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ABSTRACT

To increase the representation of African Americans in science fields, potential candidates must have positive personal science experiences. Even with recent reforms, most students in the United States have a limited exposure to science experiences, especially African American students. One approach to addressing this problem has been to offer science enrichment programs for African Americans, as in Atlanta's Saturday Science Academy. The science experiences gained at this program are obtained through laboratory experiments and social interaction. Laboratory experiences enable the students to encounter science in a hands-on manner, use science equipment, question the world around them, and succeed in reaching attainable goals. The social experiences include attending the program at an historically Black university where African American children can interact with other African American students with similar interests. This document is a case study that discusses the science aspect of the Saturday Science Academy and examines how the Academy establishes an environment which supports positive lab and social experiences for African American students (n=24). (Author/ZWH)

Scenes from a Science Classroom: An Enrichment Program Experience

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Abstract

To increase the representation of African Americans in science fields, potential candidates must have positive personal science experiences. Even with recent reforms, most students in the US have limited exposure to science experiences, especially African American students (Weiss, 1989). One approach to addressing this problem has been to offer science enrichment programs for African Americans, as in Atlanta's Saturday Science Academy. The science experiences gained at this program are obtained through laboratory experiments and social interaction. Lab experiences enables the students to encounter science in a hands-on manner, use science equipment, question the world around them, and succeed in reaching obtainable goals. The social experiences include attending the program at an historically Black university (Clark Atlanta University), where African American adults serve as role models, and where the children can interact with other African American students with similar interests. This case study will discuss the science portion of the Saturday Science Academy and examine how the Academy establishes an environment which supports positive lab and social experiences for African American students.

Scenes from a Science Classroom: An Enrichment Program Experience

At present, minority students total over thirty percent of the nation-wide school-aged population, of this, sixteen percent are Black. The number of African American teachers in 1986 was only seven percent (Weiss, 1989). According to the Commission on Excellence in Teaching's 1987 report, if current trends continue, the minority teaching force will drop to about five percent by the year 2000 (U.S. Department of Education, 1991). Interestingly, the year 2000 is expected to be a watershed for public education in the U.S.

Attention has been refocused in recent years to the inadequate learning of science by American students. (Mullis & Jenkins, 1988). These authors also report that the average science proficiency of 9-, 13-, and 17-year old White students and Hispanic students is higher than that of African American students at all three grade levels investigated.

To increase representation and achievement of African American students in the sciences, future scientists from minority populations must have positive personal science experiences as students. Haladyna, Olsen, and Shaughnessy (1982) suggest there is powerful evidence that student attitude toward science is related to perception of self and the ability to learn. These authors report that students with a strong positive regard for their own abilities to learn have a more positive attitude toward science.

The role of hands-on science and role model interaction relative to encouraging positive experiences for African American students has been investigated by Bloom (1976). He provides evidence of the importance of students' feelings about science. Data collected from 17 countries on six different subjects indicated that as much as 25% of variance in achievement may be attributed to students' feelings about what they are studying, to their school environment, and to their own self-concepts. Likewise, classroom environment has been shown to be an important determinant of attitude toward science. Keeves (1975) has studied the relationship between the classroom learning environment and cognitive and affective learning outcomes. He concluded that characteristics of teachers, peers, curriculum, and classroom climate are strongly related to attitudes toward science. It is the philosophy of the Saturday Science Academy (SSA) staff that positive experiences will contribute to an increased student self-identity, self-concept, and a positive attitude toward science (Webb).

One approach to increasing the representation of African Americans in science has been to offer enrichment programs to students, such as the Saturday Science Academy of Atlanta's Clark Atlanta University. In an impact study on the SSA by Webb, McNichols, Thompson, and Washington (1993), the authors concluded that:

> 1. The Academy effects and promotes positive student attitudes toward and perceptions of science as an area of study and as a career.
> 2. The Academy, through its activities and experiences for students, promotes positive student self-concept regarding science.
> 3. The Academy encourages student participation at all levels - from advanced course selection in high school to college science majors and choice of science as a career.
> 4. The Academy develops, reinforces, and expands students' interests in science and science as a career.
> 10. The Academy, for the majority of its students, provides the first stepping-stone, among many, toward students' pursuance of science as a career.
> 11. The Academy is increasing the representation of African Americans in science and engineering. (p. 28)

