One Size Fits All?: Mapping Out STEM Learner Empowerment Across Educational Contexts

A Doctoral Research Study through Portland State University's Graduate School of Education

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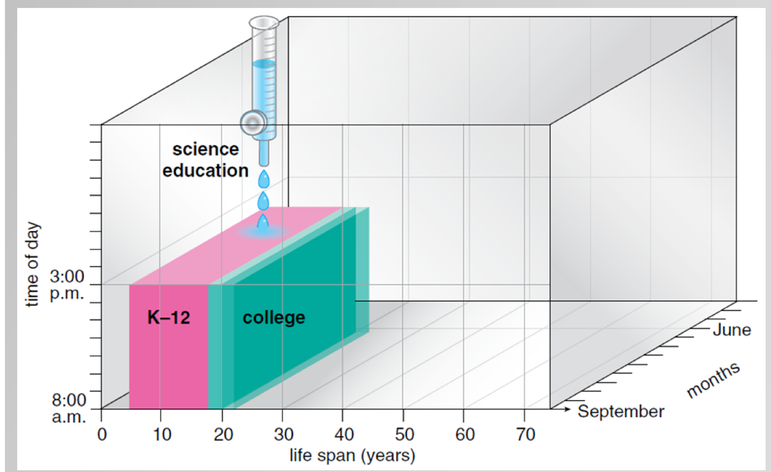
Why should we care about culturally sustaining STEM ecosystems?

- Approximately 85% of learning takes place beyond the classroom and similar formal education settings (Cross, 2006).
- While science centers provide accessible education and exposure to STEM-related content and experiences (Falk & Dierking, 2010; National Research Council, 2009), only one in four adults in the United States reported visiting a science center within the past year (National Science Board, 2014).
- In many cases, the learners who visit our institutions are not representative of the larger communities in which these institutions are located.
- Rather than arising from essential differences in interests between groups, there is evidence that the persistent disparities in STEM representation result from the complex interplay of multiple systems of privilege and power that limit the support, encouragement, and sustenance to which certain learners often have access.
- Interest and a desire to learn about and engage with STEM topics may be present to roughly equal degrees across demographic groups (acknowledging the existence and legitimacy of variations in individual preference).
- The experiences of female learners and learners of color in the United States have the potential to differ substantially from male and White learners, and these differences in lived experience may affect the degree and types of support they receive for their STEM learning motivation and self-efficacy.
- Creating culturally sustaining STEM ecosystems requires educators to recognize and support the agency of learners and the legitimacy of their pedagogical preferences, as well as the value of other resources within their ecosystem.



Visual representation of classroom learning time over the average lifespan (Falk & Dierking, 2010)

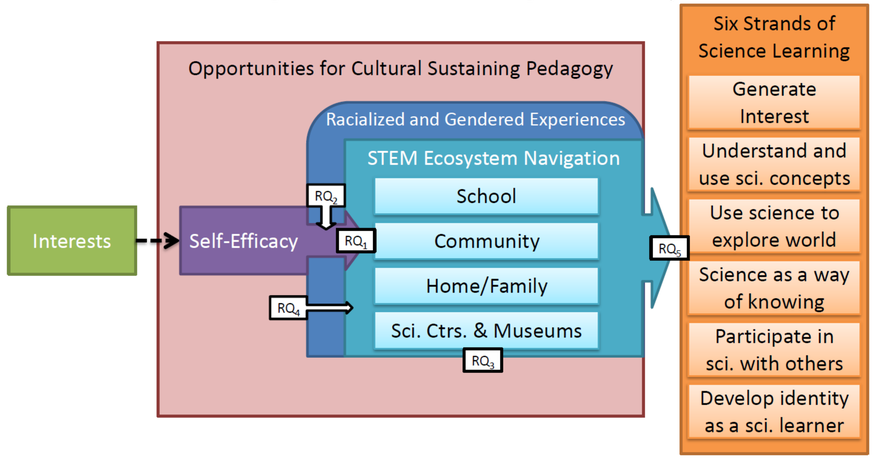
What is the problem?

Research and experience alike indicate that learners are not engaging in STEM or being supported in fostering STEM interest at equitable rates, and we as STEM educators do not sufficiently understand their individual and cultural motivations and needs, nor how they engage with their holistic STEM ecosystems to seek out culturally sustaining experiences and resources through their educational journeys.

What questions are guiding this research?

- RQ_1: In what ways do the feelings of self-efficacy expressed by Portland-area learners correspond with expressed preferences regarding the various resources in their local STEM education ecosystem?
- RQ_2: In what ways do race, gender, and ethnicity impact the relationship between expressed self-efficacy and STEM ecosystem preferences among Portland-area learners?
- RQ_3: To what extent do Portland-area learners report feelings of cultural sustenance when engaging with the various resources in their local STEM education ecosystem?
- RQ_4: How is the relationship between feelings of cultural sustenance across STEM ecosystem resources among Portland-area learners mediated or moderated by race, gender, and ethnicity?
- RQ_5: In what ways do Portland-area learners indicate that their agentic engagement in their various STEM ecosystem resources correspond to the learning outcomes proposed by the Six Strands of Science Learning?

Conceptual Model for Proposed Study



Who will this work support?

I envision the findings from my exploration of this research problem as being of primary value to STEM educators in informal settings, but I believe they will likely be relevant to those in formal settings as well, and most importantly, I hope they will serve to highlight the legitimacy of the motivations and agency of learners as expressed through their STEM education choices.

What is my study design?

Theoretical Framework: Critical theory paired with complexity theory
Key Concepts: (a) Culturally sustaining pedagogy, (b) Self-efficacy, (c) The six strands of science learning, (d) STEM learning ecosystems, (e) Communities underrepresented in STEM
Methodology: Critical quantitative
Method: Cross-sectional survey design
Sampling Frame: Portland, OR area 6th- to 8th-graders
Instrument: 99-item questionnaire comprised of four ecosystem location-specific pages, each with 24 items assessing self-efficacy (8 items), six strands of science learning (6 items), and cultural sustenance (10 items), as well as one demographics page (3 items)
Data Collection Procedure: Survey administered by researcher in 12 Portland-area 6th- to 8th-grade STEM classrooms

What challenges have I encountered?

- There have been few prior implementations of critical quantitative methodology
- No quantitative measures of culturally sustaining pedagogy appear to exist
- Peer-reviewed literature regarding STEM ecosystems and six strands of science learning is minimal
- There are numerous bureaucratic complexities involved in gaining access to 6th- to 12th-grade classrooms
- Individually and culturally meaningful incentives for students can be challenging to identify and include in a cost-effective manner

What questions, ideas, cautions, or resources would *you* like to share with *me*?

Please use a sticky note to offer any suggestions and recommendations you wish—I am so grateful for the opportunity to learn from my wonderful STEM education colleagues!