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College Mathematics Literacy Workers of the Young People's Project Chicago: A Community of Practice

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In college, I decided to pursue mathematics as a discipline of study despite my apprehension concerning my own "average" mathematical abilities. I was counseled repeatedly that only mathematically talented students should pursue a major in mathematics, implying that there was some "natural" mathematical talent that one either had or didn't have. To disprove that assumption, I studied mathematics anyway and committed myself to working diligently even when the content was difficult to grasp. One of the most important decisions I made, which transformed my understanding and the way I thought about mathematics, was to work as a peer tutor in the college's mathematics tutoring laboratory. As a tutor, my ability to conceptualize mathematics in broader ways began to take shape, contributing to my own mathematics literacy. More importantly, I had the opportunity to help struggling students. Through the practice of tutoring my peers, to improve *their* performance in mathematics, *my* confidence and understanding also grew. Engaging in mathematics through conversations with my peers strengthened my knowledge of the subject and my ability to communicate mathematical concepts to others.

In retrospect, I recognize that this experience helped to shape how I saw myself as a mathematics doer and knower (i.e., this experience helped to shape my mathematics identity). Mathematics identity, as defined by Martin (2007), "refers to the dispositions and deeply held beliefs that individuals develop about their ability to participate and perform effectively in mathematical contexts and to use mathematics to change the conditions of their lives" (p. 150). Beyond building confidence in my mathematics ability, the peer tutoring experience ultimately helped to shape my mathematics literacy—my conceptual understanding of mathematical topics—and my identity—my broader sense of self outside of mathematics. My experience as a peer tutor motivated me to become a mathematics educator so that I could continue to help others understand and engage in mathematics. My engagement with mathematics continues to deepen my mathematical content knowledge, influence how I see myself, and creates possibilities for thinking about mathematics and doing mathematics in new and different ways.

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Given the importance of the tutoring experience in my own life, I wanted to study whether other students' experiences as individuals helping others to learn mathematics in an out-of-school context positively influenced their identities and roles within their local communities. The Chicago chapter of the Young People's Project (YPP) provided a venue to pursue this question. The research question that guided the project was *What identities and roles do African American college mathematics literacy workers see themselves having in their local communities as a result of their participation in the community of practice, the Young People's Project Chicago?* Here, I begin by briefly explaining the necessity of mathematics literacy for citizenship. I then give a background of Young People's Project, community of practice and modes of belonging, and explain how YPP constitutes a community of practice (Wenger, 1998)—a useful construct for considering questions of identity.

Mathematics Literacy For Citizenship

The need for complex and sophisticated mathematical knowledge and problem solving has grown over the past 100 years and is strongly attributed to technological advancement. Many African American students are unable to take full advantage of careers in the sciences and technologies due to limited access to meaningful mathematics. In the 1960s, poor Mississippi sharecroppers had to demonstrate literacy and a modest interpretation of the Constitution in order to vote (Moses, 1994; Moses & Cobb, 2001). Today a similar demonstration is necessary for Black students in mathematics who must make the case for themselves that acquiring mathematics literacy is an issue of civil rights in that every citizen should be able to access quality mathematics education to become mathematically literate (Moses, 1994; Moses & Cobb, 2001). When we prepare students for citizenship, we prepare them to take a position on issues, utilize their voices effectively, and to deal with situations critically as they arise (Rudduck, 2007). Some have suggested that there is a need to establish communities where students can become engaged in and excited about doing mathematics, and where they can take an active role in the teaching and learning of mathematics with their peers outside of school. The work of the YPP is a response to this call.

YPP and YPP Chicago

The YPP is a youth-driven organization affiliated with the Algebra Project[1]

[1] The Algebra Project is a national initiative, rooted in the U. S. Civil Rights Movement, that is carried out in schools and afterschool programs. The main purpose of the AP is to improve the mathematics literacy of young people of color underserved by existing education reform efforts in order for them to gain political and economic power and access to opportunities.

