

Where are all the A's?

An Action Research Paper by

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December 10 2014

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ABSTRACT

Eighth grade girls show little to no motivation to do well in science class. The reasons for low achievement and aptitude are wide and varied. The purpose of this research study is to uncover the lack of motivation and achievement of girls, particularly in African American girls as it pertains to my eighth grade science class. It will attempt to address the dwindling number of American students completing degrees in the STEM fields, particularly science.

The initial findings indicate previous science education plays a factor in motivation and achievement. Getting to know the girls on a personal level did increase motivation but not achievement. Giving a choice in assignments did increase engagement but not achievement. It is hoped this study will continue in order to gain an understanding of the impact of race and culture on science education, and subsequently increase motivation and achievement.

A recent study from the National Science foundation (2013, p.8) showed that African American women make up less than 2% of the science and engineering workforce. Many factors are responsible for these low numbers, however many indicators point to cultural and historical factors as well as experiences in early and middle education. As a middle school science teacher in an urban school, I cannot help but wonder what I can do to increase the number of African American women in the science and engineering workforce.

The purpose of this research study is to uncover the lack of motivation and achievement of girls, particularly in African American girls as it pertains to my eighth grade science class. It will attempt to address the dwindling number of American students completing degrees in the STEM fields, particularly science.

In 1991, Judith Ramley, former director of the National Science Foundation's education and human resource division saw the need for a change in the way science and math are taught. It was her vision to go from direct instruction using only a textbook to activities requiring problem solving, discovery, and exploratory learning. In other words, she strongly believed in requiring "students to actively engage in a situation in order to find its solution." (Fioriello, 2011, para. 3) Though it has been twenty years since Ramley had her vision, little has changed in the area of science education and those obtaining college degrees in a science or related field.

As someone who has taught in two different middle schools in Little Rock, Arkansas for the past five years, I have observed that girls are either motivated to learn science or they are not. My undocumented observations are that female girls do not perform as well as males, and in particular, African American girls are less motivated to

do well in science than either Hispanic or White girls. In the first week of school, I had all students fill out goal sheets which required them to list three academic goals. Nearly all girls indicated they wanted an A or B in science, yet I have less than half of them performing at this level, and it is mostly due to not completing required work; most of which is to be done in class. The grades and work ethic I view daily are unsettling to me. I know that recent research from ACT shows that “the level of academic achievement that students attain by eighth grade has a larger impact on their college and career readiness by the time they graduate from high school than anything that happens academically in high *school*.” (ACT 2008) Implementing effective strategies for female students that lead to an increase in motivation, confidence and achievement in science will assist in overcoming their fears. It may also allow them to discover some inner talents they may not have known existed, and better prepare them for high school and college or trade school.

Questions to consider are:

1. How do I motivate 8th grade female students to be more interested in science?
2. Why does there appear to be little to no motivation for African American female students to perform well in middle school science?
3. What teaching strategies can I employ to create a classroom environment that will motivate African American female students to a higher percentage of completed work?

I believe once I can discover the reasons for underperformance and lack of motivation, I can then find resources to improve my methods of teaching.

Literature Review

Over the years, there have been many studies and reports about women in science, all concluding that science is an underrepresented field for women. A large majority of the studies are reflective of white middle class female students and adults making it difficult to find research on strictly African American female students. I did find The “Black Girl Turn” (2014) by Pinder and Blackwell. They look at the study of gender inequality in science from the typical studies involving white, middle class girls, in order to understand the African American females’ experience in the science classroom. The specific focus is on what happens in early education and how it might influence success in science later in their education careers. The article gives a strong background of the research done on gender inequality in science careers. Pinder and Blackwell go on to point out all of the gender and race biases in education today. Additionally, they discuss cultural, historical and biological factors that have negatively influenced African American girls and their success in science education.

When it comes to African-American girls and chosen fields of science, culture and heritage also play a large role in determining academic success. Brickhouse, Lowery and Schultz (2000) examine four seventh-grade African American female science students that were chosen because they already had an interest or aptitude in science. The authors give a background of how girls are encouraged to be “girly” and play with dolls and not chemistry sets, how because of this, girls enter school already at a scientific disadvantage. The study focuses on both student and teacher self-perceptions and shows that African-American females in particular believe they have to give up their culture and heritage in order to blend in and be successful.

The way that a girl is treated by their peers can also impact success in a science classroom. As Anderson and Palincsar (2002) reveal in their study of four sixth-grade girls of different races and socioeconomic status that work together in a collaborative learning classroom. The authors focus on the interaction and conversations that take place between the girls and notice the unintentional discrimination set forth by three of four girls, which singled out the only African American girl of the group the privilege to succeed in science. Most importantly it focuses on the relationships “and how the privileging of ideas is connected to that of people and how the practice of science is connected to that of discrimination.”