In the present study, tapes, observations, and interviews of the seventh grade section of the SSA in the spring of 1993 were used as data. Analysis of this data, indicated that experiences in science at the Saturday Science Academy fit into two broad categories: lab experiences and social interaction. Lab activities enable students to experience science in a hands-on fashion, to use equipment, and to question the world around them. The social experiences include interaction with members of an historically Black educational institution, Clark Atlanta University. In the SSA, African American adults act as both educators and role models for their students. Students are also encouraged to interact with their peers.

After a brief description of the program and the methodology, a series of hands-on activities is delineated. In these activities student/teacher, student/student, and student/researcher interaction will be highlighted as a means of analysis. The second component of the SSA, peers and role models, is analyzed in the same manner. It is revealed that, though the interaction was sometimes playful, it usually led students to formulate their own explanations. The students also demonstrated an ability to work in a group and share tasks.

The Program

The Saturday Science Academy (SSA) was created in 1979 to:

> Develop positive attitudes toward science, engineering and technology . . .
>
> Increase the students' self-concepts and beliefs in their abilities to be successful in the sciences, engineering and technology (Webb p.1).

These goals appear to be a driving force for the science teacher observed in the spring of 1993. The SSA draws third through seventh grade children from the Atlanta metropolitan area. Selection is made by examination of the applications the children fill out. This includes an essay: "Why I want to attend the Saturday Science Academy."

Once selected, over 200 children are placed into groups by grade level. They attend the free program for ten Saturdays from 9 to 12. Each Saturday, there are four classes: science, mathematics, computers, and creative expressions. As part of the philosophy of the program, the students are neither graded nor do they take pretests or post tests.

Methodology

The researcher acted as a participant observer in five of the nine Saturdays the SSA met during the spring of 1993. The class had twenty-four seventh grade students, one teacher and three to four assistants. Field notes and audio recordings included teacher directions, teacher-student interactions, assistant-student interactions, and student-student interactions. The researcher also interviewed the teacher and six of the children.

All participants were African Americans with the exception of the observer, who was a White female. Nine of the seventh graders were male and fifteen were female. The female instructor teaches biology at a local high school. The assistants were undergraduate students taking a science methods course at Clark Atlanta University. One assistant was male and the others were females.

According to Glesne and Peshkin (1992), the researcher always has an impact on the setting studied. Being the only White in this environment made me, the observer and primary author of this paper, a numerical minority. The concerns of Whites researching the experiences of Blacks has been addressed by Anderson in her study of race relations(1993). She notes that:

> Minority group members have insights about and interpretations of their experiences that are likely different from those generated by white scholars (p. 43).

I entered the field with the intention of observing and describing the kinds of experiences these children have in the science classroom at the SSA. This description inevitable is shaped by my own interpretation of the events. Anderson asks, is it possible for an outsider to describe the experiences of those from another race? This concern was present in the observers mind throughout the research. One attempt to address this challenge was to utilize member checking by asking the teacher and other staff members to examine the data gathered and the paper in process. This technique helped to increase the validity of the various types of data gathered.

In this paper, participant names have been changed and quotes have been formed into sentences.

The Lab Experience

Performing lab activities is important for all students, yet minority students have the least opportunity for these experiences (Mullis & Jenkins, 1988). In order for the participants at the SSA to have these hands-on experiences, Andrea Cramer, the science teacher whom i observed, drew from a variety of hands-on activities (see Table 1). This enabled the students to be both mentally and physically active. When considering the activities, she choose those that would give the participants the opportunity to use science equipment and everyday materials to learn science, encourage the students to ask questions about the world around them, and bring about a feeling of success in science.

Hands on

The author of *Elementary School Science for the '90's* (Loucks-Horsley, 1990) states that science education should "give children an opportunity to explore how things work firsthand, through activities and experiences with a wide variety of materials" (Loucks-Horsley, 1990 p. xiv). This experience is important at any age, but is especially important at the ages of the children in the SSA, grades' three through eight. Miller and Prewitt (Miller & Prewitt, 1979) claim that seventh grade represents most students' first exposure to science. Simpson and Troost (1982) maintain that this introductory experience may influence students' attitudes and possible commitment to science and science-related activities.

