

## ***Science Identity Work and Persistence from an Intensive Family Workshop Series***

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### ***Background and Research Questions***

This research project focuses on understanding the immediate and long-term impacts of an intensive workshop series for rural families with youth aged 8-11 years old at two science museums in the pacific northwest. Families spent six hours on six Saturdays with their children learning about wildlife and marine ecology. To examine workshop impacts, we focused on two overarching research questions: 1) How do the workshop series lead to family science persistence and motivation? And, 2) How does the series lead to more community engagement in science learning opportunities? Core to the programming itself was the importance of facilitating culturally sustaining pedagogy which included connecting science phenomena to the lived experiences of families. Other programming elements included facilitating hands-on family learning both in and between each workshop as well as facilitating a culminating project that were shared out at the last meeting. In this project, specifically we focus in on the science identity work of youth and how it is co-constructed within family interactions, supporting family persistence in science both during and after the workshops.

Theoretically this project builds on the work of science capital and identity work; science persistence; and connected learning ecosystems. Science identity work has been found to play a large role in one's long-term participation, or persistence, in science (Calabrese Barton et al., 2013; Vedder-Weiss, 2018; Zimmerman, 2012). Our perspective of identity work focuses on its social nature; how such work is situated in interactions and is socially constructed (Carlone & Johnson, 2007; Gee, 2000; Riedinger & McGinnis, 2016, Vedder-Weiss, 2018). Within interactions, science identity work involves individuals considering their sense of self in relation to science, the degree to which one sees themselves as interested and competent in science, and the extent to which others recognize (or an individual perceives others as recognizing) them as a scientist. At the same time, in these interactions, individuals are actively contributing to the identity work of each other. This dynamic and multifaceted view of science identity work sees science identity, self-efficacy, and persistence in science as mutually reinforcing. For example, participating in science activities can increase others' recognition of a youth, let's say, as a "science person", which in turn contributes to the youths' science self-efficacy and their recognition of self as a "science person." Further, a youth's developing science identity can motivate them to seek opportunities to engage in science, which over time can support science persistence.

Families have been found to be an important source of youth's early science learning (Callanan & Jipson, 2001, Crowley et al., 2001; Dierking & Falk, 1994). Within everyday family interactions, youth and their family members can engage in science including science identity work together, shaping each other's engagement and individual and collective identification with science (Aschbacher, Li, & Roth, 2010; Dou et al., 2019; Riedinger & McGinnis, 2016; Zimmermann, 2012). Further, the degree to which science is already embedded into a family's life and their family science identity ("we are a science family") contributes to youth's and caregiver's evolving science identity, which as previously mentioned, can reinforce each other (Archer et al., 2012)

By taking a sociocultural perspective to science identity work we can examine how science identity work is socially constructed within family interactions leading to support to family persistence in science after the workshop series. We also deliberately focus on this age range (8–11-year old's) since youth are beginning to engage in identity(ies) exploration and development. Additionally, families are given the opportunity to engage in science activities both in and outside of the workshops. Our research design focuses on examining how those activities and opportunities for families to engage in science enables them to continue to participate in science in their own community, sometimes involving other family and community members. Through their interactions with each other and potentially others, we examine how families continue to engage in mutual science identity work over a year after the workshops end.

### **Research Design**

Our research approach is a mixed-method, extended design to examine the impacts on families and youth over a year after the six Saturday workshop series. We gathered pre, mid, post (immediately after the last session) and 3-month surveys from 16 families and 18 youth (Age range 8-12; average age = 9.8) that collected attitudes and behaviors related to science interest, motivation, identity, and engaging in science activities in their communities. Basic descriptives were calculated and repeated measures ANOVAs were modeled for impacts on participant attitudes over time. While the sample is small we were still able to calculate significant increases in several youth attitudes reported below.

