ABSTRACT

The 2006 National Science Board called for new strategies and instructional materials for teachers to better serve English Learners’ (EL) needs. Bilingual Collaborative Online Projects in science were created to assist ELs' construction of science knowledge, facilitate academic English acquisition, and improve science learning. Two bilingual Collaborative Online Project units in science are freely available on an instructional website: the Let's Help Our Environment and the What Your Body Needs units. These projects combine two constructivist approaches, Project-Based Learning and the Cognitive-Affective Theory of Learning with Media, for the teaching of science embedded in culturally and linguistically relevant instruction. This study hypothesizes that Collaborative Online Projects will assist ELs' construction of science knowledge and facilitate academic English. Results of a pre-/post-test design pilot study (N=136) showed statistically significant differences for both tested science units. Teachers also reported that the Collaborative Online Projects were an effective method of online science instruction.

Keywords: Bilingual, English Learners, Online Project-Based Learning, Science, Technology

INTRODUCTION

Science Learning Outcomes for English Learners (ELs) of Hispanic Origin

According to the 2010 census, PreK-12 Hispanics made up nearly one quarter (23.9%) of the U.S. public school enrollment, a 7% increase from 2000. In 2007, 7.2 million Hispanic elementary and secondary school students spoke a language other than English at home. Mexican, Dominican, Salvadorian, and other Central and South American students are the predominant students who
have difficulty speaking English. While ELs speak more than 150 languages, the overwhelming majority (77%) speaks Spanish.

Science scores from the National Assessment of Education Progress (2011) indicated that Hispanic students lagged behind all ethnic groups, except for African American students, on 4th, 8th, and 12th grade benchmarks. In 2010, the national high school dropout rate was higher among Hispanics (5%), African Americans (5.5%), and Native Americans/Alaska Natives (6.7%) compared to Caucasians (2.3%) or Asians/Pacific Islanders (1.9%) (NCES, 2013). College enrollment rates also showed differences by race. Of all 18- to 24-year-old Hispanic adults, only 34.8% attended college (NCES, 2011), compared to Caucasian (44.7%), African American (37.1%), Asian (60.1%), Pacific Islander (37.8%), or biracial (38.8%). On average, fewer Hispanic students attended college than any other racial group except for American Indians/Alaska Natives (23.5%). Middle school is the point at which the performance of ELs begins to take a downward turn, affecting performance throughout students’ secondary school experiences.

Because it takes seven to 10 years to develop the cognitive academic language proficiency (CALP) necessary to learn successfully in a second language (Cummins, 1981), ELs often do not have sufficient knowledge of academic English and science vocabulary to benefit from science instruction provided in English (Garcia, 1988). Academic English requires an extensive array of skills, use of reading and writing, and background knowledge (Garcia, 2005). Yet, academic English is what students need in order to reach benchmarks on state achievement tests (Wong-Fillmore & Snow, 1999). To keep these students from falling behind their English-speaking peers in academic areas such as science, English language learning must be integrated into science instruction (Lee, 2005). Cleghorn (1992) and Kearsey and Turner (1999) found that when teachers incorporated use of native languages, science content was made more accessible to bilingual students.

Research has also shown that it is important for science instruction to take into consideration prior cultural knowledge in relation to science disciplines (Lee, 2005). This integration is critical given the climate of standards-based instruction, high-stakes assessment, and accountability. Culturally relevant pedagogy focuses on students’ culture and language (Lee, Deaktor, Hart, Cuevas, & Enders, 2005). For most Hispanic students in American schools, culturally relevant pedagogy includes the Spanish language and the environments, traditions, foods, plants, and animals found within a Latin American context. However, appropriate high-quality materials that are both linguistically and culturally relevant, and that meet current science education standards, are difficult to find (National Science Foundation, 1997).

Bilingual (Spanish/English) Collaborative Online Project units in science were designed, with funding from the National Science Foundation, to provide both culturally and linguistically relevant instructional materials for middle school Spanish-speaking ELs. We chose to design bilingual Collaborative Online Project units because research on ELs’ achievement within different types of EL programs found greater success when the students’ native language was used to support content-area learning and least success when students were immersed in the new language without linguistic support (Thomas et al., 2002). This is especially true for newcomers and those who are literate in their native language. The following section presents the conceptual framework behind the development and conceptualization of the Collaborative Online Project units, followed by a complete description of instructional components of the units.

Conceptual Framework

This study combined constructivist approaches of Project-Based Learning and the Cognitive-Affective Theory of Learning with Media (CATLM) for the teaching of science embedded in
I.Q.-I Question: Teacher and Student Questioning in an Online Environment
www.igi-global.com/article/question-teacher-student-questioning-online/2332?camid=4v1a

System Conversion: Teaching vs. Reality
www.igi-global.com/article/system-conversion-teaching-reality/2284?camid=4v1a