Science in a Cultural Context: Teachers as Cultural Brokers

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Background and Literature Review

- In spite of a stated emphasis on the importance of the sciences in the United States (National Research Council, 2014), many schools in the US are still not inspiring enough children from diverse backgrounds to want to become scientists. (Dewitt & Archer, 2015). This is especially true, according to James (2001), for children from indigenous backgrounds.
- Two major challenges for educators attempting to provide equity and access to the children are a lack of science content and pedagogical knowledge and a lack of knowledge about how to bridge two seemingly disparate ways of understanding the world.
- One strategy to mitigate this problem is to provide practitioners with cultural and content knowledge, such that they can act as cultural brokers navigating seamlessly between two or more languages, cultures, and world views and provide assistance for others attempting to navigate unfamiliar cultural territory (Wyatt, Chapman de Sousa, & Mendenhall, 2017).
- Another is to implement a culturally responsive curriculum. Ladson-Billings (1994) describes this as "a pedagogy that empowers students intellectually, socially, emotionally, and politically by using cultural referents to impart knowledge, skills, and attitudes" (p. 382).
- Teachers at a Hawaiian language immersion (HLI) public charter laboratory school on the island of O`ahu wished to teach their K-3 students the sciences from both a western and Hawaiian perspective, but like most teachers, they were unsure how to start. They wanted to learn both content and strategies.
- We utilized job-embedded professional development (PD) strategies grounded in the local community and driven by participant need. This type of PD has been described as a significant factor in improving the practices of PK-6 teachers (Goodyear & Casey, 2013).
- Because prior research (Schonleber, 2006) showed congruency between the Montessori approach and a Hawaiian way of teaching and learning, the teachers were interesting in learning whether they could adapt some of Montessori's ideas for their curriculum.

Research Questions

Our research questions were, (a) what aspects of Montessori's cosmic curriculum (if any) could best support the integration of science concepts from both a Western and an indigenous perspective; (b) could place and inquiry-based pedagogies support the teachers in their ability to act as cultural brokers, and (c) how would the use of job-embedded professional development support the teachers to create and implement a sustainable science curriculum based on both Western and indigenous views of science?

Methods

- This exploratory case study utilized qualitative methods. Grounded theory methodology (Denzin & Lincoln, 2011) guided the overall design strategy.
- **Setting and Participants:** The study was conducted from 2007-2009 at a K-12 HLI public charter school located in a semi-rural area of Hawai`i. Participants included 6 K-3 HLI teachers, the *Kumu* (administrative leader), 40 HLI students ranging in age from five- to eight years, and the principal investigator. A retrospective was conducted in 2017.
- **Data Sources:** Data sources included semi-structured focus groups, teacher reflections and work samples from workshops and a summer course, classroom observations and coaching sessions, and school documents.
- **Procedures:** We began in the spring of 2007 by *exploring and clarifying teacher needs* through focus groups and the administration of the Science Teaching Beliefs Instrument (STEBI) (Riggs & Enochs, 1990). We next created *a community of practice* based on our initial work. Four workshops and a summer course provided teachers with needed content and pedagogical knowledge, and ongoing consultation and coaching commenced. In the fall of 2008, teachers began *implementing inquiry and place-based projects*. Individualized coaching and observations continued on a monthly basis for all classrooms through the spring of 2009. At the conclusion of the spring, 2009 semester, the students and their families concluded the year by *celebrating their learning*. We used some of the initial questions from the STEBI to ascertain perceived student and teacher confidence with regard to teaching and learning the sciences.
- **Data Analysis:** The "constant comparison" method described by Strauss and Corbin (1994, p. 283) was used for qualitative data analysis. Data were coded first by key words; then emergent themes. Axial coding led to the grounded theory that best explained the date. Member checks concluded the study.

Findings

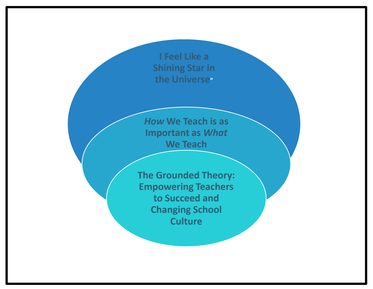

Figure 1. The three emergent themes and the grounded theory that emerged.

Figure 2. Children's art work depicting the Hawaiian concept that each individual and each star in the universe is unique.

Figure 3. Child's artwork depicting the relationship of ocean to land creatures-a Hawaiian classification system

- The three themes shown in Figure 1. describe the major outcomes and grounded theory to emerge from the data. The first theme helped us to better understand how the use of job-embedded PD supported the teachers in creating and implementing a sustainable science curriculum. It also became the grounded theory for the study, as it tied the other two themes into a coherent whole.
- The second theme provided insight into our second two research questions about the aspects of Montessori's cosmic curriculum that best supported the integration of sciences concepts for the teachers, and whether the use of place and inquiry-based strategies supported teachers in their ability to act as cultural brokers Figure 3. shows one outcome of this work.
- The third theme showed the teachers the power of the strategies they adopted and tried over the two years of this project. When asked during the final interview how she felt about being at her school, one student said, "I feel like a shining star in the universe. " Figure 2. shows art work depicting the Hawaiian belief that each person, like each star in the sky, is a unique gift to the whole.

Discussion and Conclusion

Teachers began this project unsure about how to implement the kind of science curriculum they wanted, and their students did not see the value of "Western Science." By the end of the project, teachers were unanimous in feeling capable of teaching what the kindergarten teacher called "two ways of viewing the world" (Anuenue, FR), and students were engaged and interested.

When asked in a retrospective interview in 2017 about what aspects of the project still endured, the answer was that they still used components of their original work, but that it has been hard to have the time to develop new projects. This is consistent with other research (e.g., Sherer & Spillane, 2011) showing that constancy over time, and enough funding to allow teachers to do professional development is a key to lasting change. Two years is longer than most PD workshops, but it was not enough time to achieve enduring change. Montessori spent 30 years doing most of the training herself (Trudeau, 1984), and in spite of ongoing voluntary monitoring, there are still wide variations in program implementation.

Finally, the teachers' assessment of the essential components for the original success of the project had not changed. Ample resources, a teacher-driven collaborative approach to change, and the use of specific educational practices that bridged indigenous Hawaiian values and Western science content, including the use of a place-and inquiry based curriculum, an adaptation of Montessori's Cosmic curriculum, and hands-on pedagogical strategies incorporating Hawaiian ways of teaching and learning were still seen as essential.

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