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# Positioning Toward Mathematics and Science Learning:

# An Examination of Factors Affecting Low-Income, African American Girls

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Abstract

**(Purpose)** The purpose of this study was to investigate the positionality of low income, African American school girls toward mathematics and science learning as they transition from elementary to middle school. The researchers sought to examine how culture, class and gender affected the girls' positioning in terms of mathematics and science, as well as the effects of the way in which teachers, parents, school counselors and administrators position the girls. **(Methodology)** In order to gather data, a focus group interview was conducted with five sixth grade girls and semi-structured in-depth interviews were conducted with two teachers, a school counselor, a principal and a parent. **(Results)** Using domain analysis, two major themes were identified, including *positioning* and *pedagogy*. **(Conclusion and Recommendations)** Implications for this study include increased emphasis on students' funds of knowledge in school curriculum and a need for further research on the role of positionality on construction of knowledge in the classroom. **(Additional data)** (contains 17 references).

# Positioning Toward Mathematics and Science Learning:
# An Examination of Factors Affecting Low-Income, African American Girls

In the fields of mathematics and science education, a substantive achievement gap has been documented for some student populations. This gap has been documented for females (Kurpius, 2004), students of low socioeconomic status (Tutweiler, 2005) and those of culturally diverse backgrounds (National Center for Education Statistics [NCES], 2003). One group that has received much attention is African American students (Foster & Peele, 1999; Murrell, 2002), who have been found to have lower academic achievement at the elementary, middle and high school levels when compared to their White counterparts (NCES, 2003). This is problematic due to the importance of these two subjects in contemporary life. Aggravated in high poverty schools (Corcoran & Chaudry, 1997; Payne, 1998) and in girls of this population (Kurpius, 2004), low mathematics and science achievement can negatively impact African American students on both the societal and personal levels. Low academic achievement can result in high dropout rates, high unemployment and underemployment rates, (Alexander, Entwisle & Horsey, 1997), and, ultimately, low participation in mathematics and science related careers (Atwater, 2000).

Numerous explanations have been offered to explain this achievement gap. Prior developmental theories consider personal factors among individual students as contributors to their low academic achievement. More contemporary theories have focused on teaching practices, advocating for the use of culturally appropriate pedagogy and culturally sensitive practices in the classrooms. Yet, a new approach is warranted in which culturally appropriate pedagogy is expanded to focus on a more holistic view of those factors that influence student achievement. Parents, teachers, and other school personnel, such as counselors, all significantly

influence student performance. The concept of positionality provides a useful explanation of those influences.

Positionality, proposed by feminist theorists, explains how one's perception of social location shapes the way in which one views and interacts with the world. This concept states that based on one's social relationships, one can determine one's own social standing and this in turn affects the perception of one's own power. (Cooks, 2003; Harley, Jolivette, McCormic & Tice, 2002). The classroom environment is a place where positionality is always present, where issues of gender and race impact the power dynamics in the classroom. As such, these power dynamics affect teachers and students and relations among them (Johnson-Bailey, 2002). In a classroom, the position of each of the members plays a role in their relationships with the subject content as well as with each other; the interaction of those positionalities significantly impacts the classroom environment (Cooks, 2003; Lee & Johnson-Bailey, 2004).

The purpose of this study was to investigate the positionality of low income, African American school girls toward mathematics and science learning as they transition from elementary to middle school. More specifically, the researchers sought to examine how culture, class and gender affected the girls' positioning in terms of mathematics and science. The researchers examined the effects of the way in which teachers, parents, school counselors and administrators position the girls.

*Methods*

Grounded theory (Dey, 1999; Strauss & Corbin, 1998) was used in an effort to uncover social psychological concepts, processes and experiences of the participants and interpret how these affected the girls' positionalities. The transcripts were analyzed to identify themes and

create theoretical explanatory schema (Strauss and Corbin, 1998). Other protocols used included member checking and peer examination in order to ensure internal validity.

*Participants*

Participants included five African American girls in their first semester of sixth grade at a public middle school located in a suburban school district in the southeast region of the United States. In addition, the parent of one of the participating girls was interviewed as well as the girls' primary school counselor, mathematics and science teachers, and principal. All participants were females; all of the participants were also African American, except for the science teacher and school counselor who were both White.

*Data Collection & Analysis*

Informed consent was obtained from the students' parents allowing them to participate in the study. The girls participated in a 90-minute focus group while the adult participants engaged in 50-minute semi-structured interviews conducted by a White, female doctoral student in counselor education. The interviews were audio-taped and then transcribed verbatim. The research team consisted of three African American professors from the local university in the areas of mathematics, science, and counselor education and two female doctoral students in counselor education (one Latina and one White). All members of the research team read through the transcripts several times, first trying to identify main phrases and later clustering these phrases into themes or summary statements. Finally, based on these clustered summary statements, domains of meanings were created. These domains were refined through constant dialogue among the researcher team members until consensus was reached. Quotes indicative of each of the identified domains were selected, and then commonalities were examined. Although several themes were identified, two major themes are reported: *positioning* and *pedagogy*.

## Findings

### *Positioning*

Under this theme, the girls spoke about factors that they felt positioned them either inside or outside of mathematics and science learning. The girls identified factors that help them view themselves as mathematicians or scientists and factors that keep them from developing this view of themselves. First, the girls spoke of the differences between the magnet and non-magnet programs. When speaking of the non-magnet program, Kayla said, "*A whole bunch of people who go here live in the ghetto. Some people don't…But if you walk through this hallway, there are so many ghetto people"*. Similarly, Tiffany recognized how the non-magnet students are labeled *"…mainstream…what they call us over there."*

This was in sharp contrast to what these girls perceived about the students in the magnet program. Tiffany noticed: "…[magnet program] *students, they stay in good houses*." Brittany called their neighborhoods "*The burbs*". Statements from the girls such as *"…those kids are real smart, smart"* and *"They are more educated than we are"* show how they view the magnet students as being positioned inside mathematics and science learning as opposed to themselves or other non-magnet students.

