Linking Identity Resources Across Roles: Family Science Workshops and Badging

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Abstract: With the goal of broadening participation in STEM, this paper reports on research that combined ideas of identity resources to support STEM-identity development and digital badge systems that combine social, emotional, and academic achievements. Specifically, we examined the identity resources linked to badges in a family robotics workshops held through a northwest library system. We found that badges, if framed correctly, can support transitional STEM-identity development by linking qualities across different roles.

Major issues addressed

Populations of youth that have limited or no access to STEM education are at greater risk to fall behind their counterparts as STEM fields continue to require more technical expertise, rendering such youth less able to direct their own social and economic success. Research on broadening participation has shown the interaction between STEM learning and STEM identity development (Bell et al., 2013; Calabrese Barton & Tan, 2009). Further, this work has explored how learning environments can be designed to better support participants' identity development. In this paper we ask: What are the family shared identity resources in an informal science learning setting and what role can badging play in supporting STEM identity development?

Potential significance of the work

Key design components of this work are to afford opportunities for families to work together and explore what it means to do robotics and e-textiles. The unique structure of the workshops is to combine tasks, such as programming, with other areas of expertise such as storytelling. In addition, participants are awarded badges to recognize achievements in the program. We argue the combination of critical analysis of badges supported by a conceptual framework of identity resources we can better understand how identity resources are and can be utilized in informal learning spaces. We hope to add to the conference theme of rethinking the learning sciences in the digital age by a) specifically addressing inequity in STEM, b) challenging standard practices of digital badge use in educational settings, and c) exploring how digital advances can usefully support identity development.

Theoretical framework

We take a sociocultural perspective on identity, viewing identity as formed not only by actions, but also by interactions with other people within the structures of the learning environments that they encounter (Holland et al., 1998; Wortham, 2006). In this work, we consider identities as one of the ways people mediate participation and demonstrate learning (Nasir, 2012) and look at identity as not just identification, but changes in practice. In addition, to marking learner trajectories and establishing membership in a community, we view badges as a tool that allows program values to be made explicit and visible to participants and educators and further develop their identities as learners. We seek to identify how badges can purposefully build identity development, recognizing that identity development is an interactive process as individuals participate within and across specific contexts (Holland et al., 1998; Wenger, 1998).

Methodologic approaches

This paper represents a portion of a 4-year NSF funded project *Robotics Backpacks for Family Learning*. The overarching project utilizes a design-based research approach (c.f. Barab, 2006) of iterative cycles of design and implementation. Data used for this paper was collected from January-February 2018 and included five workshop dates in one location, involving five number of families (fourteen individuals total). We gathered video data (one camera per family) to capture family interactions and used these data to identify and classify moments of role-specific activity along with interactions and discussions about badges. Through collaborative qualitative analysis of recorded family activity, discourse, and timeline of family generated artifacts, we mapped to the workshop roles as identified through the badging system provided enough context to determine which identity resources were or were not taken up.

Major findings, conclusions, and implications

There are two major findings associated with this work. First, using roles as the organizing structure for a badge system affords the opportunity to highlight a range of practices associated with those roles. We found that badges, if framed correctly, can support transitional STEM-identity development by linking qualities across different roles. In each workshop learners earned badges as a roboticist, artist, computer scientist, electrical engineer, researcher and storyteller. The roles bound specific characteristics while exposing shared qualities.

What surfaced through workshop play are qualities such as *attention to detail* and *precise* that participants who are skilled at programming and others skilled at storytelling, both possess. This interdisciplinary approach afforded the opportunity for badges to highlight skills that can be found in multiple types of roles and opening moments for participants to see themselves as "programmers", "artists", and/or "electrical engineers" who may not normally identify as such. Though qualities such as *attention to detail* or *precise* have specific requirements for each role domain (an electrical engineer is precise through different practices than a storyteller is precise). However, through linking participant activity to qualities of different roles, we are able to demonstrate through proximity that Participant A was precise in her depiction of her family story as indicated by the continual modification of her storyboard in the same way her brother was precise in correcting his coding. Both ensured their work represented the end results accurately. Employing a broad definition of "precise" in badge criteria permits the type of flexibility needed in order for participants to be able to see themselves in different roles. They can begin to identify qualities they already possess as being applicable to domains where they have little or no experience.

Second, we identified when practices shifted in the context of the program. For example, how families imagined robotic components in their story shifted as their understanding of how to make the robotics work developed. One father played with LED configurations in week 2 that informed the families' use of lights in their final diorama (week 5). With shifting practices, individual participation within families also shifted, as too did the resources available to participants in the activities. An example of this occurred when one mother shifted her practice from "project coordinator" to "programmer", changing the family dynamics and the resources available for identity development. Badges, if framed correctly, can support transitional STEM-identity development by linking qualities across different roles.

We propose badges and STEM practice-linked identity resources work together in two directions. In one way, badges support roles and practices that impact identity development by highlighting specific activities and marking achievement. In the other way, badges tell us in what ways the program is supporting identity development through the analysis of the types of resources and practices required to earn each badge. Badging can then serve as a design tool and as an analytical tool for examining the type and quantity of specific identity resources geared towards a specific aim, such as STEM.

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