but only with those who spoke English more fluently. When there was some exchange between the teachers and the low-performing ELLs, the teachers heavily relied on other ELL students for translation, as the following excerpt shows:

T: Sandy, can you ask Maria if she can tell me something important about water? Sandy translates and Maria shakes her head.
T: (a face with a shocking expression.) You can’t!!! Let’s see… do you use water at home???

Conclusion

Although science is recognized as an important subject for students’ future careers, it is pushed aside in the curriculum because it is not considered as critically important as reading or math. The persistent concern that emerged was that ELLs are not accommodated at all in the science classroom. Even though the teachers had been instructed during workshops and in weekly consultations in the use of strategies for making the subject matter content more comprehensible, they did not accommodate the ELLs as intended. Despite the discussion of strategies for working with ELLs, the participating teachers did not implement, or only partly implemented, the strategies discussed in the weekly meetings. One of the participating teachers did not implement any of the strategies that would make the content comprehensible to ELLs.

On one occasion this teacher said in the weekly meeting that it is more important for ELLs to attend an ESL class, which is 30 minutes of pull-out instruction focusing directly on grammar. This participating teacher does not recognize that when their needs are being, met ELLs are able to learn grade-level content in their own classrooms, or that pull-out ESL class is not the most desirable overall program for these students. The teacher’s statement may have reflected her attitude that all students should master English before taking mainstream classes.

We believed that the workshops that we conducted and the weekly consultations with these teachers would have resulted in more attention to ELLs in the classroom and in more appropriate instruction, but in terms of the quality of instruction, the results were disappointing. Perhaps more extensive professional development programs for teachers, in which they themselves experience the inquiry approach as it is modeled, may be more successful in influencing teachers’ choices of instructional activities for their students. If the teachers had used activities such as those that had been suggested to them, they may have realized that inquiry teaching could appropriately address science content standards.

Professional development for mainstream teachers has emerged from this study as the most pressing issue regarding the science education of ELLs. ELLs by far spend most of their time in the mainstream
class. If the mainstream teacher does not know how to differentiate his or her instruction and how to accommodate ELLs’ different needs, ELLs will continue to be the children left behind their FEP peers (Brown, 2003).

References


*based upon the following article (Fall 2004):