Towards an Ecological Approach to Measuring STEM Identity Shifts Amongst Non-Dominant Girls

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Introduction

Studies suggest that lack of opportunities, low STEM confidence, and isolating STEM environments are factors that highlight the racialized and gendered realities within STEM learning settings that make it difficult for many non-dominant girls to develop a positive STEM identity (e.g., Hall & Brown, 1976; Maloney & Tai, 2018; Margolis & Fischer, 2002; Johnson et al., 2011; Ko et al., 2014). In this poster, we describe an ecological approach to measuring shifts in interest and identity development amongst non-dominant middle school girls in a STEM maker program. Our driving questions for this work were: (1) How can we assess STEM identity shifts over the course of a computational making program and (2) How can we better understand the influence of program components on youth developing STEM identities?

Perspectives

Our approach to investigating girls’ STEM identity development assumes that identity shifts happen over time, are influenced by social, cultural, and institutional factors, and can only be measured by taking an ecological view of learning and STEM engagement (Barron, 2015; Ko et al., 2014; Nasir, 2011). Specifically, we used longitudinal qualitative and quantitative data measures to understand identity shifts.

Framework

The sociopolitical framework proposed by McKenzie de Royston & Nasir (2017) was the best fit for our data. The authors propose a four-level framework based on the early works of Bronfenbrenner (1979), who argued for conceptualizing a developing child as an individual nested within multiple layers of context that shift over the timeline. The framework involves four tiers: social, institutional, cultural, and individual. Using this framework, we analyzed case data to understand possible shifts in participants’ identities.

Results

Changes in interest and identity development were not obvious when using the more traditional identity and interest survey measures alone, although there was evidence of growth in qualitative analysis (Erete et al., 2017). Thus, we present the results of measuring STEM identity development using a sociopolitical framework (McKenzie de Royston & Nasir, 2017) as an example of going beyond traditional quantitative measures to use both qualitative and quantitative data to explore the social, institutional, cultural, and individual factors that influence identity shifts.

Discussion and Scholarly Significance

This work provides an empirical example of how to operationalize a framework to understand shifts in identity that traditional survey measures may not be sensitive enough to discover. The qualitative data gave us a more nuanced understanding of the case learners and showed how social, institutional, and cultural factors impacted their interests and identities. For example, through interviews we saw stereotypes about computer scientists fade and we learned about interactions the girls had at home with family members around the artifacts the girls made in the DVD program. Connections between family and STEM activities (e.g., being able to make a website for a family member’s business) were a crucial driver in the girls’ interest in STEM domain learning and potential careers. These findings were not documented by surveys alone.

Our results provide insight into how non-dominant girls in STEM shifts demonstrate in identity over time, which could inform measures of long-term success of STEM programs targeting underrepresented girls. For this purpose, our next steps include formalizing measurement of program success that incorporate qualitative and quantitative data about social, institutional, and cultural factors that impact girls’ STEM identity shifts over time.

Context and Methods

Digital Youth Divas (DYD) is a blended online and face-to-face out-of-school program engaging middle school girls in design-based engineering and computer science activities (Pinkingard et al., 2017). DYD is purposefully designed to impact girls’ interest and identity, sense of community, and computational knowledge through five interconnected program components: (1) Self-paced, hands-on, project-based learning activities including introductory circuitry and programming projects through fabrication and design; (2) Narrative storylines with non-stereotypical characters; (3) An online social network where girls access resources, upload project work, and interact with others; (4) In-person and online mentorship from racially diverse, female mentors; and (5) Workshops with parents that create a supportive parent community. We describe results of case study analysis of four girls who participated in DYD during a 20 week program in a large cohort (N=90 girls). Case data for each participant included attendance records, pre-post surveys items about experience, interest, identity, e.g. Barron et al., 2014, interviews, program fieldnotes, virtual ethnographies (Hine, 2008) that describe online interactions, artifacts of participation, and parent surveys. The four learners were from one focal cohort classroom (N=20) and were selected to represent a range of interest and prior experience as indicated on the pre-survey. Three identified as African American and one as Latina. Two were in fifth grade and two were in sixth. Household income ranged from $30-80K.

Institutional

e.g. Districts, schools, policies or reforms, classrooms

Family and the people in charge of the learning environment i.e. the mentors, can be considered as the institutions which influence the perception of young girls.

Cultural

e.g. Disciplinary (math, science, etc.), classroom, communities

For our data, we can define “culture” as the practices and the communication patterns in and outside of the classroom (i.e., at home, during the program, online) and the medium through which knowledge shared.

Individual

e.g. Racial and ethnic, class, academic or domain-specific

This is an amalgamation of all the previously discussed factors that impact the individual’s perception. The change in opinion about individual education and career options can be considered in this tier.

References


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