Interplay of Artistic Identities and Mathematical Dispositions at an Art Crating Company

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We share preliminary findings from our pilot investigation of mathematical engagement and dispositions of workers at an art crating company. We aim to contribute to conceptualizations of artistic identities and productive mathematical dispositions through case studies of participants who primarily see themselves as artists. While they do not consider themselves to be "math people," their work is steeped in complex mathematical reasoning. Findings from the study contribute to the design of mathematics learning settings that support productive mathematical dispositions.

Background and Framing

Students often experience mathematics as an activity distinct from their lives. Ladson-Billings (1997) argued that in the U.S. mathematics is commonly seen as a discipline in which some are capable of engaging while others are not. This makes it culturally acceptable for individuals to be "bad at" mathematics. Additionally, there might be misalignments between students' identities and the characteristics of successful mathematics learners. Boaler and Greeno (2000) made it clear that how mathematics is taught has deep effects on how students view what it means to do mathematics, and what constitutes the process of learning mathematics. They analyzed interviews comparing students' experiences in AP Calculus classes that employed two very different forms of instruction: didactic and discussion-based. In the didactic classes students saw mathematics as "closed" in the sense that there was one right answer with no room for interpretation. These students listed qualities like "perseverance" and "obedience" as characteristics of successful students, and explained their affinity for mathematics based on how well their views of themselves aligned with these qualities. Boaler and Greeno worried that many students are alienated from mathematics because they are not willing to author identities compatible with didactic classroom settings.

Boaler and Greeno (2000) drew from Holland and her colleagues' (1998) work on "positional identity," describing it as "the way in which people comprehend and enact their positions in the worlds in which they live" (p. 173). Positional identities are "relative to socially identified others, one's sense of place, and entitlement" (Holland et al., 1998, p. 125). Another important aspect of identity is that which relates to participation in cultural activities, or what Holland and her colleagues call "figured worlds." Figured worlds are socially constructed systems of activity where actors, artifacts, and events are attributed particular meaning and interpreted in predictable ways by participants. Boaler and Greeno's (2000) findings revealed the potential mismatches between students' positional identities as learners and the figured worlds of their mathematics classrooms; at the same time their results raised questions about the interplay between students' experiences in the figured worlds of their mathematics classes and their developing identities as mathematics students.

Through ethnographic case studies of two fifth graders' mathematics learning, Jackson (2009) provided some insight into how mathematics and mathematics learning were constructed through instruction, and how "social identities" of students were simultaneously (and reciprocally) constructed. By social identity Jackson was referring to how students viewed and positioned themselves and how others viewed and positioned them in the local classroom setting. The mathematical social identities constructed by and for the students were influenced by how mathematics was constructed at the school and in the class, and vice versa.

This view of identity, consistent with Holland and her colleagues' (1998), is the one we use in this study. Identity, in this sense, plays a crucial role in learning by influencing how students understand themselves as learners and as capable mathematicians. It is clear, then, that mathematics learning settings must support the development of identities that are better aligned with learning and doing mathematics in both the short and long term (Cobb & Hodge, 2002).

A critical aspect of students' identities are their dispositions, or "ideas about, values of, and ways of participating" (Gresalfi & Cobb, 2006), for doing and learning mathematics. Productive mathematical dispositions have been associated with seeing mathematics as a sensible domain that one can reason about, and seeing mathematics learning as a process one is capable of (e.g., Kilpatrick, Swafford, & Findell, 2001). This involves opportunities for students to engage and identify as competent mathematicians, and to see themselves as participants in and authors of mathematical activity (Boaler & Greeno, 2000; Gresalfi & Cobb, 2006). These opportunities can be supported through classroom mathematical practices (Gresalfi 2009).

To contribute to the design of settings that support students' construction of productive mathematical dispositions while remaining respectful of students' existing identities, we are working towards developing more nuanced understandings of what productive mathematical dispositions might look like, and how they might intersect or interact with identities affiliated with other disciplines. In particular, we investigate artists and artistic identities of workers at an art crating company, which builds custom crates for art objects. Many of the employees at the company are artists, working at the company in order to make a living in a setting related to their chosen (but not-yet profitable) art professions. In this project, we attend to the artistic identities and mathematical dispositions of the workers, with the goal of developing rich descriptions of the artistic identities of workers at the company, and how these artists view their own mathematics activity, engagement, and learning.