(Moses & Cobb, 2001) founded in Jackson, Mississippi in 1996. The YPP was created as an after-school mathematics initiative by an alliance of African American Algebra Project graduates who wanted to take an active role in their community by preparing youths to become more mathematically proficient. YPP has three main objectives: (a) to use mathematics literacy to develop youth leaders and organizers who would radically change the quality of education and life in their communities; (b) to develop young people as facilitators, mentors, and advocates for mathematics literacy; and (c) to assist a target population of Algebra Project students and non-Algebra Project students to successfully complete algebra by eighth or ninth grade in order to enter a college preparatory mathematics sequence in high school (Moses, 2006). YPP works to achieve these objectives through the development and implementation of mathematics games and activities in schools.

YPP Chicago was started in 2002 through local city partnerships, with the objective of operating training hubs throughout the city of Chicago for the development of college mathematics literacy workers. YPP Chicago was "founded on the belief that there is work that young people can and must do to change the conditions of their lives and that math literacy work was a good place to start" (YPP, n.d., ¶1). They also believe that African American students in economically depressed areas, like Chicago, are disenfranchised the most when it comes to mathematics education and that mathematics literacy work is a necessity in those communities. As it relates to mathematics, it is rare to find grassroots organizations that execute mathematics programs in urban settings that are led by Black students. The work of YPP offers a way for African American students to exercise their voice in schools while reinforcing what matters to them most.

In the larger project, I wanted to investigate how the role of mathematics teaching among peers mediates the mathematics identities of the African American students who serve as peer facilitators. Considering the YPP as a social context for engagement in mathematics, I also wanted to know what other aspects of their identities are shaped by the mathematics literacy work in which they participate. Through this active involvement, African American students can effect change in their communities for the purpose of liberation for themselves and others. In this sense, liberation refers to the connection that is made by students in what is being learned and how it informs what they know, think, and engage in their world.

Communities of Practice and Modes of Belonging

A community of practice (CoP) is a collective group unified by common interests where members interact regularly in order to create and improve what they learn and share over time (Wenger, 1998). CoPs are an important part of our eve-

ryday lives as we are each a part of a number of CoPs both implicitly and explicitly. CoPs range in their level of formalness and involvement; some individuals are core members, and others hold peripheral membership. CoPs contain a combination of three fundamental elements: (a) a domain of interest or mutual engagement; (b) a community or joint enterprise; and (c) a focus on practice or shared repertoire (Wenger, 1998; Wenger, McDermott, & Snyder, 2002). From an identity point of view, there are three modes of belonging that are part of learning and constructing identity: engagement, imagination, and alignment. Engagement describes interactions as an ongoing collaboration with members in communities that can change. Imagination is the ability of members to create new images of themselves beyond time and space. Alignment is the mode of belonging in which all efforts, such as energies, actions, and practices, come together to produce coordinated activities.

I consider YPP Chicago to be a CoP because of its community-based mathematics literacy work. There is a common mission statement that unifies mathematics literacy workers and affirms mathematics literacy workers' purpose, inspires members to participate, gives members meaning and a context for their outreach work, and guides their learning and the knowledge they produce. YPP Chicago members also share a commitment to improve young people's understanding of numbers through mathematics literacy activities in which they participate. In this community setting, mathematics literacy workers also form social bonds through prolonged interactions with each other.

Methods

In this article, I report on two participants, who are college mathematics literacy workers (CMLWs), Naomi and DeMarcus.[2] Naomi was a 21-year-old African American female student at a large urban university majoring in African American studies, gender studies, and performance studies. She was born and raised in the South, but relocated to Chicago to attend college. She had worked with nonprofit organizations since she was 14 years of age and learned of YPP through her involvement in other youth-oriented work. At the time of this study, she had been involved in YPP work for nearly one year. DeMarcus was also a native of the South who relocated to Chicago to attend college. He was a 21-year-old African American student studying at a large urban university. His major was African American studies with a concentration in history. DeMarcus realized that teaching was the career he wanted to pursue and his work with YPP enabled him to improve his teaching skills and his interactions with young people. At the time of the study, DeMarcus had worked with YPP for about six months.

[2] Proper names throughout are pseudonyms.

