Classroom of the Sea: Problem-based learning for the deaf

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Abstract
The Classroom of the Sea (COS) Project is an interactive problem-based learning environment embedded in marine science for deaf high school students to assist them in understanding and communicating scientific concepts. COS mixes a real and virtual environment for the students and teachers aboard a research vessel as they gather marine science data to address a problem. The students note the locations of their samples and record them on the ship’s LAN. Once the students return to their classrooms, students, faculty and researchers work to place the data they have collected on web sites enabling students to experiment with real data, generate hypotheses, test these hypotheses and write up their results. Knowledge, attitudes and behaviors (KABs) and self-efficacy measures related to science literacy and procedures of the students are collected to measure changes.

Introduction
For the purposes of this study, constructivism is defined as meaning making, rooted in the context of the situation whereby individuals construct their knowledge of, and give meaning to, the external world [1, 2, 3, 4] as a product “shaped by traditions and by a culture’s toolkit of ways of thought” [5]. “Consistent with this view of knowledge, learning must be situated in a rich context, reflective of real-world contexts for this constructive process to occur and transfer to environments beyond the school or training classroom.” [6].

For learning and transfer to succeed, the educator must design a constructivist learning environment. But, what constitutes a constructivist learning environment, particularly for a project like the Classroom of the Sea simulations? - A learning environment in which students identify and address real problems of acoustics, marine life, changes in the ocean environment and the impact of various parts of the marine environment. An environment was created in which students go to sea on a research vessel several times a year, collect data and present it on the web for others to view (see www.cos.uconn.edu). The others that view and explore this data are predominately hearing students at high schools across the USA as well as other students in schools for the deaf.

A key component in this definition is problem-solving activities. Problem-solving skills are essential for today’s workforce. One of the best ways of preparing students for this is through the use of real-world, authentic problem-solving. This method of instruction, commonly called Problem-based Learning (PBL) has been used for decades, starting in medical schools in the 1950s and then adapted for use by business schools, schools of education, architecture, law, engineering, etc.

COS is a model that meets the criteria for PBL in a constructivist environment. It is authentic, complex, substantive, learner empowering, and challenging.

Working through an interdisciplinary team COS combines real and virtual environments by scheduling working class trips for the students and teachers aboard the research vessel RV Connecticut for a day. During this period on the ship the students gather marine science data related to addressing a specific component of the problem-based learning environment (PBL).

Once the students return to their classrooms, students, faculty and researchers work together to place the data they have collected on web sites enabling students to experiment with real data and share their data and insights with other students, both hearing and deaf.

Because this is a special population of deaf high school students, there are special challenges of communications among the students, teachers and crew of the ship. A specific challenge of this project is the development of a set of communication signs that represent science concepts for which currently there are not any American Sign Language (ASL) signs/symbols.
Procedures

Each trip out to sea, the students (n=10-12) complete pre- and post-assessment of science knowledge, attitudes and behaviors. Students write about their goals and objectives, as well as their accomplishments.

Knowledge, attitudes and behaviors (KABs) of the students were collected to measure changes related to science literacy, attitudes and things the students can accomplish. The KAB approach is a derivative of Bloom’s taxonomy of cognitive, affective and psychomotor skills and has been used effectively in a varied number of research studies [7].

Additionally, self-efficacy measures are collected. Self-efficacy (SE) is a concept developed by Bandura and focuses on a person’s belief of self-agency; that a person can attempt and accomplish a specific task successfully. Bandura’s work has demonstrated that SE is a good predictor of task commitment and task engagement [8]. In the COS study, the SE is related to science procedures.

Both the KAB and the SE scales used a Likert-type format with two anchors for responses (1=Strongly Agree and 5= Strongly Disagree), where 1 represents the strongest response.

In addition to the scales, students were asked about their reactions to the activities in a written survey. Student interactions were observed during ship as well as classroom activities to examine communication access patterns among these deaf students using scientific concepts.

Results

The pre-test Cronbach reliability for the KA portion of the KAB instrument was .87. The SE scale for scientific procedures was .95.

Mean scores on the KAB indicated that students reported knowing and understanding science concepts, had a positive attitude towards science and believed they could successfully conduct science procedures as well as tasks on the ship (Mean’s ranged from 1.14 to 1.71, where 1= Strongly Agree and 5 is Strongly Disagree). SE responses were also positive with means ranging from 1.57 to 1.86 regarding students’ ability to conduct scientific procedures.

Responses to open-ended questions were also positive, as exemplified by the following two responses: “I never really liked science before being involved in COS though I’ve always had good grades” and “Science particular made me feel smarter. Though it’s not what applies to my future career but it’s a great benefit. (sic) “

Conclusion

The results of the COS project have demonstrated that a PBL environment can be successful in increasing students’ KAB and self-efficacy related to science for deaf students. Additional studies are being conducted to examine the long-term impact as well as the effects of transfer of KABs and SE to other academic areas for these students.

References