A 2005 study by Jayne E. Stake, and Kenneth R. Mares found that success in science could not be done by knowledge acquisition alone. They point out that science aptitude and the acquisition of science knowledge are important; however, they maintain, “students must sustain high motivation and confidence in their abilities to achieve in science.” (Stake & Mares, 2005) The study Stake and Mares did was over seven years, and collected data on students in summer enrichment programs for science. They wanted to see if there was a “splashdown effect” as in a connection to the summer program and their science aptitude, attitude and motivation to do well once they returned to their home high schools. To go along with my theory, it was motivation to do well that had the biggest increase with students in the study. “These findings suggest that the full impact of science-enhancement programs on science attitudes has been underestimated in previous research when follow-up measures were not included.”(Stakes & Mares, 2005)

Methodology

Participants

Rokevia Cooper	8th grade black female	Current Science Grade: C
Kylie Freeman	8th grade black female	Current Science Grade: D
Noelia Lopez	8th grade Hispanic female	Current Science Grade: C
Alani Maiden	8th grade black female	Current Science Grade: A
Kayla Maxwell	8th grade black female	Current Science Grade: B
Emily Davault	8th grade white female	Current Science Grade: A
Tanaiah Sims	8th grade black female	Current Science Grade: A
Amari Robinson	8th grade black female	Current Science Grade: A
Aiiryel McCoy	8th grade black female	Current Science Grade: B
Maramé Hughes	8th grade black female	Current Science Grade: D

Materials

Research Based motivational teaching strategies:

1. Get to know your students
2. Become a role model for girl interest
3. Give students as much control over their own education as possible

Survey Questions for each girl. Questions uncovered:

- Current student perception of science – and why
- Background education in science from elementary thru 7th grade
- Time spent on hands on activities vs textbook activities and worksheets
- Opinion of current science class – and why
- Current grade in science

Procedure

The length of study to date has been just eight weeks. I began by talking to my girls about it and asking for their participation. I then sent home parental consent forms and waited for their return. After nearly two weeks, I had twenty consent forms and felt I could begin my project. I started with asking the girls to answer survey questions via Google forms. Of the twenty that agreed to participate, only 10 answered the initial

survey questions. Once I had their answers on paper, I developed more probing and clarifying questions to interview in person.

I then began to implement research based motivational strategies, one each week for three weeks. Each week I checked the assignment completion rate for the girls that were participating. I wanted to see if they were completing more or less work or about the same as before the study began. The first two strategies I chose to focus on were:

1. Get to know your students. Although this was done via several “getting to know you” activities in the beginning of the year, this time I would take special interest and focus on these particular girls. Getting to know the participants was more than just a computer survey. The personal interviews were really where this took place.
2. Give students as much control over their own education as possible. I made student choice assignments. I created lists of 10-12 different activities that students could do, and they were to choose 6 of them to complete within the week.

Analysis

I used both qualitative and quantitative data collections. The initial survey questions and personal interviews were used as qualitative data. The post strategy interviews were also qualitative. I used inductive analysis to try and find links and similarities between race and/or background science education. The quantitative data

was using the completion rate of assignments prior to and during the study. The analysis in this section is a pure number comparison.

Findings

The questions that I addressed in my research are:

1. How do I motivate 8th grade female students to be interested in science?
2. Why does there appear to be little to no motivation for African American female students to perform well in middle school science?
3. What teaching strategies can I employ to create a classroom environment that will motivate African American female students to a higher percentage of completed work?

If I can find the reasons for underperformance and motivation to do well, then I can find resources that will allow me change the work completion rate, the strategies used or the classroom environment.

I created a survey for the girls to answer. The questions were related to their past science experiences and their current perception and opinion of science class in school. I asked every girl to answer the question, "What is your current perception of learning science in school?" and asked them to rank it on a scale of 1-10. They were then asked to state why they felt that way. All of the answers were 5, 7 or 8.

The girls that ranked 5 stated:

"I don't think I'm smart enough to learn more about science"

"Sometimes I feel that science is unnecessary, unless you actually want a career in science."

“I can easily learn if someone would teach me right, but when I don't understand I do feel stupid.”

“I don't think I am smart enough to remember and get a lot of information without it leaving in some way.”

“in all of my previous science classes, my teachers rushed through things and I never got the chance to fully get an understanding of the lessons. I actually like science, and I would love to have a better understanding of science.

