Learning-Through-Teaching in a Science-Focused Youth Development Program

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Background

- STEM major attrition is a pressing concern in the US.
- 28% of bachelor’s degree seeking students enter a STEM major, and nearly half (48%) leave their STEM major before graduation (Chen & Soldner, 2013).
- Out-of-school time (OST) STEM programs can prepare youth for their journey toward a STEM career (National Research Council, 2009).
- Participation in OST STEM programs is linked to positive learning outcomes (Afterschool Alliance, 2011), but it is unclear how these programs positively affect youth.
- Learning-through-teaching (LTT) is effective in supporting youths’ science learning in formal learning environments (McNeil, Lizotte, Krajcik, & Marx, 2006).
- Less is known about the role of LTT in youth’s science learning in OST learning environments.
- The purpose of the current study was to conduct an in-depth, qualitative exploration of the role of LTT in youths’ science learning in an OST learning environment.

Method

Context
Participants were graduates of the Science Minors and Achievers (SMA) program. SMA is a science-focused, youth development program that takes place at the Museum of Science and Industry, Chicago. SMA is a free program and serves a diverse group of high school aged youth. LTT is a core part of the SMA program curriculum and takes the form of science presentation experiences for guests on the Museum floor.

Participants
16 youth who graduated from the SMA program in June, 2017.
- 62.5% female; 37.5% male; 0% non-binary
- 50% white; 31.25% African American/black; 18.75% Latinx
- 3 (18.75%) participants identified as multiracial

Procedure
Semi-structured interviews (55-120 minutes) were completed during summer, 2017. The interviews were audio recorded and transcribed verbatim for analysis.

Interview Protocol
Participants discussed their experiences in the SMA program, what they gained from participating in the program, and plans for the future.

Data Analysis
Data analysis was guided by a two-phase, modified grounded theory process (Charmaz, 2006). In the initial coding phase, three researchers read each transcript, identified themes, and developed a coding framework. Then, in the focused coding phase, they confirmed the coding framework accurately reflected the data. The end result was a coding framework that revealed relations among LTT experiences and youth outcomes.

Research Question
How do learning-through-teaching experiences relate to youths’ science learning in a science-focused, youth-development program?

Results

Presentation and Communication Skills
Participant described an improved ability to conduct presentations and/or communicate, and/or identified particular presentation and/or communication skills that they developed as a result of their science presentation experiences.

“There’s a challenge because you never know who’s going to come in to see your facilitation. It can be a kid who’s four years old. It can be a person who is 80 years old. It can be a perfect English speaker. It can be a person who does not understand English. All of you have that extra step to really be knowledgeable in that subject so you can present to all people.” -Sofia

Science Knowledge Construction
Participant described learning new science facts and/or increasing their understanding of science concepts as a result of their science presentation experiences.

“They [science presentation experiences] helped reinforce what I learned in school and made me think about it in a new way. Once I had the opportunity to teach people about it, then I realized, “Oh, now I get it.” Before I was just memorizing facts and repeating them, and now, I legitimately understand them.” -Lucy

Increased Confidence
Participant described a feeling of increased confidence, including but not limited to, self-confidence, confidence in their ability to talk to people, confidence in their presentation skills, and/or confidence in their science knowledge as a result of their science presentation experiences.

“I feel like I’m a lot more confident in my skin. Um, like, just speaking to people. I still need to work on eye-contact, but I’m a lot more confident. I can walk up to somebody and start a conversation out of the blue. I was just thinking about this a couple days ago. When I first got here I was, like, a little more shy […] but now I just go up to someone, start a conversation, so I would say I’m a lot more confident, I learned how to communicate efficiently, to get my ideas across and whatnot.” -Emma

Teamwork
Participant described an increased ability to work effectively with others and/or described a greater understanding of what it means to be a part of a team.

“I feel like if I never did [science presentations], I would have still, in my head, the thought like, it’s every man for themselves, instead of learning that, “Okay, if I’m gonna build a night light, I gotta have other people help me. I can’t just hold the wires and tape it together. I need someone to hold the black wire, while I hold the red wire, and someone else tapes it.” -Angelica

Conclusions

- Science presentation experiences facilitated learning-through-teaching experiences for youth, which emerged as an impactful experience related to youths’ science learning.
- Youth often indirectly alluded to the role of the longer-term nature of the program as being impactful of their science learning. It is unclear if the same results would emerge from participation in a shorter-term program.

Strengths & Limitations
- This study contributes to a more nuanced understanding of how OST programs contribute to youths’ science learning by exploring the role of a particular program feature, learning-through-teaching experiences.
- Youth often referred to the science presentation experiences, but did not always identify the process of LTT specifically.
- An objective assessment of LTT, such as systematic observations, would strengthen the evidence for the impact of LTT in the science presentation experiences.

Future Research
- Conduct follow-up interviews with same sample one year post program graduation to explore the longer-term impacts of LTT on youths’ science learning and development.
- Explore the role of gender to assess whether LTT is affecting male and female teens’ science learning in the same ways.

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