The study took place at Abelin Preparatory High School, where the CMLWs along with high school mathematics literacy workers (MLWs) participated in daily workshop training in preparation to teach mathematics games to elementary school children. Abelin is part of the Chicago Public School system and was founded in 1998 as a neighborhood charter school located on the west side of Chicago. Approximately 670 students attended Abelin from 9th through 12th grade at the time of data collection. Ninety-seven percent of the students enrolled were African American, and 3% Latina/o. Ninety-two percent of the student population were eligible for the free-and-reduced lunch program, and 97% of the students who attended the school resided in neighborhoods on the west side of Chicago. The work of the CMLWs in workshop training sessions consisted of critical reflections about what activities worked and did not work and interactions among attendees as they developed and learned about the mathematics activities that would be used in the elementary schools. The duration of the workshop training sessions was over a 4-week period. They were conducted after school for about three hours a day, for 4 days, for a total of 12 hours each week. The overall focus of workshop training sessions was for CMLWs to help MLWs to develop a deep understanding of a mathematically rich game, called Flagway.[3] The workshop training consisted of five components: (a) building MLWs' basic mathematics competency with numbers 2 through 100, (b) building MLWs' facilitation skills, (c) building MLWs' awareness of community social issues, (d) teaching MLWs how to effectively play Flagway, and (e) planning for implementation of Flagway at elementary schools.

Data were comprised of 92 hours of observations, two semi-structured interviews of each participant ranging from one to two hours, student work from mathematical tasks of the mathematics concepts taught in the workshop training, and participant reflections on their daily workshop trainings. To answer the overarching research question, I drew from each CMLW's view of mathematics literacy, their interpretation of the YPP's mission statement, and how they sought to embody the expectations of the mission in their mathematics literacy work. The mission statement was developed by its members in 2006, and provides a framework for CMLWs' practice as they engaged in mathematics literacy work. Thematic analysis was used to shed light on how each CMLW viewed mathematics literacy and embraced the mission of YPP, and how their view of the mission statement shaped their work and identity as mathematics literacy workers within the community of practice.

[3] The Flagway game was developed to help young people expand their understanding of natural numbers, through exploration of mathematically rich numeracy activities.

Identities and Roles in Mathematics Literacy Work

Looking beyond mathematics identity, Holland, Lachicotte, Skinner, and Cain (2003) define identity as "a concept that figuratively combines the intimate or personal world with the collective space of cultural forms and social relations" (p. 5). They start with the premise that "identities are lived in and through activity and so must be conceptualized as they develop in social practice….They are important bases from which people create new activities, new worlds, and new ways of being" (p. 5). Through social interaction with individuals that are around us, there is growth and development in how we see ourselves and who we hope to become (Gonzalez, 2009; Holland et al., 2003). As Gonzalez (2009) affirms, "identities affect agency and action" (p. 27). In this sense, *identities* are the broad ways in which we see ourselves and the *roles* that we play are how we take up our identities and put them to work. An "agent of change" and "doer of mathematics" were two identities that were common themes between Naomi and DeMarcus.

Agent of Change. An agent of change, in this context, is defined as someone who purposely worked toward creating social, cultural, or behavioral change in society or in others through his or her work or actions. A doer of mathematics is someone willing to engage in thinking deeply about mathematical ideas (Brewley, in press). Naomi and DeMarcus discussed in length how their work with young people in YPP helped to inform how they view their broader purpose in society. They had several revelations about themselves as a result of their work in YPP.

Naomi explained that her purpose in doing mathematics literacy work was "to make sure that Abelin [could] survive....I can leave, and Abelin will still be a functioning site with students who are impacted in a positive way." She further explained that she believed her purpose was to be able "to affect those students in a way that they were inspired to do something in their community, or they feel like they have done something to their community." Naomi also stated, "Whether it be I start teaching again through other…nonprofit organizations or working for human rights campaigns, or working for social change, social policy…I just have to make changes." In regards to how she viewed herself in doing mathematics literacy work, it can be described as activism. Naomi contended:

> I contextualize the entire mission statement with Bob Moses's bigger picture of being a civil right activist and mathematics being a civil right….I should be able to access education so that I can exercise my full human potential. [In] a lot of minority communities and low-income communities, that's not what's happening….We started off with trainers, then the instructors, and then the CMLWs, and then we spread ourselves all around all areas of Chicago. And I think I just really think that it [was] sort of supposed to be a movement….Like the word *radical* [italics added] to me means we are not taking this anymore. We are not going to sit here and let our students just continue to be below math literacy rates. Like we are not going to do it.

