Chris Kucewicz
Adolescent Development
Mid-Semester Paper
10/27/2019

The Effects of Identity Development on Student Collaboration in Math Classrooms

Traditionally, math classrooms have been spaces where students are expected to listen closely to the teacher's instruction in order for them to memorize a procedure that is deemed necessary to be able to complete the upcoming set of problems. As a result, student collaboration in math classrooms is hard to find. So, during times when we may ask students to work in pairs to share work or ask students to collaborate on a complex problem/project, students generally work independently, only to compare solutions at the end rather than collectively working together to find a solution. The most meaningful mathematics learning takes place when the classroom environment encourages collaborative mathematical discussion and problem solving, however, this is often encumbered by students' social and mathematical identities. "Across studies, greater identification with mathematics has been shown to afford greater engagement in learning activities, which can lead to more learning opportunities" (Langer-Osuna, 1085). My vision for my future classroom is a student-centered classroom where students are encouraged and motivated to work collaboratively. It is helpful to explore Erikson's identity theory, Positioning Theory, and Jo Boaler's supplemental research on brain development and math education to understand how adolescents' identity development affects their participation and collaboration in math class. By focusing on two specific areas of identity development in adolescents - identity as a learner of mathematics (which I will refer to as "mathematics identity"),and social identity - one can develop an understanding of the challenge of student collaboration in math classrooms. To truly have an in-depth appreciation of this issue, it is important to comprehend the factors that affect how students form both their mathematical and

social identities. My experiences leading groups of students in math classrooms as well as my educational experience as a math learner has provided my motivation for this topic.

According to Goldin, et al., students "not only acquire knowledge but also become a certain person through learning mathematics" (14). My efforts during my student-teaching experience in an 8th grade math class at getting students to have rich mathematical discussions has not been as successful as I would have hoped thus far. I find that students simply do not participate, or they will wait for one student to get an answer and then the group will copy that answer without any meaningful discussion as to how the student got their solution, if that solution makes sense, how we know it makes sense, etc. Despite my efforts (through scaffolded instruction and group work, tasks that are easily accessible to all, variety of ways to represent ideas, class norms, etc.) to create a space where students feel safe and comfortable sharing their thoughts and ideas, the amount of collaboration between students is almost nonexistent. Even when I ask for volunteers to share their answers, I have noticed the same pattern of students who consistently raise their hands to share their work. A student survey on their feelings about math and math class, and how they view themselves within the context of a math class would be a good addition to this paper. This gave me the idea that there is a different issue at play that could be restricting collaboration. So, a question I started to think about is: "How do students' mathematical identities and social identities affect their participation and collaboration within class?"

Mathematical Identity: To Be or Not to Be a "Math person"

Mathematics identity is defined as "the dispositions and deeply held beliefs that students develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics in powerful ways across the context of their lives" (Gholson & Robinson, 349).

Thinking outside of the classroom, it is common for the phrase “I’m just not a math person” to come up when numbers or computation is involved. Trying to make out exact change when paying and adding together the prices of items bought on a shopping trip are a few of the many times outside the classroom when we use math to make sense of everyday occurrences. Interestingly enough, it is more uncommon to notice a lack of identification with other subjects. For instance, rarely are the phrases, “I’m not a Social Studies person”, “I’m not a Biology person”, “I’m not a Literature person” used in conversation. Transitioning to classrooms and school work, students may say “I’m just not a math person” as a reason to quit working on a math problem that they have been struggling with. Identifying as “not a math person” consciously, or subconsciously, implies that students have considered the question of Erikson’s Identity vs. Role Confusion stage: “Who am I, in regards to this subject?” (Nakkula & Toshalis, 22). In my experiences as a pre-service math teacher, I have noticed that mathematics identity seems to be rather binary. Students either strongly identify with math, feeling confident they can do it, in which case (s)he may consider her/himself a “math person”, or students will identify as “not a math person”. For the most part, it does not seem as though there is any spectrum. For example, “I’m kind of a math person” is rare to hear. Gholson and Robinson in their article *Restoring Mathematics Identities of Black Learners: A Curricular Approach, Theory Into Practice* examined a “silhouette activity” in which students identified external messages they have received about mathematics as well as internal messages they tell themselves. Several messages listed included: “I’m good at math only”, “You’re good at math, do this…”, “Aren’t you supposed to be good at math?”, “Math is not your strong suit”, and “You’re a math genius”. As one can see, many of the messages, both internal and external, relate to mathematics identity as either a “math person” or “not a math person”.

