Using familial STEM identity to understand identity development through social units

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Recommended Citation

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Session Type: Paper Presentation
Presentation Date: April 2023
Presentation Location: Chicago, IL
Keywords: STEM identity, STEM identity development theory, Familial STEM identity, STEM contexts, STEM activities

Abstract

Using case study data, we illustrate the need for a more comprehensive model of STEM identity development that accounts for the STEM affiliation of youths, their caregivers, and siblings–not as a collection of individuals but as a coherent and functional unit. We introduce the concept of familial STEM identity as a framework on which to expand STEM identity development theory, particularly as it relates to learners whose social identities are tightly embedded in family relationships, values, and culture. We emphasize the value of familial STEM identity in the context of diversification of STEM fields and formal and informal STEM programming with related goals. We argue that such reframing is especially necessary when STEM institutional contexts drastically differ from those with which youths are comfortable outside of the institution. This work further implies that observation tools and program assessments should be designed to gauge the context's compatibility with learners, reconstituting analytical lenses on the construction of learning contexts' fit for youths and families with diverse experiences and insurgent dispositions, rather than on learners' fit for learning contexts.

Purpose

Using case study data, we illustrate the need for a more comprehensive model of STEM identity development that accounts for the STEM affiliation of youths, their caregivers, and siblings–not as a collection of *individuals* but as a coherent and functional *unit.* We introduce the concept of *familial STEM identity* as a framework on which to expand STEM identity development theory, particularly as it relates to learners whose social identities are tightly embedded in family

relationships, values, and culture. We emphasize the value of *familial STEM identity* in the context of diversification of STEM fields and formal and informal STEM programming with related goals.

Theoretical Grounding

Identity is often operationalized in terms of how an individual feels about themselves as a "kind of person" (Gee, 2000) or "member of a community" (Avraamidou, 2018; Rahm & Moore, 2016). Although such perspectives underscore the social context in which identity development occurs, they undervalue the central role that family members play, particularly in relationship to social identities salient to STEM contexts (Hecht & Crowley, 2020). This decentralization and decontextualization of the child from the family unit is often a factor of the context of STEM identity studies, which primarily take place in schools and classrooms with older children, typically outside of and dissociated from participants' home lives, and focused on a particular place and time.

Nevertheless, when a child develops interests and affiliations with STEM fields, these are prompted from what is available for uptake within their familial context–what Pattison and colleagues (2020) refer to as a "family-level systems phenomenon" (p. 80). Moreover, this development takes place within *both* a short-term and long-term dynamic temporal system (Lichtwarck-Aschoff et al., 2008) that presents a need to take a child's developmental context into account (e.g., age-level, dependency on parents). Thus, an individual's affiliation with STEM is directly related to the forms of affiliation made possible by their social contexts. For youths, that social context is highly defined and bounded by their parents, and in some cases siblings, more so than extended family members or friends (Dou et al., 2021), with the role of the classroom influences weighing differently as a child develops agency away from their caregiver(s)' interests and values (Renninger, 2000).

Research Approach

We focus our presentation on data from a multi-case study of three families (our cases) who participated in a longitudinal study of family STEM engagement and interests. This case study is situated within a broader, multi-method research context to understand the contribution of family science conversations to youth STEM identity development, allowing for findings from those studies to shape the interpretation of our cases' narratives. All parents in the case families were immigrants from Latin American countries living in U.S. cities with large Latine- and immigrant-majority communities. Data included five interviews and two videos of family engagement in STEM activities. Both caregivers and children participated in each interview. The content of the interviews progressed from discussions of the family's broader extracurricular and educational experiences to experiences and conceptualizations more focused on STEM (as defined by the participants) contexts, both experienced and abstract.

Our comparative analysis was informed by guidance for case studies situated in complex sociohistorical environments (Bartlett & Vavrus, 2016). We attended to the social circumstances of the contexts in which children and caregivers described developing and expressing their STEM identities to study how development appeared to co-occur with social partners.

Findings

We found that although children constructed their identification with STEM in different ways, even defining STEM and STEM professionals differently, their articulations predominantly aligned with parents' interests, values, and notions of performance-competence in relation to STEM, which were constructed and reinforced through language. We illustrate this with the example of Mafe and Irie (pseudonyms). During our first interview with Mafe, a 12-year old Latina and first-generation migrant, she expressed an interest in herpetology, which her mother Irie encouraged through participatory conversations with Mafe and the interviewers. As the focus of our interviews turned toward Mafe's career aspirations in relation to her personal and family-related values and experiences, Irie's encouragement abated, replaced by an urging that Mafe consider careers that her mother felt were more aligned with Mafe's interests and abilities. The tone of Mafe's and Irie's STEM-related narratives shifted over time from a state of consonance to a state of dissonance and back to a state of consonance. This system's level dynamism (Lichtwarck-Aschoff et al., 2008) coincided with changes in Mafe's self-perception related to a future career in herpetology and to science more broadly.

Significance

An objective of many STEM learning institutions is to trigger and sustain positive STEM affiliation of learners (i.e., STEM identity). The concept of a *familial STEM identity* suggests that efforts may falter to produce persistent outcomes if restricted to *individuals*, especially for younger learners in families with collectivist values (McGee & Bentley, 2017). Thus, objectives to "increase" STEM identity may have limited short-term effectiveness, and efforts to *reframe* how institutions understand STEM identity to reflect social group units are likely to have more durable influences. In other words, learning institution's efforts to support expressions of STEM identity may be better achieved by *reforming learning contexts* to align with the lived experiences of learners, rather than adopting traditional, individual-centric (and often, even unintentionally, deficit-based) reform approaches. Such reframing is especially necessary when STEM institutional contexts drastically differ from those with which youths are comfortable outside of the institution. This work further implies that observation tools and program assessments should be designed to gauge the context's compatibility with learners, reconstituting analytical lenses on the construction of learning contexts' fit for youths and families with diverse experiences and insurgent dispositions, rather than on learners' fit for learning contexts.

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