DeMarcus felt "willing to undergo or figure out any new way of instituting certain forms of education that will make these things more exciting, to build confidence, and to [help the students be] more willing to take anything on that comes in their path." DeMarcus often referred to the need of making mathematics more enjoyable for the population of students that he had worked with daily. He argued: "I felt almost as though my education was somewhat of an injustice…So the combination for striving for social equality and improving the lives and the achievement potential for kids like me…led me…on trying to be an educator." DeMarcus reiterated that his mission working with youth is in alignment with the Young People's Project:

> I essentially feel as though the mission with the Young People's Project is essentially my mission in working with youth….My goal in education is to empower….I want to help build self-sufficient students. And I mean self-sufficient in that I want them to be of the character where they can go into a situation with as much confidence in their heart and success or failure to have the strength to take it on.

Naomi and DeMarcus collectively believed that their role was to help uplift young people in the community to achieve a higher level of mathematical literacy. They spoke about this empowerment in a variety of ways. Naomi saw her role as being proactive in helping others understand mathematics while shifting how mathematics is perceived in the local community. Naomi also spoke to the importance of minority and low-income communities having access to education in order for them to exercise their full human potential. DeMarcus believed that his role in YPP was to build competent and self-sufficient students and to help them to be prepared for situations that may arise by having the confidence to meet any challenge, no matter if they succeeded or failed. In his own conception, DeMarcus reiterated how education was used as a tool to disenfranchise Black people. For him, it was the combined effort of "striving for social equality and improving the lives and the achievement potential for kids" that fueled his efforts in the community and in becoming an educator.

Doer of Mathematics. Naomi demonstrated a high comfort level in doing mathematics, and could be considered a confident doer of mathematics (Martin, 2000, 2007). She believed that she could do mathematics easily and was generally "good" at the subject. Working in the YPP workshop training provided her further opportunity to engage in mathematics. Through opportunities that were provided to her earlier in her schooling, she understood that possessing strong mathematics skills was an invaluable tool that afforded opportunity and access. She explained:

> It's like so [important] for minorities to be skilled in that area because it allows them to excel….It opens a lot of doors. Like if I hadn't won that competition. I got a two thousand dollar scholarship. I got a laptop….Just so many doors, so many opportunities, just for, you know, my math skills. And so, it's really important.

Naomi also pointed out that she did not hesitate to do mathematics even if it required more thinking time of her than others. She stated, "I really think…I enjoy math, and I like doing math, and I love discovering it, and I love figuring stuff out….And I think coming from that standpoint…the fact that it takes me longer to do math, and I'm still not intimidated by it." Here, Naomi echoes the necessity of embracing struggle when doing mathematics. She reifies the importance of struggle with new mathematical ideas as part of the learning process.

DeMarcus possessed a comfort level in doing mathematics that developed over time. In many respects, his confidence grew as a result of his work in the YPP workshop training and YPP in general. An increasingly confident doer of mathematics is defined as an individual who demonstrates a sense of confidence or willingness to do mathematics that developed through prolonged engagement. DeMarcus attributed some of the challenges he had with mathematics to how he saw himself, his own perceived ability, and his enthusiasm. He also indicated that he had some apprehension about engaging in mathematics from prior schooling experiences because he perceived his peers to be better at the subject than he was. His desire to do mathematics evolved in a positive way the more he engaged in mathematics through the workshop training and with the students. He realized that as a result of his work in YPP, he had a renewed interest to do mathematics problems that he found challenging. DeMarcus provided the following insight about doing mathematics:

> I consider myself a person [that is] not too good at math. And I consider myself a person unwilling to do math for a large portion of my life. I feel as though in that respect, I can relate a lot to the kids that I work with….Like [the workshop training has] improved my willingness to do math in everyday situations. I can definitely say before this program, I'd see [certain] number[s] and refuse to touch it. And I felt as though, [if the workshop training] was able to have this effect on me, then it would be possible for it, the kids that I work with, to have this effect [on them]. So, I guess one of the bigger influences on me is knowing this is possible.