The girls noticed a separation between the magnet student's schooling environment and their own:

> Kayla: *"If you look at the walls and you see painting, that's [the magnet program]. If you look at these walls, you don't see nothing but maybe some words, like someone wrote, 'blue,' up on the wall. I think that's wrong, too."*
>
> Brittany (about the magnet program): *"Every time you pass through that hallway, it's so quiet. I like looking in the classrooms."*

Lyndel: *"The* [magnet program] *bathrooms…"* Girls together: *"…are so clean!"* These statements reveal that the girls are aware of the differences between their school experience and those of the students in the magnet program.

The girls also showed how they position themselves as outsiders to mathematics and science learning by saying things like *"it was too boring!"* The girls also spoke about how the classroom environment affected their positioning in regards to mathematics and science. For example, when speaking of their experience in the science class, they stated that they felt less inclined to work in groups or hands-on activities, unlike the boys. However, the girls said that when working in all-girl groups, they felt better about experimenting with the material. This shows an understanding of how gender plays a part in power differentials in the classroom.

At the end of the focus group, Kayla asked the interviewer about her own experiences with mathematics and science, *"Did you like math and science?"* This shows that the girls are positioning the interviewer as a mathematics and science learner, who perhaps attended a magnet program. Thus they are thinking not only of their own positioning but about the positioning of others as well.

*Pedagogy*

This theme was composed of two subthemes: school relevance and engagement. The school counselor spoke about ways to engage students:

> *"When you have people who are really enthusiastic about what they do, and have creative ideas, and they don't limit the children, and they allow the children to use their imagination to become creative, they will…. Even the African American authors, when they write children's books, they write with a real cultural base… I think it's engaging."*

When reflecting on what they found as engaging, the girls said: (Kayla) "*I like it if you get to do experiments. But if you have to sit down and do book work, it's so boring."* (Tiffany) *"I like when we do the labs…*." (Brittany) *"Our teacher last year was a good teacher. She taught us math with music. She made up a math rap."*

The girls also identified ways in which teaching practices hinder their level of engagement: (Kayla) *"They'll be like, math is blah, blah, blah, blah…maybe after they say that they could explain it."* (Lyndel) "*Tell Mr. Smith…to do some math rap. All Mr. Smith really wants to do is talk…mostly all people like music."*

The parent participant was asked about her perception of her daughter's attitude toward math; she stated: "*She likes math. I have found that if you don't make things interesting for your child, then they are not going to be interested. They love music and dance. If she applies the methods then I think it is good for her."* She also spoke about things that help encourage her daughter, including support from teachers and open parent-teacher communication.

The principal also spoke about the importance of hands-on or relatable material in order to engage students in the learning process:

> *"…Whenever you take students away from text learning and you're giving them something hands-on, then they are going to be excited…. I think it's the teacher that engages the children and all children want to have the opportunities to learn…when they are working with manipulative[s] and hands-on things, they are right there with the teacher."*

Similarly, the science teacher spoke about making the material relatable to the students:

> "*… There's always something to tie it in with. Like I said, I use a lot of real life situations. My student population responds more to real life events as opposed to pulling out a storybook and opening it up. They can relate to what's going on around them*."

The mathematics teacher also found ways of making the instruction relevant: "*I teach the skills first and then the music is just part of the enhancement and also enjoyment.…"* Thus, all participants showed an awareness of how student engagement contributes to high achievement. Furthermore, all agreed that in order to be engaged, students need to relate to the material, connect to their past experiences and learn through active involvement.

## Discussion

The findings of this study are consistent with other research focusing on students' awareness of their marginalized experiences in the classroom (Brooks, West-Olatunji & Baker, 2005; West-Olatunji, Baker & Brooks, 2006). These interviews suggest that the African American girls are aware of their positionalities in relation to mathematics and science. Furthermore, they recognize those factors that influence their positionality, as when they discussed the opportunities that students in the magnet programs have that they do not. Given that an individual's positionality is not fixed and can be shaped through awareness (Maher & Thompson Tetreault, 2001), teachers can facilitate students' awareness and, as such, shape students' learning experiences. Furthermore, teachers, counselors, and administrators can provide experiences that move African American girls toward a positive positioning of mathematics and science education. The girls' positionalities affect the way in which they interact with teachers, with other students and with the material that is being presented (Lee & Johnson-Bailey, 2004). Thus more research is warranted examining the effects of the students'

positionality and the interaction of teacher-student and student-student positionalities in the classroom.

## Significance and Conclusion

This study provides a holistic approach to addressing the challenges that African-American girls face in mathematics and science classrooms. The study examined the influence of not only student factors, but also the role of teacher, parents, administrators, counselors, and the school environment in helping students achieve in mathematics and science. In this way, this research looks at the combined effects of stakeholders and related factors and therefore implies that interventions need to be holistic or ecosystemic in nature.

Through these interviews, the girls showed an awareness of other people's expectations of them. They seemed to know which factors supported and which one's hindered their positioning as mathematics and science learners. Although one cannot escape one's positionality, one can shape it by developing awareness. Thus, teachers need to realize that they can help change girls' positionalities by helping them become more aware of their process as mathematics and science learners. Furthermore, teachers and administrators need to recognize how their own positioning affects the students' positioning in relation to mathematics and science.

Finally, this study points to the need of helping teachers become culturally sensitive. The information gathered shows that teachers need to receive training on culturally appropriate pedagogy and socio-cultural frameworks. These can help enhance classroom interactions and promote effective learning for students of diverse backgrounds.

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