Study Design, Methods of Analysis, and Significance

We share case studies of six workers at the company. Cases include employees from three departments: design, shop, and packing. Designers manage projects, assessing the goals and constraints of the job, measuring art objects, and developing specifications for crates. They produce a representation of the crates called a "cut sheet," which is passed on to the crate shop. Crate shop employees cut and assemble the major parts of the crate exterior. This, along with the cut sheet, is transferred to the packing department, where packers create the protective and supportive interior of the crate. Work activity in all three departments is saturated with different forms of spatial reasoning, including complex measuring practices, spatial organization of materials, and transformation of spatial representations across different scales and contexts. Workers recognize their activity as deeply mathematical and dominated by problem solving events, and a fair amount of expertise (and often collaborative discussion) is involved in interpreting a cut sheet and executing its instructions.

While our focal participants see themselves as capable of doing and learning the mathematics relevant to their jobs, many of them were not successful in school mathematics and do not identify as mathematically inclined. Art and art creation figure largely in their world of crate design, construction, and packing, as does the embedded mathematical activity in which they engage. The setting is permeated by artistic meanings and significance for these workers; at the same time, mathematical competence remains critical to their success, and their dispositions toward doing and learning mathematics have consequences for their work. As such, the study centers on three main research questions: RQ1) What are characteristics of the workers' artistic identities? RQ2) How is doing mathematics and the process of mathematical learning socially constructed in this workplace? RQ3) What are characteristics of workers' mathematical dispositions in the context of their work? What is the interplay between workers' artistic identities and their mathematical dispositions?

We make comparisons along two dimensions. First, each department has different goals for work, and engages in substantially different spatial practices. Investigating workers from each department allows us to discover nuances in mathematical engagement. Second, we choose one relative newcomer to the job and one relative old-timer for each department. This provides comparative leverage for making conjectures about "expert" spatial practices and how learning is organized, speaking to what it means to do mathematics as well as processes of learning.

We use primarily ethnographic methods, including participant observation and interviews. Data include field notes, video recordings, and artifacts from the field. As the study progresses and mathematical practices are defined and characterized, fieldwork shifts to selective observations of work more directly related to these practices. Analysis of fieldnotes provides insight into how mathematics and learning is socially constructed, from the workers' perspective (RQ2).

Initial interviews focus on workers' histories of participation in art, mathematics, and the company. Later interviews will include "job simulation" tasks (Scribner, 1986), allowing us to test conjectures about their mathematical practices and characteristics of their mathematical dispositions as they solve problems (RQ3). Video-elicited interviews will serve to provide member-checks as well as additional data regarding all research questions. Video also serves as data for microethnographic analysis of work and mathematical practices. The frequent collaborative consulting interactions that take place make mathematical practices and learning (RQ2) visible for analysis. These interactions also allow for analysis of how workers position themselves and each other in relation to mathematical activity (RQ1, RQ2, RQ3).

Significance

Research has suggested what certain features of productive mathematics dispositions might consist of, like conceptual agency and authority (Gresalfi & Cobb, 2006). However, this study can contribute understandings of how individuals who strongly identify with other disciplines might come to also have productive mathematical dispositions. In other words, the findings could be thought of as contributing possible trajectories of learning identities—specifically, how different prior dispositions can be built upon to support, eventually, positive mathematical identities.

References

Boaler, J., & Greeno, J. G. (2000). Identity, agency, and knowing in mathematics worlds. In J. Boaler (Ed.), *Multiple perspectives on mathematics teaching and learning* (pp. 171–200). Westport, CT: Ablex Publishing.

Cobb, P., & Hodge, L. L. (2002). A relational perspective on issues of cultural diversity and equity as they play out in the mathematics classroom. *Mathematical Thinking and Learning*, *4*, 249–284.

Gresalfi, M. (2009). Taking up opportunities to learn: Constructing dispositions in mathematics classrooms. *The Journal of the Learning Sciences*, *18*, 327–369.

Gresalfi, M. S., & Cobb, P. (2006). Cultivating students' discipline-specific dispositions as a critical goal for pedagogy and equity. *Pedagogies*, *1*, 49–57.

Holland, D., Lachicotte, W. J., Skinner, D., & Cain, C. (1998). *Identity and agency in cultural worlds.* Cambridge, MA: Harvard University Press.

Jackson, K. J. (2009). The social construction of youth and mathematics: The case of a fifth grade classroom. In D. B. Martin (Ed.), *Mathematics teaching, learning, and liberation in the lives of black children* (pp. 175–199). New York: Routledge.

Kilpatrick, J., Swafford, J., and Findell, B. (Eds.) (2001). *Adding it up: Helping children learn mathematics.* Washington, D.C.: National Academy Press.

Ladson-Billings, G. (1997). It doesn't add up: African American students' mathematics achievement. *Journal for Research in Mathematics Education*, *28*, 697–708.

Scribner, S. (1986). Thinking in action: Some characteristics of practical thought. In R. J. Sternberg & R. K. Wagner (Eds.), *Practical intelligence: Nature and origins of competence in the everyday world* (pp. 13–30). Cambridge: Cambridge University Press.