The science instructor at the SSA chose activities from a variety of disciplines. These activities and the disciplines the instructor felt they covered are listed in Table 1. She described her decision to me this way:

> I try to have the students see different areas. Although [my specialty is] biology, I've been working on more physical science ideas . . . You never know what [the students] get at school. Some of them may have seen some of this before. Even so, it's still good for them to see it again.

Insert table 1 about here

Mrs. Cramer, the instructor, stated that "It's important for [the students] to be able to be active in science." This is consistent with Weiss (1987), who reported that two-thirds of elementary science teachers and more than three-fourths of secondary science teachers indicated that laboratory-based science classes are more effective than non-laboratory classes. Mrs. Cramer also mentioned that she wants the students to manipulate objects as well as to think about what they are doing. Thinking began on the first day with the first activity, the toothpick puzzler. Pairs of students were given 22 toothpicks and asked to use the toothpicks to form an irregular design drawn on the board. The activity directions were to remove five toothpicks to form two squares. Natalie and Rolita were working together.

Rolita: Do you think we should move this one?

Natalie: I don't know!

The young women debated which toothpicks to move for a couple of minutes.

An assistant approached them:

Female assistant: How's it going?

Rolita shrugged her shoulders.

Natalie: We don't know which to one move.

Female assistant: Just try some and see what happens.

The pair began to move the toothpicks. It took many tries for them to form two squares. Thinking aloud was a part of the process for this pair. Each move had to be justified to each other, and this led to a discussion about the change. Soon they raised their hands. "Is this the answer?" The assistant looked and responded, "I'm not sure, let me check." The young women had indeed been able to form two squares.

Question the world around them

The message in a book by Doris, *Doing What Scientists Do: Children Learn to Investigate Their World* (1991), is that science is a process of inquiry and investigation. Andrea Cramer at the SSA supported this notion by encouraging the students to question their world. "I want the children to begin to question things," was stated as one of her objectives and this attitude was encouraged during the warm up activities. Andrea feels that this helps to set the stage for the day.

On the fourth Saturday, the science educator gave a demonstration called funny water as a warm up activity. She placed three polystyrene cups in front of the students and filled one with water. She then moved the cups around. The students had to choose which cup had water in it. The teacher then made a tossing motion with the cup, but there was no splash.

Mrs. Cramer:	What happened?
students:	It should have been in that cup.
	I saw it in that cup.
	It wasn't that cup, it's the other cup.

The teacher then shook all three cups at the students, one by one. Not one cup splashed.

Mrs. Cramer: What happened?

students: She's got something under them.

The teacher showed the students the bottom of the cups and the top of the table.

students: How did she do that?

Where did it go?

Maybe it went in the air.

Yeah, evaporated!

Several other students agreed that they felt the water had evaporated. The teacher then showed the students the inside of the cups. One had a substance in the bottom.

Mrs. Cramer: What do you think now?

student That's it. The water is in that

Why wouldn't that splash out.

It isn't runny.

Mrs. Cramer: It's a chemical that absorbs water. The water I placed in the cup is absorbed by this absorbent powder. (she holds the cup to a student) What does it feel like?

Raymond: (the student hesitates)

Mrs. Cramer: It's okay. Just squeeze the cup.

Raymond: (the student squeezes the cup). It's hard! (his eyes open wide)

Mrs. Cramer: That's what happens when the powder absorbs the water.

During each of the five observed classes, the students had a brief warm up activity. These warm up activities had a discrepant event which seemed to defy the expectations of the students. The students reacted by asking questions about the activity among themselves during and after the warm up activities.

Science equipment

"Objects and events introduced in science programs become more understandable when they show up as real-life examples in familiar places" (Gega, 1990, p. 112). The students had the opportunity to use everyday items and science equipment in the SSA labs. On the second Saturday, the students used everyday items to build a glider: straw, paper, and tape. This glider activity allowed the students to use these familiar items in a new way. Not only were familiar items used, but unfamiliar items were also part of the experience.