DeMarcus recognized that although his disposition toward mathematics had evolved, some of the young people with whom he worked still struggled with developing a desire to do mathematics.

While both of the participants were considered to be doers of mathematics, Naomi could be considered a confident doer of mathematics who was intrinsically motivated. Naomi believed that mathematics was a challenging discipline to study but chose to engage in it anyway. Naomi also expressed a general sense of enjoyment when she did mathematics. DeMarcus' increased confidence in doing mathematics was developed over time and grew from his initial uneasiness, which came from earlier experiences in his schooling. DeMarcus made a decision that he

would be more confident in his approach to mathematics and he attributed this change with his work in YPP workshop trainings.

Discussion and Conclusion

The identities found in CMLWs are supported by research that have documented other outcomes that were associated with students involvement in afterschool program initiatives that were not limited to academic achievement. These findings included motivation to succeed in school and an increased commitment in learning (Mahoney, Cairns, & Farmer, 2003), a higher self-esteem and improved emotional adjustment and interpersonal skills (Barber, Eccles, & Stone, 2001; Gerstenblith et al., 2005; Mahoney, 2000; McLaughlin, 2000) as a result of student participation.

Several of the reasons that led to membership in YPP, as described by Naomi and DeMarcus, are echoed in findings from other studies that have examined the factors that contribute participation in community or school-based activities. These included friend endorsements of the afterschool activities (Huebner & Mancini, 2003), activities found to be fun as motivation for participation (Gambone & Arbreton, 1997), opportunities to learn (Strobel, Kirshner, & McLaughlin, 2008), and the acquisition of new skills and involvement in the community (Perkins et al., 2007). Also in accord with McLaughlin's (2000) findings, youth that participated in afterschool programs in urban settings wanted to participate in something greater than themselves. These students selected programs where they could make an impact in their community, posses some autonomy in decision making, participate in a learning environment with committed adults, and reflect consistently on how well the program was going for them.

At the Symposium

In the breakout session following the symposium at the 2011 Benjamin Banneker Association Conference, there was one reoccurring question that conference participants seemed to ask: *What other organizations are doing work similar to The Young People' Project?* Although there are several initiatives aimed to helping students in urban settings improve their mathematical skills, there is a dearth of grassroots organizations such as YPP that are run by young people interested in mathematics education related initiatives. Participants of the breakout session suggested a further exploration of additional outlets and resources where mathematics literacy work could take place and is taking place. Certainly, there are other community spaces where students have opportunities to build multiple mathematics skills, social awareness, which ultimately impacts their identities. Community-based organizations like the Algebra Project has

continued this work since they first began developing mathematics curriculum in the early 80s. The Algebera Project approach to teaching and learning mathematics steps away from traditional methods learned in schools (Moses & Cobb, 2001). One other local community based organization discussed in the breakout session was the Nsoromma School.[4] Located in Atlanta, Georgia, the Nsoromma School is an afterschool and weekend enrichment program that uses an African-centered approach in developing the character and the academic acumen of students in the area of mathematics, science, and engineering.

In discussions with breakout session attendees, the Benjamin Banneker Association (BBA) was also considered as a site where those interested improving the mathematics education of youth could come together. As a national organization, BBA's scope extends beyond teachers to include teacher educators, researchers, and administrators. The BBA with its mission devoted to mathematics education advocacy, leadership, and professional development in supporting teachers in providing African American students high quality education could be an additional stakeholder at the forefront of this effort. One suggestion was made to host workshops through organizations like BBA around the country where school district administrators, educators, researchers, parents, students, and other community members could come together to share their individual expertise, discuss community issues, and generate solutions to aid in improving what students take away from their schools and classrooms as it relates to mathematics. If the goal is to see the brilliance of our Black children actualized, community stakeholders should come together to figure out how to solve the problems of Black student achievement in mathematics.

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[4] For more information on the Nsoromma School, visit www. http://www.nsoromma.org/.

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