The girls that ranked 7 stated:

“When it comes to science, it's hard for me to understand at times.”

“Science isn't my biggest interest.”

“NOT SMART ENOUGH.”

The girls that ranked 8 stated:

“I really do love science, I do. I am very curious when it comes to scientific things.

However, with my past two years of a not-so-favorable teacher, I didn't really like it too much.”

“Science is a tool to help you discover new thing and I love to discover.”

The lowest (5) overall perceptions of science also had the least amount of time spent on science in elementary school - 1-2 hours per week. Science was delivered in elementary school as well as 6th and 7th grades as mostly lecture with textbook and worksheets and very little hands on activities.

The mid-high science class perceptions (7) also had very little elementary science - average 2 hours per week. For these girls, science was done 50% text/worksheets and 50% hands on in elementary, with all text/lecture/worksheets in 6th and 7th grades.

The two students that ranked their perception of science class an 8, had the most elementary exposure averaging 3+ hours per week, and more than 50% hands on activities. Their 6th and 7th grade science classes were delivered mainly text/lecture, with a few hands on activities.

Summary of Initial Findings via Google Forms Survey:

Overall Perception of Science Class in school Scale 1-10	7th grade hands on # of hands on activities in science class per week	7th grade delivery- how was science taught? Text, Lecture, worksheets, hands on lab?	6th grade hands on # of hands on activities in science class per week	6th delivery - how was science taught? Text, Lecture, worksheets, hands on lab?	Elementary – how many hours a week did you have science on average	Elementary Delivery- text book, worksheets, hands on
5	0-1	50/50 Text/lecture, Lecture and worksheets	2-3	50/50 Text/lecture	3	About 50/50 text, hands on
5	0-1	All Text book - read and answer questions	0-1	Lecture and worksheets	2	all text
5	0-1	Lecture and worksheets, activities	0-1	Lecture and worksheets, activities	1	all text
5	0-1	50/50 Text/lecture	0-1	We did a descent amount of projects and a little bit of textbook work.	1	all text
7	4-5	worksheets and other lesson	4-5	50/50 Text/lecture	2	all text
7	0-1	All Text book - read and answer questions, Lecture and worksheets	0-1	Lecture and worksheets	3	About 50/50 text, hands on
7	0-1	50/50 Text/lecture	0-1	50/50 Text/lecture	1	about 75% text, 25% hands on
7	0-1	50/50 Text/lecture	2-3	50/50 Text/lecture	2	About 25% text, rest hands on
8	0-1	All Text book - read and answer questions	0-1	All Text book - read and answer questions	5	About 50/50 text, hands on
8	2-3	50/50 Text/lecture	0-1	Lecture and worksheets	1	About 25% text, rest hands on

Personal interviews were conducted with some of the participants. Analysis of the comments made to questions asked uncovered a lack of confidence as well as a lack of motivation. “You have to be really smart like Sheldon *on Big Bang Theory* in order to get science. I am not even close, so I will never get science.”

“I’m really smart everywhere else, but in science it just doesn’t make sense. It’s the only class I am dumb in, and the only class I don’t ask questions in.”

One girl that was doing well, who also had a great background in science from elementary school on, said “ever since we made tornadoes in a Coke bottle in 3rd grade science I really liked it. I was always good at it, and I always want to know why and how things work. I had really great teachers that helped me learn all the things I wanted to know.”

I noticed a couple of patterns. The first pattern had to do with background education. The less time spent on science prior to eighth grade, the less motivation the girls had.

I also noticed that even if they did have more time spent on science, the girls that who had science delivered mainly via text were also not very motivated.

The first motivational strategy I implemented was from the Center for Teaching at Vanderbilt University: “Get to know your students.” The survey questions I had produced were a way for me to get to know the girls, how they felt about science and why. While it was not an all inclusive “get to know me” survey, it gave insight as to the feelings of the girls. I found 4 of the girls changed their attitudes towards me just by me asking them to be part of my project. They asked more questions and became more attentive in class. Outside of class, they greeted me every morning and did not leave the school at the end of the day without at least a goodbye or a hug. This behavior was primarily evident in the three lowest performing girls.

The second motivational strategy was also taken from the Center for Teaching at Vanderbilt University: “Give students as much control over their own education as

possible". I created a list of twelve different activities that students could do, and they were to choose six of them to complete within the week. I found this may have been too lofty of a goal for a first "choice" assignment. The activities covered different topics, and students were more confused than ever. I spent a lot of time going over each individual task and expectations for each one. In the end, the assignment completion rate did not improve.

Overview of the Study

The purpose of this research was to try and uncover the reasons for the lack of motivation and achievement in middle school science, particularly in African American female students in my 8th grade science class.