Using science equipment was also part of the SSA curriculum. Looking through microscopes to examine ready-made slides occurred on the last day of the SSA session. First the students were introduced to the parts and workings of the microscope. Then the children chose slides to examine and practiced focusing the image. For most of the students, this was their first encounter with a microscope. Some students remarked at the difference between what can be seen by the naked eye and the image through the microscope:

William: Wow! I can't believe it looks like this!

Brittany: EEEUUUU. It's really ugly!

When asked about previous experiences with science equipment, students responded that they had had very little opportunity to work with science equipment.

Rolita: We don't get to do *real* science

Researcher: What do you mean by 'real' science'?

Rolita: You know. Use stuff like this.

This theme that using microscopes was somehow 'real' science was repeated by several students. They seemed to perceive that 'real' science meant using technical equipment.

<u>Success</u>

According to Powell, "school success can be possible only if an individual feels capable of this success" (Powell, 1989). Establishing an environment where success is obtainable but not guaranteed was part of the routine in this classroom. One example occurred during the glider experiment. When testing the gliders that the students made, Andrea gave the students goals to meet. On the board she had written:

20 feet - Good

30 feet - V. Good

40 feet - Excellent

Andrea drew the attention of the students to the board. She explained, "We're going to test your gliders once you have completed them. If you can obtain twenty feet, that's good. . . . Okay?; if your glider will go thirty feet that's very good, forty feet, excellent . . . Okay?." Natalie commented to her friend, "Twenty feet is a long way."

As the students were creating their gliders, Shana asked, "How big should I make this?" or David inquired, "Should the first loop be bigger than the second?" Jerome, an assistant, encouraged the students to make their own judgments by responding, "What do you think?" Even though the students wanted a direct answer, the assistant would redirect questions back to the students.

A group of about ten students had finished their gliders and were waiting for the opportunity to throw them.

Mrs. Cramer: Which is the front of your glider. What does the flow look like? What is the front of the glider . . .

Raphael: The small end.

Mrs. Cramer: The small is the front, the large is the (she looks at her own back end) back.

student onlookers: laughter

Raphael threw the glider.

student onlookers: Ohhh, good

Mrs. Cramer: OK. Not quite twenty feet. About eighteen feet. Let's try it. You get two tries. Pay attention to how you throw it . . . Where you hold it has something to do with it.

Raphael threw the glider a second time. It flew about 6 feet.

students: laughter

Mrs. Cramer: OK. Didn't make twenty feet. Now go back and try it again and see if you can figure out what's wrong. Maybe you need to make them a little smaller . . . or larger. (she said while pointing to the loops on Raphael's glider).

We'll talk about it when everyone has had an opportunity.

Many of the students did not make it to the twenty foot marker on the first throw. Mrs. Cramer expressed a desire for the students to succeed, but did not want to tell them what to do. Graham (1989) stated that "we gain information about ourselves based on the affective communications of others" (p.61). Mrs. Cramer tried to be encouraging and gave the participants some hints.

Mrs. Cramer: If you are observant, you will notice something about which loops are going the greatest length.

It seemed that Mrs. Cramer was trying to encourage the students as well as focus the children's attention on the size of the loops. You can see later that Harold used this information to think about his own glider.

> Mrs. Cramer: I wonder how yours is different than the persons before you? Yours is going a little less far . . .

A third example:

> Mrs. Cramer: OK, now look at this. Maybe you'll want to watch someone else's and compare. See the difference between your loop, size of the paper, size of the diameter of the loop.

After the first throw had not been successful for Sholana, she returned to the room and altered her glider. She came out to the hall and waited for another turn. I asked her how far she thought it would go. "I don't know. I hope better than before. I made this loop smaller," she said, pointing to the front loop. When Sholana threw her glider this time, it flew 21 feet. It had made it past the first marker! As she went back to the classroom, I asked her what she felt. She replied, "I want to see if I can make it go further."

Another student, Harold, was not able to make his glider reach the 20 foot mark in two turns. After Harold had tried his glider the second time, I asked him some questions:

Researcher: Did you figure out how the [glider] can be designed so that it can go further?

Harold: You have to make them really ssssmall. You have to make them so these are a little smaller (pointing at the back loop).

