One Small Space , A Topic of Wonder, and Montessori: Increasing Equity and Access to the Natural Sciences for Young Children and Adults in Underrepresented Communities

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Purpose and Background

- The purpose of this qualitative case study was to document how preschool teachers in non-Montessori settings would respond to a unique approach to teaching STEM. The approach incorporates the cultural studies and cosmic education curriculum of Dr. Maria Montessori, the natural world, the pedagogical strategies developed through the Center for Research, Equity, Diversity, and Education (CREDE), the tools of scientists, and the children's own interests.
- The project was driven by the need find better ways to provide equity and access to the sciences and the natural world for children and adults from underrepresented communities, and the need for more scientists from diverse backgrounds and cultural perspectives as the world confronts climate change and the resultant instability to communities and countries.
- While adults may want to provide experiences that support young children in viewing themselves as future scientists and in providing them with access to the natural world, they may not know how to provide these experiences. Many preschool teachers, especially teachers from underrepresented communities, state that they do not have enough foundation in science education to feel confident in their ability to teach science content and do not view themselves as capable of being scientists themselves.
- One possible solution to this problem is early exposure to a culturally and developmentally responsive natural science curriculum that is learned in the company of trusted adults. These trusted adults include early childhood practitioners who can act as cultural brokers in the learning process.
- Dr. Maria Montessori developed a culturally responsive, place-based and integrated approach to teaching the sciences to preschool-age children that began as an extension of her practical life and sensorial areas of the preschool environment and was refined by her experiences in India during WWII
- The curriculum that evolved includes a holistic view of the natural world where the parts of science the Western world calls botany, zoology, anthropology, and chemistry are viewed worthy of study as separate topics, but always with an understanding of the interrelatedness of all the sciences and the natural world and always within the context of the child's own culture.
- As an experienced Montessori teacher educator, I wondered how or if Montessori's approach to teaching the sciences could be helpful in both increasing the confidence of non-Montessori trained adults and/or if the use of Montessori's approach could help foster both a sense of "I am a scientist" and a "falling in love" with the natural world in adults and children.

Research Questions

1. How would non-Montessori educators perceive incorporating the Montessori cultural studies and cosmic curriculum approach to teaching the sciences?
2. How would children in non-Montessori programs from diverse communities respond to the activities and ideas they learn and use from this approach?
3. What challenges might adults and children encounter in learning and enacting this approach?

Theoretical Framework and Methods

- **Theoretical Framework:** Sociocultural theory, with its emergent view of learning and development, framed this exploratory case study. Grounded theory methodology, utilizing mixed methods and an emancipatory research paradigm guided the overall design strategy.
- **Setting and Participants:** The study was conducted from 2018-2020 at two preschool centers located in a semi-rural area of Northern California. Participants included 10 self-selected early childhood educators and 40 preschool-age children. 85% of the children were of Latinx ethnicity, 60% spoke only Spanish when they entered preschool, and 100% were eligible for free or reduced lunch.
- **Data Sources:** Data sources included surveys, semi-structured focus groups, teacher reflections and work samples from workshops, classroom observations and coaching sessions. We adapted the Science Teacher Self-Efficacy Belief Instrument (STEBI) and the Draw a Scientist Test (DAST) to measure changes in participants' perceptions of themselves as scientists and science teachers.
- **Procedures:** We began at site 1 in August of 2018 by *exploring and clarifying teacher needs* through two small group meetings and the administration of both the STEBI and the DAST. We next created *a community of practice* based on our initial work. Four workshops provided teachers with the needed content and pedagogical knowledge to get started and ongoing consultation and coaching commenced. In the late fall of 2018, teachers began *implementing projects based on what they were learning*. Individualized coaching and observations continued at site 1 through the spring of 2019. We ended the project at site 1 in May of 2019 with a *celebration of learning*. We began working with site 2 in August of 2019 and used the same procedures, concluding in May of 2020. For the second site, we had to move to Zoom meetings and we could not have a celebration of learning, due to COVID.
- **Data Analysis:** The "constant comparison" method 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 four emergent themes and Grounded Theory



Figures 3 and 4. Children and adults exploring a topic of wonder

- **Theme 1 revealed that educators perceived the Montessori cultural studies/cosmic curriculum framework as easy to remember and allowed for both creativity and a sense of structure**. Educators expressed that they enjoyed, sometimes to their surprise, that they liked learning about their "topic of wonder" and felt comfortable working collaboratively with the children.
- **Theme 2 related to educators and children learning together**. Teachers' use of "joint productive activity" increased a sense of competence in teaching science and children included what they were learning in their play activities.
- **Theme 3 involved the teachers' appreciation for having the ability to problem-solve and work together on their projects**. Working together created a sense of shared knowledge about the topic no matter what the role of the adult.
- **Theme 4 showed the continued racial and structural inequity for people who work in the field of early care and education in the US**. Both sites experienced the disruption of turnover in teachers and teacher's assistants due to lack of childcare and/or lack of a living wage and benefits.

Discussion and Conclusion

- The findings from this study suggest that it is possible for an experienced and highly trained Montessori educator to provide accessible and useful PD activities to non-Montessori trained educators. It would be useful to replicate this study in different regions of the US with different Montessori educators to find out if this was an idiosyncratic event.
- The strategies used in this approach enabled early childhood educators gain a long-needed sense of self-efficacy and confidence in their ability to create a place-based STEM curriculum using the natural world. The US has a dearth of scientists from underrepresented groups and the approach to teaching STEM that we shared with non-Montessori teachers seemed to support them in gaining self-efficacy in teaching the natural sciences.
- The findings also showed that children who were engaged with this project were able to conceptualize what it means to be a scientist, felt an increased sense of responsibility for "nature," and showed us through their play that their views of scientists changed to including viewing themselves as scientists.
- And finally, the data bring to light the shameful fact that too many early childhood educators live in poverty. This fact was brought home powerfully to me when, to my shock, one of the teachers said to me, in response to discovering she was considered an essential worker, "I knew I was going to have to get my own health insurance [when I decided to become a preschool teacher]; I didn't know I would also need to buy my own life insurance."

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