Additionally, in-depth, semi-structured interviews were conducted with each family after every week; at 2-3 months; and one-year. The research team created an in-depth coding scheme for the qualitative interview data with the goal of capturing how the family workshops as a whole, as well as specific workshop components, impact: (a) the degree to which and how families are connecting with other people and places in and outside of the workshops; (b) connections families made to their prior experiences; (c) families' continuing to participate in science-related activities outside of the workshop; (d) changes in family members' science-related identities, self-efficacy, confidence, and attitudes; and (e) changes in families' perception of science and scientists. We are currently analyzing the interview data from the first round of family programming at the two pacific northwest museums only. While we collected data on a variety of attitudes and behavior related to the families' engagement, the findings below focus on those insights directly related to family science identities, youth confidence, and engagement in science activities after the workshops.

### ***Analyses and Findings***

Through survey and interview analysis we found two broad themes related to the building of science identities and persistence over the course of the research project. First, through these intensive workshops families, including youth, develop science identities directly as well as broader, more accessible views of science and scientists. The design of the programming around families rather than just youth pointed to the important role of family learning in shaping youth science learning, identity, and participation. Parents (or caregivers) and their children are seeing each other's interest and motivation to engage in science increase and this in turn builds their science

identities over the course of the workshop series and in the months following. And, second, that families and youth begin viewing science as all around them and not just in the lab. They see that anyone can be a scientist and that they themselves can do science. There was an increase in their own sense of science identity and confidence as someone who knows about and can engage in science. They benefited from being scientists, using scientific tools, and meeting different types of science professionals.

Findings for the first theme were the most pronounced in our surveys of youth and their parents. Table 1 shows increases in both youth self-identifying as a science person (item a) and being able to relate science to their lives (items b, c). As well, they were more likely to describe their families (item d) and peers (item j) as seeing them as a science person and others as being more likely to ask them about science; a clear sign of confidence and awareness of their broadened science knowledge. While not all items related to family interactions around science significantly increased, all of them did have increases and seeing their parents as interested in science (item i) and talking to them about it (item f) are important signs of family science interaction and identity formation from the youth's perspective. When looking at science activity engagement (activities from hiking, gardening, and other non-traditional science activities) in their communities we found a 45% increase in engagement across both sites.

Table 1: Pre, mid and post measures of science identity, family, and peer interaction (Scale strongly disagree = 1 - strongly agree = 7)

| <b><i>Science self-identity and engagement</i></b>           | Pre  | Mid  | Post   |
|--------------------------------------------------------------|------|------|--------|
| a. I see myself as a science person.                         | 4.44 | 5.14 | 5.25   |
| b. I use science ideas in my everyday life.                  | 3.89 | 5.12 | 5.13*  |
| c. I see how science relates to my life.                     | 4.67 | 5.50 | 5.50   |
| d. My family sees me as a science person.                    | 4.33 | 5.38 | 5.71*  |
| <b><i>Family interaction and identity</i></b>                |      |      |        |
| e. My parents encourage me to do things science related.     | 5.11 | 6.12 | 6.13   |
| f. I talk to my parents about things related to science.     | 4.89 | 6.00 | 6.25** |
| g. My parents/guardians want me to be interested in science. | 5.38 | 6.12 | 6.14   |
| h. My family likes to do sciencey things.                    | 4.89 | 5.38 | 5.29   |
| i. My parents/guardians are interested in science.           | 4.78 | 5.63 | 5.71*  |
| <b><i>Peers and others</i></b>                               |      |      |        |
| j. My friends/peers see me as a science person.              | 3.22 | 4.75 | 5.50** |
| k. Others ask me questions about science.                    | 3.00 | 4.50 | 4.62*  |

\* =  $p < .05$ ; \*\* =  $p < .01$  (two-sided tests)

### ***Families and youth are developing science identities***

In the following select passages from interviews with the parents and caregivers we recognize both the importance of science identity work as well as making science

accessible for families both in and outside of the workshops. In one of the museum's culminating projects, families facilitated public facing presentations within the museum space. This parent was surprised to see her daughter's confidence in presenting science concepts to others participants and the general public:

"she's not normally like that, like outgoing. But like, anytime anybody... even looked in the direction of her board, she would go right up to them. And she'd be like, you want to learn about gray whales and, like, bring them over. And I think she probably talked to most of people there. She was a little bit nervous at first, but then it was like... 'I'm here and this is what I'm doing'."