Researcher: smaller

Harold: um hum

After alterations, most of the students' gliders traveled at least twenty feet. When Harold redesigned his glider, he added an extra ring. His glider flew the furthest in the class at 43 feet.

Most of the students decided to take their gliders home. Rolita and Natalie were discussing this:

Rolita: Let's take them home!

Natalie: unhm

Rolita: Let's see how far we can get it to go.

Natalie: Yeah.

Natalie and Rolita not only were taking the product of a science activity home, but they also had future plans for continuing the activity.

The various approaches Mrs. Cramer used promoted the possibility for success. For written instructions, one student would read the directions out loud. During these times, the class was quiet. After the student finished, Mrs. Cramer briefly summarized the directions, asked for questions, and added any additional hints for the activity. This meant that each student could read his or her copy of the activity and would hear the directions in two different ways. Never the less, being careful that the students had an opportunity to understand the directions for each activity did not mean that the activities were of a cookbook style.

Directions with choices were the norm in Mrs. Cramer's room. She explained, "This allows them to decide." When giving the students instructions on how to build the Chark glider, the teacher was careful not to be too explicit.

> Mrs. Cramer: Notice I didn't give you any specific instructions as to the size of the paper that you're going to use . . . (pause) You also do not have any instructions on how large the loops should be. I want *you* to determine that. It's going to be by trial and error.

This discussion summarizes Mrs. Cramers approaches to learning. She was not giving them detailed instructions, but was allowing the students to make their own decisions. This fits in with the philosophy of the program in that the children should be sccessful and believe in their own abilities in science.

Concepts and ideas were discussed before and after the activity. This discussion led to a comparison of results. At the end of each class, a debriefing period occurred. For example, after the students tried to get a paper clip to float on water, Mrs. Cramer directed the students' attention to the front of the room:

> Mrs. Cramer: Who got the paper clip to float? Anybody? Did anybody get theirs to float? (about half the class held up their hands) Why did it float? Can anybody tell me? Hmm? What made the paper clip float?

She gathered student ideas and reinforced the concept of surface tension.

A third important factor that contributed to successful completion of lab projects was extensive interaction between the lab assistants and the students. In the science class there were at least three lab assistants. These were education students that attended Clark Atlanta University. This made a ratio of six students per leader. This low student:teacher ratio made it possible for the students to ask questions and the leaders to check student progress.

The Social Experience

During the 1970's and 1980's there has been a decrease in African American students enrolled in science courses (Rutherford, 1993). James and Smith (1985) collected and examined data from which one could draw inferences regarding the grade level at which science subject preference and attitudes decline. The results showed that the greatest declines are in the sixth and seventh grades.

Attitudes are related to classroom environment. Several investigators have studied the situation and conclude that there is a connection between the classroom learning environment and cognitive and affective learning outcomes (Haladyna, et al., 1982; Keeves, 1975; Simpson & Troost, 1982; Talton & Simpson, 1985; Tolman & Morton, 1986; Walberg, 1969).

The environment at the Saturday Science Academy includes a majority of African American staff, as well as some staff members from Africa, and a predominantly African American student population attending Clark Atlanta University. This puts the program in a cultural setting that encourages interaction between the role models and the participants. In the Spring of 1993, the SSA participants were all African Americans. The participants interacted with one another, as well as with staff members.

Role Models

Miller and Prewitt (1979) have summarized research on the importance of minority role models:

> Although some research evidence has indicated that minority students may benefit from having teachers who serve as positive minority role models, these results show that there are

relatively few Black . . . eighth grade science teachers" (p. 104).

The SSA program addresses this problem by providing African American role models. The teacher and her four assistants were all African Americans in the session I observed.

According to Vygotsky, in order for an individual to realize his or her potential conceptual development, it is necessary to have the assistance of an adult or capable peer (Wertsch, 1985). The ratio of adults to students at the SSA was very low, 6:1. This provided an opportunity for a significant amount of adult-student interaction. All the adults in this classroom (with the exception of the researcher) were African Americans. One assistant was male, and the other adults were female. The assistants typically roamed the room and checked out students' progress. The interaction following occurred when the students were trying to get a paper clip to float on a pan of water.

Female assistant: How's it going?