The Role of Social Identity in Math Class

Research tells us that students' social identity development occurs simultaneously with students' mathematics identity development. Langer-Osuna says "research in math education suggests that social identities are indeed at play in mathematics classrooms" (243). Osuna-Langer uses positioning theory to describe much of the social identity development that occurs in students, and she defines positioning theory as a theory "which asserts that individuals draw upon and mutually construct storylines as they engage in conversation" (Lager-Osuna, 1082). In this research, the main aspect of social identity that was drawn upon was student authority. In other words, an aspect of identity adolescents take up which gives them a sense of superiority or inferiority when interacting with other adolescents. Additionally, Sullivan describes, adolescents as consistently seeking to form supportive relationships or, as Sullivan calls them, "genuinely reciprocal friendships." This need for supportive relationships also comes into play as students develop their identity through collaboration, having to balance numerous expectations.

Shaping of Identities

Now that an understanding of these identities has been provided, it is important to consider the factors that affect how these identities are shaped and their implications for student collaboration.

Throughout a child's schooling, she/he processes countless explicit and inherent messages that are relayed through teachers, classmates, textbooks, parents, etc. about their place in math. "Who gets to enact mathematical authority has historically been narrowly defined and remains linked to racial and gender stereotypes and storylines about who is good at mathematics" (Langer-Osuna, 1085). In *Mathematical Mindsets*, Jo Boaler says "Girls look up to their female teachers and identify with them as teachers convey the idea that math is hard for them or that

they are just not a “math person”. Traditionally, there is the stereotypical idea that White and Asian men are the only ones who can succeed at high levels of math (Boaler, 106). When students are fed these racial narratives about who can and can’t succeed at math, students organize their own assumptions about their own and one another’s mathematical competence (Langer-Osuna, 243), and over time they internalize them to the point where girls and students of color may conclude that they just aren’t “math people”. On the other side of the spectrum, the White and Asain males may conclude that they are “math people”. Zooming out of the school context, adolescents grow up in a society where certain groups of people are already positioned for success. In *Understanding Youth*, the author states:

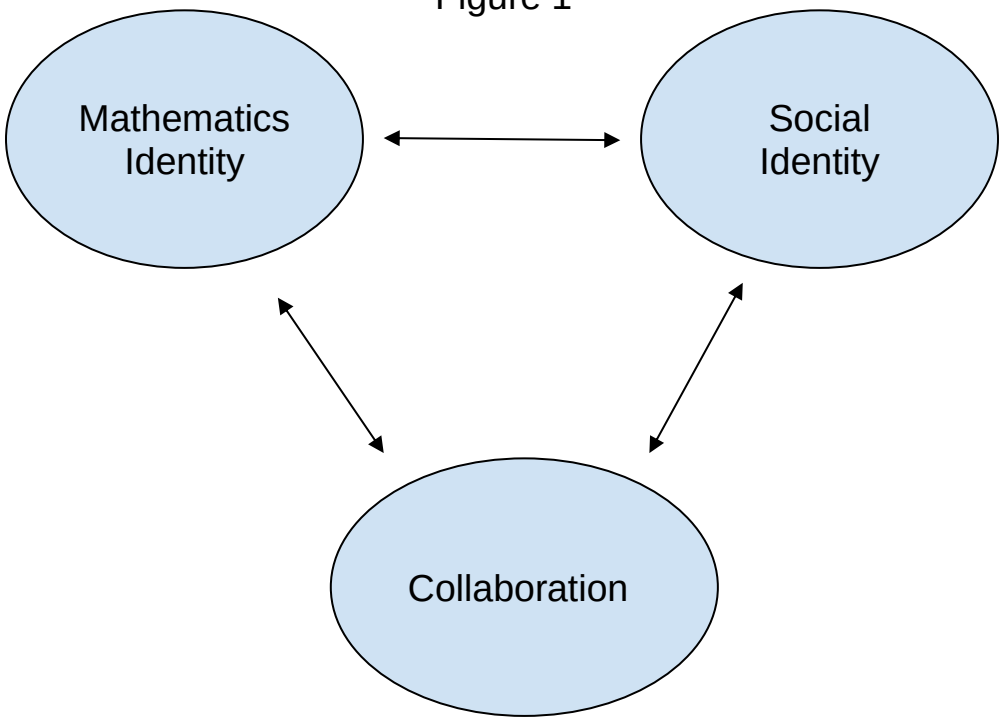
> “Gilligan situates adolescent development within the sociopolitical reality of patriarchy, the male-dominated social order. Within our patriarchal system, she argues, girls and women become sexually objectified and socially limited due to their assumed capacity for carem relationship building, and intuition. Boys and men, on the other hand, are understood to possess less inherent capacity for these traits instead are framed in terms of their strength, intelligence, emotional control, and leadership abilities. Although these assumptions hold little to no biological validity, the result is that adolescents learn to perform their gendered selves in response to these dictates.” (Nakkula, 103)