Daughter continues: "I thought it was really fun. I really enjoyed making a booth with my parents and I really liked talking to people. I think I'm no longer an introvert, I'm more of an ambivert now." Other parents recognized their own shifts in how they viewed science when asked about their own interest in science fields.

"I think it's funny because when I think of science, I think of like, chemical reactions. And like lab science that I did not enjoy in school. I mean, I know that like, chemistry and stuff is interesting to some people - it's not interesting to me. But like, this [workshops] is interesting to me. And I feel like, although I wouldn't like consider myself a science person, at least before this, like, I'm very interested in what we're learning. And, like, I'm going to carry it with me, even after the workshops are done. And I'm excited to you know, continue seeing animals on the trail cams, and going out and finding tracks and things like that. So I would say that I'm becoming more sciency than I was before."

This same parent when asked about her child's experience said the following:

"I think that now she does think of herself as loving science, where, in the beginning, she didn't really think of herself as being a sciency person. She was filling out that survey a couple weeks ago, and she was like, I am a scientist, like, I do love science, I am good at it. And I can see her confidence is higher now."

### ***Science is something accessible, collective, and place-based***

Other families discussed the importance of making science more attainable and accessible in the workshops especially in their own communities for themselves and their children.

Oh, this [science] is really exciting. And something reachable for her [daughter] where she felt like I can do this. This is something I can do... I walked the same trail, I look at things you know. So I think it was motivating because it was within reach, it was within grasp instead of (something) kind of vague and out there.

Another parent also discussed the importance of actually *doing* science in the workshops and the importance of using trail cams to gather data like a 'real' scientist.

“They've [educators] made it seem so like doable for anybody, like you don't have to be a trained scientist... don't have to have a college degree to go out and enjoy trail cam footage or tracking animals or, you know, you can do that just because you love it. And anybody can do that. And even if you don't have trail cameras, you can still look for tracks, and scat, and you can still observe and you can still use binoculars... it's something that anybody can do and anywhere... you don't have to be out in the wilderness to find animals... we found animals in our backyard and other people that live in town have found different bird species coming into their feeders.”

Other parents discussed the significance of the culminating project (in this case a book that they wrote about their experiences in the workshop) to extending her daughter's science interest and curiosity in other subjects and especially when they are visiting the community library.

“I think that (culminating project) gave her tons of confidence, where she's like, oh, there's real learning that relates to this, and real people that have done this, and I can do this too... it just kind of opened up her world... They're [daughters] checking out a ton of nonfiction books at the library... And creating the book helped where I think she found some of those to do our research. And then she's like, ‘Hey, let's stay. Let's learn about this other animal.’”

Taken together the above quotes highlight the importance of family identity work and making science more accessible and doable for families both in the workshops and their communities.

### ***Implications and Contributions***

The findings above suggest that intensive science learning opportunities for families, including youth, can help support the development of science identities directly as well as broader, more accessible views of science and scientists. Again, the design of the programming around families, their lived experiences, and science persistence pointed to the important role of family learning in shaping youth science learning, identity, and longer-term participation. Families and youth also begin viewing science as all around them and not just in the lab and “doable” for anyone. There was an increase in their own sense of science identity and confidence as someone who knows about and can engage in science, use scientific tools, and connect to different types of STEM professionals and organizations in their communities.

These findings strongly support the idea of family learning, especially for this age group, being an important element in developing science capital and connecting them to their own science learning ecosystems in ways that anchor that persistence in their identity formation. While this project has a small sample size, we argue that the findings are still robust and point to the importance of further research. It is important to note that the larger project will facilitate at least 10 more family workshop series at these two museums and two other locations in rural Texas and New York. Maybe the most important takeaway from these findings is the significance of incorporating families and peers into the design of youth science learning both in and outside of school. And while

we focus on learning that occurs in museums and outdoor spaces we see these insights being easily extended to other science learning experiences and learning ecosystems.

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