Rolita: Uh, OK. . . . We can't get it to float.

Female assistant: Let's see.

Rolita's partner, Nikki, carefully placed the paper clip on the water, but it sank.

Rolita: See?

Female assistant: Did you dry it between tries?

Nikki: Oh, uh,..no.

Female assistant: OK, try that and let me know if you have any more problems.

On a different Saturday, the students were participating in a starch test. An example of adult student interaction occurred when one of female assistants was checking the learning of a student group.

Female assistant: Can you explain to me what happened?

Brittney: Well, we put the iodine in the starch it turned purple and there was like

(Walter began to mock Brittney using hand and facial gestures.)

Brittney: Shut up!

We put the Benedict's solution in here, put it in the water, and boiled it.

Female assistant: OK. What happened when you put it in the water?

Harold: In the water?

Female assistant: In the water when you boiled it.

Harold: It stayed the same.

Female assistant: It stayed the same color?

Walter: It turned orange.

Female assistant: Oh. Well, it looks like you knew what was going on.

Small talk did transpire between the students and the assistants. The students would ask the assistants about their goals.

Raymond: So, what you are you doing here?

Male assistant: I'm in grad school.

or

Brittney: Are you in school here?

Female assistant: Yes.

Brittney: What do you want to do?

Female assistant: I want to teach biology. We're doing this as part of a class.

The conversations between the adults and the students were sometimes playful. One morning Raymond was looking at his handout and asked Mrs. Cramer about the name Chark glider,

Raymond: Why doesn't it have an 's' instead of a 'c'?"

Mrs. Cramer laughed.

Mrs. Cramer: You would ask me that!

Mrs. Cramer and the students laughed.

Mrs. Cramer: Why does it have an 's' instead of a 'c'? . . . Okay . . .Well, it's because it's someone's name, the guy that invented the glider.

The culture in the science classroom also included some gender messages. During the glider activity, Brittany threw her glider. It hit the ground directly in front of her.

Mrs. Cramer: Oh, you're a girl, of course you don't know how to throw an airplane. Here, here, throw it like this.

The teacher moved Brittany's arm in a direction parallel to the floor.

Mrs. Cramer: Girls can be engineers too, now

Two messages were sent. Which one did the students hear? Even though Mrs. Cramer recognized her initial message, it appeared to the researcher that girls don't throw airplanes was stronger. Even in the best of programs, where there is a concerted effort to encourage an individual's ability perceptions of science, sometimes mixed messages are given.

On the third Saturday, Bryon, an assistant for the computer class, led the students to science class. He stood in the doorway as the students filed in. When a male student passed by, Bryon would look directly at the young man and make a comment or gesture such as: "How ya doing?" or "Hey." or look at the young man and nod his head. Bryon did not say anything to or directly look at the female participants. It appeared that the assistant gave special recognition to the male students. This was later confirmed by another staff member. The crisis of the Black Male is documented and remains a concern of the African American Community (Hatchett, 1986, O'Brien, 1988, Richardson, 1992). This assistant was supporting one of the goals of the SSA, which is to reach out to the African American boys (Webb, 1993).

According to Anderson in a study of seventh grade students (1989), two thirds of the students studied reported they seldom or never had any input into the selection of class projects. At the SSA, some of the adult student interaction led to changes in the curriculum. When the students arrived on the second and third Saturdays, they asked about the toothpick puzzler activity.

Rolita: Aren't we going to play with toothpicks?

Mrs. Cramer: You want to play with those?

William: I liked that game!

With that information, Andrea Cramer included another toothpick puzzler as a warm up activity in the fifth week.

Peers

It is widely acknowledged that adolescence is one of the most critical periods of human development. Coleman (1961) found that peers have a strong influence on the values, attitudes, and aspirations of adolescents. Kandel and Lesser (1969) hold that peer and parental influence are strongly related to the educational goals and plans of students. Newcombe (1969) concludes that there are four structural aspects of a peer group--size, homogeneity, isolation, and importance--that relate to students' attitudes. Picou and Carter (1976) also find that peer modeling and peer encouragement have significant effect on educational aspirations of students.