Since children are born into a society with ingrained gender norms, these norms become internalized from a young age, and children may not think anything of it as they live their day-to-day lives. The effects these norms have on adolescent girls, according to Gilligan, are that girls will not talk as an effort to appear attractive to the boys (Sadowski, 91). The traits mentioned in *Understanding Youth* are generally consistent with the roles that boys and girls play in math classrooms.

Langer-Osuna describes Erikson's ideas about context for collaboration by saying that "contexts consist of socially constructed and ratified definitions of a situation that dynamically change. As contexts change, the roles and relationships among interactions also change, and individual rights adjust accordingly in ways that structure who gets to speak, in what ways, and to what effect" (1079). Along with factors that accumulate over time to affect identity development, students' identities adapt and change in real-time during collaboration with peers. In this sense, students' mathematical and social identities are shaped through collaboration, but they also shape how students collaborate amongst each other which is visually described in the diagram below which is labeled "Figure 1."

During a collaboration activity, students bring to the table their current identities as well as their perceptions of their classmates' identities. As stated in Langer-Osuna's article, "Through positioning theory, students do not simply 'bring themselves' to learning in an abstract sense; rather students construct themselves and others discursively through mathematics activity.

Figure 1



Positioning is ‘identity in interaction’’(3). Often these identities and perceptions affect which students participate, but interactions within the collaboration activity also shape who participates going forward. Typically, students with stronger mathematical identities are most easily able to construct the authority to lead collaboration. “Students can garner such authority by being positioned as competent at math” (Langer-Osuna, 1080). On the other hand, students with greater dissociation from a math identity can be easily shut out of collaboration. This is supported in the Langer-Osuna article when she points out that, “particular kinds of positioning moves led to particular mathematics identities as ‘smart’ or ‘dumb’ among the students, which affected the nature of their mathematics discussions” (1082). Essentially, students will position others according to if they view them as a “math person” or not, and based on these preconceptions, some students have more ground to speak than others. In this constantly evolving model of mathematics identities, social identities, and collaboration, students’ own identities will change through their interactions with their group members as stated by Langer-Osuna:

> “When such bids [for authority] are regularly accepted by peers, consistently positioning students with intellectual authority, those experiences develop into identities for those students as powerful mathematical thinkers. Conversely, when such bids are regularly rejected by peers, positioning students as lacking authority, those experiences develop into marginalized identities and the failure to form a sense of belonging.” (243)

Evidence of this took place in one of the Langer-Osuna’s case studies, where a group of students who were collaborating in a math class were examined. Study of the students’ interactions showed that “Brianna’s displays of authority were positioned by group members as inappropriate and bossy, whereas Kofi’s displays were positioned as not only appropriate but helpful to the

group members. This affected their subsequent engagement in the class; that is, Brianna's engagement plummeted while Kofi's increased" (243).

As previously mentioned, since throughout schooling racialized narratives are communicated about who can succeed at math, female students and students of color will often not have the perceived social or mathematical identities from their peers, which often results in them getting left out of mathematical discussions. "Bids for authority by students from historically marginalized groups can be fraught with tension and conflict" (Langer-Osuna, 243). As a result, the mathematical identities of these students could be in a crisis - similar to the moratorium adolescents experience when they have pressure on identities they are working to construct (Nakkula, 21). A crisis where they may enjoy math and consider themselves "math people" but messages from peers and perhaps teachers or society are telling them that they are not math people. What once was a strong mathematics identity could quickly turn to an identity not associated with math, similar to the experience of Brianna described above.