I observed student time on task as well as the grades they were receiving on individual assignments and as an overall grade. I asked all eighth grade female students to be part of my research project. My research was done with survey questions, interview questions and observations.

Summary of Findings

Observations and answered survey questions showed the less time spent on science prior to 8th grade, the less motivation the girls had in my 8th grade science class.

I also noticed that even if they did have more time spent on science, the girls that had science delivered mainly via text were also not very motivated compared to the girls that were given more hands on activities.

Girl attitudes seemed to improve just by me asking their permission to be part of my study. There seemed to be a stronger relationship between me and the girls who answered the survey questions and interviews than those that did not. These girls show more of a desire to learn, yet I saw no improvement in completion rate of assignments.

The student choice assignment did not yield an improvement in completion rate of assignments either, though it did show more engagement and time on task than with previous assignments.

Limitations of the Study

There were several limitations of this study. The first and most significant was time. While I wanted to learn about my girls and their lack of interest in science, I learned that everything does not always go as planned. I was not able to implement as many motivational strategies in the classroom that I would have liked to. I was not able to take the time to find out specific strategies for African American girls, or to interview farther to get information on their culture and heritage. Also, I have forty seven female students, and all but a few were eager to participate; however, only twenty three brought back their consent forms. Of those twenty three, only ten completed the survey questions, making the number of subjects included another limitation. I implemented the strategies for every student in the classroom, and I was able to observe the additional thirteen girls; however, without background information it was hard to draw a conclusion as to their lack of motivation.

Conclusion

After several weeks of research, I was able to find a few studies that relate to the achievement of African American girls in science. Brickhouse, Lowery and Schultz (2000) examined four seventh grade African American female science students that were chosen because they already had an interest or aptitude in science. In their study, *“What Kind of a Girl Does Science? The Construction of School Science Identities”* the girls are tracked through seventh and eighth grades, and a short follow-up was done for their ninth grade year. Interestingly, their conclusions for lack of achievement point to teacher perception and implemented strategies. One of their girls had been an above average student in science and showed a genuine interest in the subject for both 7th and 8th grade. However, when she got to high school, she was placed in a class where the teacher, “spent most of his time at his desk or talking on the telephone rather than teaching.” Sadly, over the course of the year, she became complacent in her class, and her attitude towards science diminished so low that by May of that year, “she was considering dropping into the lowest-track science class for 10th grade.”

In another study conducted by Anderson and Palincsar (2002) it was revealed “the privileging of ideas is connected to that of people, and how the practice of science is connected to that of discrimination.” Finally, Pinder and Blackwell (2014) studied the effects of cultural, historical and biological factors that have negatively influenced African American girls and their success in science education. All of these are great studies, and provide insight to the under or non-achieving African American female student. Inferring through their results, one can determine that it is the teacher and classroom environment that makes the biggest impact. This has been evidenced in my

classroom as well. I have observed an increase in interest and engagement in class since I began this study. However, I have not seen an increase in student assignment completion, nor have I seen the grades increase. I believe that I have only learned why the girls act as they do, but I have not found effective solutions to change the attitude to increase their aptitude, motivation and grade.

The studies on motivation and confidence in the science classroom offer a variety of solutions to combat many of the problems observed in my classroom, and in the previously mentioned studies, I am not convinced that motivation and confidence strategies are race specific as much as they are more related to an individual person. A study of race and cultural impact was to be included in this paper; however, I would need more time to study that relationship.

Recommendations

It is my recommendation that all elementary schools implement hands-on science immediately. Of my well performing and motivated girls, all had a significant amount more time spent on science from elementary forward. I would also encourage teachers to learn general motivation strategies as well as content specific motivation strategies. Shumow & Schmidt had documented success with the strategies they have written about in their book "*Enhancing Adolescents' Motivation for Science: Research-Based Strategies for Teaching Male and Female Students.*" I plan to continue to use resources I have discovered to implement strategies in my classroom. My ultimate goal is for my girls to expand their knowledge base and grow academically. It is up to me to find the best practices to use in order for that to happen. I will continue to monitor and observe the girls in my study to see which strategy may have the best effect, or if it is a

combination of strategies. I will continue to talk with them regularly to see how they are feeling about science.

Through more one-on-one interviews, I will learn more about my girls, and will gain an understanding of the impact of race and culture on science education. Once I find strategies that work, I will share them with my team, who all teach the same group of students. My next wondering is if I am successful in raising achievement and motivation for African American girls in my classroom, will the same strategies work for all girls, and will they transfer success in other courses?

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