Measuring Contextual Identity Shifts in Makerspaces

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Abstract: Many students fail to see themselves as potential scientists or engineers based on established stereotypes of who "belongs" in STEM. Thus, identity and the extent to which it is considered compatible with STEM engagement is a fundamental issue of access. This poster reports on the development and initial validation of a new approach to quantify shifts in multifaceted identity that are locally meaningful to participants in Making contexts.

Multiple dimensions of identity and the Making context

It is essential to understand the dynamics of underlying identity beliefs that limit STEM engagement. Because members of specific groups disproportionately feel that their sociodemographic identities are incompatible with pro-STEM identities—in many cases, despite STEM interest and achievement (cf. Archer et al., 2010)—it is essential to foster discourse where identities are not constructed into unidimensional, either-or dichotomies (e.g., one can either present a feminine identity or a STEM identity, but not both). Individuals construct and articulate their identities as multifaceted constructs that reflect complex representations of personal traits and self-characterizations used to establish the relationships and boundaries between themselves and others (Sedikides & Brewer, 2001). Further, identities facilitate individuals' abilities to (1) lay claim to traits and values that they feel distinguish them from others and (2) signal social belonging with other individuals and groups for which they feel affinity on the basis of any number of perceived traits (Ashmore, Deaux, & McLaughlin-Volpe, 2004).

One context that may facilitate such conjunctive identity expression or development is Maker camps and classes (Peppler, Halverson, & Kafai, 2016a, 2016b). Numerous studies highlight how the tools and materials used in Making activities, the processes of Making, and the products of Making can support a multiplicity of STEM identities while providing space for creativity and personal expression (e.g., Kafai, Fields, & Searle, 2014).

Purpose

Despite the growing recognition that identity is multifaceted and emergent, quantitative research instruments used to examine identity and identity shift have traditionally engaged only single identity facets in any depth (e.g., STEM; gender; race) and do not accommodate multiplicity or intersectionality. Most often the conclusions drawn about intersectionality rely on disaggregation of the focal identity facet by a single demographic indicator item, which precludes the ability to understand how multiple facets of identity might interact (Stirrat, Meyer, Ouellette, & Gara, 2008). Thus, the purpose of this study was to develop and validate a measure of multifaceted identity that could detect shifts in participants' respective identity complexes as they navigated rich STEM environments such as Makerspaces. In keeping with the personal, contextualized, and dynamic nature of identity construction, the measure needed to be capable of repeated use over the course of multiple days of engagement and rely on locally constructed meanings that would authentically represent identity categories as understood and embraced by the individuals within the localized context.

Methodology

We adopted a phenomenographic strategy for measurement development (Feldon & Tofel-Grehl, 2018; Marton & Pong, 2005). Initially developed as a wholly qualitative paradigm, phenomenography assumes that individuals' conceptions of their experiences can be understood both within personal and collective frames. Thus, constructed meanings are considered within the contexts of the individual's personal explanation, the structural nature of the social relationships relevant to the context, and the broader pool of meanings. Further, phenomenography posits that while there may be a very wide range of personal conceptions held across individuals, the range is not infinite (Marton, 1994). As qualitative inquiry yields saturation (i.e., no new categories emerging from new data collection), the number of distinct conceptions identified can serve as the foundation of the range of responses offered for closed-ended survey items.

To preserve the personal and local meanings that imbue multidimensional identities, the first step in our phenomenographic approach was to facilitate group discussions amongst Maker camp participants regarding identity, with the goal of generating categories that were both meaningful to the group and articulated according to their own framing. To accomplish this, the first identity dimension discussed and presented as a worked example was STEM identity. Students were presented with various STEM-related identity labels appropriate to

a Making activity (i.e., scientist, engineer, tinkerer, designer, crafter) and asked to discuss what meanings those held and if there are any missing that should be included. Through discussion, we elicited shared conceptions of these labels. The discussion facilitator then asked what other types of identity were important to the students. Emergent themes related to gender (i.e., female, male, transgender, non-binary), sexuality (i.e., heterosexual, homosexual, pansexual, asexual), and outside activities (i.e., gamer, nerd, artist, athlete). As each dimension of identity was articulated, discussed, and refined by the participants, they were asked to reach consensus on the categories under each dimension.

Based on the labels they devised, the categories under each dimension were each assigned to a different color of plastic bead. At the end of each weekly session, students were asked to draw one bead of their choosing from each dimension to represent their multidimensional identity. These beads then inherently provided a longitudinal record of their multidimensional identities and shifts across categories over the course of the camp. After each session, each student's bracelet was photographed and date stamped to preserve the longitudinal record of identity stability and change.

Results

Application of the space state grid approach permitted visualizations of individuals' pairwise transitions amongst locally meaningful identity categories, both for individual participants and the collective sample. Further, the mapped transitions reinforced the need for a longitudinal measure, as shifts in identity facets were frequent in some (e.g., STEM identity, social identity) and remained present, even in less frequent categories (e.g., gender, sexuality). Given the common assumption and research practices that treat gender identity as static (even when non-binary options are made available), the detection of week-to-week shifts suggest that more sensitive measures are necessary. Although preliminary in its analyses due to limited sample size, the internal consistency of the two primary constructs—dispersion and duration—reflected promising value as a quantified measure. Although quantification fundamentally restricts the full scope of individually constructed meanings around facets of identity, the local construction of categories using shared meanings offers a more facile and inclusive measurement tool than has previously been available. Future work will explore its measurement properties more fully with a larger sample and also examine opportunities for convergence across different communities. Strategies for handling analysis when data are missing not at random will be assessed for their ability to appropriately utilize this measurement approach when locally constructed categories do not converge.

References

Archer, L., DeWitt, J., Osborne, J., Dillon, J., Willis, B., & Wong, B. (2012). Science aspirations, capital, and family habitus: How families shape children's engagement and identification with science. American Educational Research Journal, 49(5), 881-908.

Ashmore, R. D., Deaux, K., & McLaughlin-Volpe, T. (2004). An organizing framework for collective identity: articulation and significance of multidimensionality. Psychological Bulletin, 130(1), 80-114.

Feldon, D. F., & Tofel-Grehl, C. (2018). Phenomenography as a foundation for mixed models research. American Behavioral Scientist, 62, 887-899.

Hull, G., Kenney, N., Marple, S., & Forsman-Schneider, A. (2006). Many versions of masculine: Explorations of boys' identity formation through multimodal composing in an after-school program. New York: Robert Bowne Foundation.

Kafai, Y. B. Fields, D. A., & Searle, K. A. (2014). Electronic textiles as disruptive designs in schools: Supporting and challenging maker activities for learning. Harvard Educational Review, 84(4), 532-556.

Marton, F., & Pong, W. Y. (2005). On the unit of description in phenomenography. Higher Education Research & Development, 24(4), 335-348.

Marton, F. (1994). Phenomenography. The International Encyclopedia of Education, 8, 4424-4429.

Peppler, K., Halverson, E., & Kafai, Y. B. (2016). Makeology: Makerspaces as learning environments. New York: Routledge.

Sedikides, C., & Brewer, M. (Eds.). (2002). Individual self, relational self, collective self. Hove, UK: Psychology Press.

Shapiro, C. A., & Sax, L. J. (2011). Major selection and persistence for women in STEM. New Directions for Institutional Research, 2011(152), 5-18.

Stirratt, M., Meyer, I., Ouellette, S & Gara, M. (2008) Measuring identity multiplicity and intersectionality: Hierarchical classes analysis (HICLAS) of sexual, racial, and gender identities, Self and Identity, 7, 89-111.