Implications

This research on identity development and collaboration in math classrooms provides significant information for math education. At the classroom level, my goal would be to create an environment where all students become the centers of their learning and the creators of their knowledge by asking questions and making connections through rich mathematical discussions. In order to achieve this, a strong foundation must be established that emphasizes the research on brain plasticity which found that intelligence is not fixed, but rather brains can grow and adapt. I would stress to my students that this research tells us that everyone can succeed at math when provided proper teaching with the hope that students form strong identities as math learners (Boaler, 4). Building on the idea of brain plasticity, I would work to change the way students

think of making mistakes through growth mindset which positions mistakes as opportunities to learn. One way I plan to help this sink in is by creating a math pledge for the class to say everyday which goes something along the lines of: “I am good at math. With hard work I can solve any math problem. I am a math person.” I would allow students to have a say when creating the classroom norms, in an effort to let them know their voices are heard. To promote collaboration, I would have students seated in groups of 3-5. Using the Langer-Osuna article’s research which showed that off-task collaboration could positively affect student collaboration, several times a week at the beginning of the class, I would have the groups do check-ins with each other where students could rate how they are feeling or explain briefly to their group members what is going on in their lives. Another strategy of Jo Boaler’s that I would implement would be to “give girls and students of color additional encouragement to learn math and science.” As mentioned earlier, girls and students of color are often given messages that they cannot succeed at math, so the hope is that additional encouragement could drive these students toward more positive math identities. Another strategy that Boaler gives to support this idea is by assigning competence. Boaler describes assigning competence as: “Practice [that] involves teachers’ raising the status of students who they think may be lower status in a group by praising something they have said or done that has intellectual value, and bringing it to the group’s or whole class’s attention” (134). Highlighting the contributions of famous female mathematicians and mathematicians of color is another strategy I have considered when thinking about how to help all students feel like they belong in math class. To do this is am planning to hang pictures/posters around the classroom of these people, and perhaps have students do a mini-report on a famous mathematician of their choice. I also plan to shift the focus in math class from speed to depth. The traditional focus on speed in math class holds deep-thinking-students back

and sends messages that speed is more important than deep conceptual understanding. An example of a way I plan to enact this is that I would not deduct points for students handing in late work, and I would also allow students to continue to retake tests until they got at least a B. These strategies would be aimed at promoting deep understanding of the content rather than flying through the curriculum.

On a school-wide level and in agreement with Jo Boaler, I would advocate for the elimination of tracking so that expectations are kept high for all students. This could help students who originally would be placed in a lower track, to avoid feeling a dissociation from math.

In summary, adolescents' constantly changing identities affect the extent to which students participate. It is important, as educators, that we are sending students the right message that everyone can succeed in math class, not just a select few. Keeping in mind how collaboration affects and is affected by ever-changing student identities, it is important to make sure as educators that we use equitable strategies, such as assigning competence, to ensure that all students feel they have a voice that is respected, and they have an opportunity to develop strong mathematics identities as "math people".

Works Cited

1. Nakkula, Michael J. and Toshalis, Eric. *Understanding Youth.* Cambridge, Harvard Education Press, 2006.
2. Sadowski, Michael. *Adolescents at School*. Cambridge, Harvard Education Press, 2015.
3. Kroger, Jane. *Identity in Adolescents: The Balance Between Self and Others*. New York City, Routledge: Taylor & Francis Group, 2004.
4. Boaler, Jo. *Mathematical Mindsets*. San Fransisco, Jossey-Bass, 2016.
5. Goldin, Gerald A., et al. *Attitudes, Beliefs, Motivation and Identity in Mathematics Education: An Overview of the Field and Future Directions.* Hamburg, Springer Open, 2016.
6. Langer-Osuna, J.M. ZDM Mathematics Education (2018) 50: 1077. https://doi-org.proxy.library.upenn.edu/10.1007/s11858-018-0965-x
7. Jennifer M. Langer-Osuna. "Authority, Identity, and Collaborative Mathematics." *Journal for Research in Mathematics Education*, vol. 48, no. 3, 2017, pp. 237–247. *JSTOR*, www.jstor.org/stable/10.5951/jresematheduc.48.3.0237.
8. *Jennifer M. Langer-Osuna.* Education Sciences.MDPI AG. 13, June 2018.
9. Maisie L. Gholson & Darrius D. Robinson (2019) Restoring Mathematics Identities of Black Learners: A Curricular Approach, Theory Into Practice, 58:4, 347-358, DOI: 10.1080/00405841.2019.1626620