Pathways to STEM Careers: Articulating a four-composite framework for inquiry

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Abstract

Longstanding (Xie & Shauman, 2003) and emerging (Cannady, et al., under review) critiques of the pipeline metaphor reflect its limitations as the privileged explanatory framework for understanding pathways to STEM careers. Such limitations warrant new analytic heuristics to better guide inquiry into the process of becoming a scientist or engineer. To that end, the current study applies a framework presented in Harris and colleagues (2012) that proposes four pathway composites, each representing one of the four combinatorial possibilities of two well-established predictors of STEM career participation: early career interest and high school math achievement. Researchers used this framework to analyze a subset of the ALR11 dataset that includes 44 life history interviews of scientists and engineers. The goals of this new analysis are: first, to scrutinize the integrity of the four-composite framework through its use with the rich, qualitative data set; and second, to the extent that the composites hold, to elaborate on the composites with themes emerging from analysis of this rich, qualitative data set.

Research Design & Methods

1. Data for this study are a subset of the ALR11 life history interviews of scientists, engineers and STEM communicators. Trained researchers interviewed participants using a guided interview protocol and a Life History Calendar, which has been shown to enhance the accuracy of timing for less salient memories by connecting them to timing for more salient memories. Participants were asked to recall science influences in their life, family, school, outside-of-school activities, other significant adults and friends/peers throughout their life. Data were collected from people in science-related careers reached through a combination of convenience sampling, snowball sampling and "cold calling." Interviews lasted about two hours each. Participants were also asked to complete an online demographic survey.

2. First, we identified a set of 44 eligible cases within the ALR11 data set using the following criteria for each subject interviewed:
   - Must be a scientist or engineer.
   - Must have completed primary and secondary education within the United States;
   - Must have clear indication of whether or not the subject completed Calculus in high school;
   - Must have clear indication of whether or not the subject was specifically interested in a STEM career prior to post-secondary education.

3. We then categorized each interview from the resulting set of 44 cases into one of the four composites.

4. Next, we analyzed the interviews using an initial coding scheme that was informed by pertinent literature, applying emerging coding as warranted.

5. We then examined the coding to discuss the similarities within and differences across the four composites. This resulted in a thematic sketch for each composite grounded in a set of constituent codes.

6. Next, we will investigate the integrity of the composite framework by:
   - Scrutinizing the salience and typicity of observed themes;
   - Assessing the limitations of the framework by analyzing inter-rater reliability for the coding that grounded the thematic sketches and by scrutinizing outliers, overlaps, and areas of ambiguity within the composite framework.

Next Steps

The research presented here represents our initial analysis. We will continue testing and refining these findings with additional passes through the data. Beyond our current study, we see several follow up investigations that would build on our findings. First, the qualitative data analyzed for this study include only those who eventually became STEM professionals. It would be interesting to apply the four-composite framework to examine cases of those who did not end up in STEM. Such a study would offer greater insights into some of the impediments and detours along the pathway. It would also enable a refined, composite-level look at what may differentiate those who pursue STEM from those who do not. Second, the qualitative case sample size for our pathway categories was often quite small. Follow up studies that enlarge the sample for each category would help add validity to our findings (or challenge validity if our current findings are not supported) and, potentially, reveal additional patterns that we were unable to see.

References