Research by Talton and Simpson (1985) concluded that the "strength of the relationship between peer and individual attitude toward science increases significantly over grades six, seven, and eight and peaks in grade nine at the beginning of the school year" (p. 23). This suggests that it is important for students to interact with peers that have positive attitudes toward science. This occurred at the SSA; the students had chosen to be at the Academy, and, while there, they had an opportunity to operate in groups.

According to Powell (1989), African American student success is related to self-concept and involves identification with others. Working with other African American students their own age was a vital part of the science classroom at the Saturday Science Academy. Most of the activities were performed in groups of two to four students. Group work has shown to enable students to learn more than they would on their own (Doise & Mugny, 1984). For example, the activity called 'What's in the food we eat' tested items for starch and sugar content. The activity that required the students in the group to work together in the testing process because it was not possible for one student to do it alone. Testing of the solution required two people. This coordination was challenging for many of the students.

Shana: Here, you have to hold it this way.

Harold: That's not what it says here.

Shana: But it's the only way it'll work.

There were also times of disagreement within the groups. The following example occurred when the students were testing for starch using test tubes. One of the students noticed that the test tubes had not been cleaned between tests.

Harold: You're going to mess it up!

Walter: Great man!

Harold: We need a clean one.

Brittney: You've got to rinse it.

Harold : Something's been in these. You have to rinse them out or the project will be messed up.

The students did clean the test tubes and the tests for starch were successful.

During the seating process, the students ended up in different seats each Saturday, which helped the students to interact with different peers during activities. The instructor, Andrea Cramer, would not let the students sit in the back of the class. "No, no. You're not sitting back there. Up here, right in front. It's better to be up here anyway."

Not all students worked all of the time. One example occurred during the glider activity. Raymond never started work on his glider. He just sat in his chair at the lab table with a pile of paper in front of him. Across the room a group of boys was socializing. Walter has just hit the tip of David's fingers:

David: Ow!

The group of four boys began to laugh.

David: What do you think you're doing?

Walter: I'm hitting you, that's what I'm doing.

David attempted to smash Walter's fingers on the table, but Walter pulled his hand away.

The boys laughed again.

Walter: You aren't fast enough.

Female assistant: How is that glider doing?

These four young men did finish their gliders with a little coaxing from the assistants. One of the young men, William, ended with a glider that flew 31 feet. Raymond, even though the assistants kept asking him about his progress, did not work on his glider. The assistants accepted Raymond's resistance to the project. It is important to note that Raymond did actively work on other Saturdays.

Summary

Appealing to students' interests and attempting to improve their attitudes toward science is a great challenge. The literature suggests that long-term affective development must begin in the elementary grades if students are to maintain an interest in science throughout their later years (Ascher, 1982; Doris, 1991;

Loucks-Horsley, 1990). The children at the SSA may or may not choose careers in science. However, the program was impressive and the observer can clearly cite the program as an effective enrichment of the students' experience in science.

In this study, the students were observed to participate in hands-on activities, use science equipment in the lab, and have some measure of laboratory success in an environment with role models and peers of the same minority group. The teacher in the SSA science classroom encouraged students to solve problems, to question what they normally take for granted, and to use one another as resources.

Considering the limited hands on science experience of African American students in the past and the usual textbook approach to science teaching, the SSA has broken the mold in order to provide an enriched environment (Mullis & Jenkins,1988). It is impossible for us to say, at this early stage, that such an environment leads African American students toward the sciences. But after a great deal of longitudinal research it will be possible to more closely examine the extent to which appropriate role models and affective development techniques impact on African American students achievement in science.

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Table 1

Activities and Experiments in the Science Class

	warm up activity	experiments	given area**
Week 1	toothpick puzzler	toothpick puzzler #2	measurement
Week 2	how paper flies	chark gliders	aerodynamics
Week 3	penny fun	paper chromotagraphy	life science
Week 4	funny water	surface tension	physics
Week 5	toothpick puzzler	What's in the food we eat I	life science
Week 6		What's in the food we eat II	life science
Week 7	the floating candle	metric system histograms	measurement
Week 8		salt marsh eco system	ecology
Week 9	snow day-no SSA	snow day-no SSA	
Week 10	bobbing raisins	Fun with microscopes	biology

**area designated by the science teacher