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African American Eighth-Grade Female Students' Perceptions and Experiences as Learners of Science Literacy

Sharan Renee' Crim

ACCEPTANCE

This dissertation, AFRICAN AMERICAN EIGHTH-GRADE FEMALE STUDENTS' PERCEPTIONS AND EXPERIENCES AS LEARNERS OF SCIENCE LITERACY, by SHARAN RENEE' CRIM, was prepared under the direction of the candidate's Dissertation Advisory Committee. It is accepted by the committee members in partial fulfillment of the requirements for the degree Doctor of Philosophy in the College of Education, Georgia State University.

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ABSTRACT

AFRICAN AMERICAN EIGHTH GRADE FEMALE STUDENTS' PERCEPTIONS AND EXPERIENCES AS LEARNERS OF SCIENCE LITERACY

by

Sharan R. Crim

The National Assessment of Educational Progress (2000) reports an achievement gap between male and female students and majority and minority students in science literacy. Rutherford and Ahlgren (2000) describe a scientifically literate person as one who is aware that science, mathematics, and technology are interdependent human enterprises with strengths and limitations; understands key concepts and principles of science; is familiar with the natural world and recognizes both its diversity and unity; and uses scientific knowledge and scientific ways of thinking for individual and social purposes. The purpose of this qualitative case study research was to investigate African American eighth grade female students' perceptions and experiences as learners of science literacy. A social learning theory (Bandura, 1986) and constructivist theory (Vygotsky, 1977) served as a guide for the researcher. Two questions were explored:

1. What are African American eighth grade female students' perceptions and experiences as learners of science literacy?
2. In what ways do the perceptions and experiences of African American eighth grade female students influence their learning of science literacy?

Purposeful sampling (Merriam, 1998) was used with four African American eighth grade female students selected as participants for the study. Data collection and

analysis occurred between Feburary and August in a single year. Data sources included an open-ended questionnaire, two in-depth interviews with each participant (Seidman, 1991); classroom observations, participant reflective journals, student artifacts, and a researcher's log. Data were analyzed through the constant comparative method (Glaser & Strauss, 1967), and richly descriptive participant portraits and qualitative case studies (Merriam, 1998) were used to report the findings. Three themes emerged from the study that positively affected the perceptions and experiences of African American eighth grade female students as learners of science literacy: 1) the influence of family members, especially mothers and grandmothers, 2) the personal connections made to science concepts and real life, 3) the creative student-researched and designed projects, labs, and experiments.Trustworthiness and rigor were established through adherence to guidelines for establishing credibility, confirmability, dependability, and transferability (Lincoln & Guba, 1985).

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CHAPTER 1

INTRODUCTION

Students often judge their academic ability and worth as individuals by the evaluations they receive from their teachers (National Research Council [NRC], 2000). Teacher biases and attitudes affect student learning, interactions among peers, and self-perceptions (NRC, 2000). These effects are among the factors that contribute to the alarming achievement gaps that exist between boys and girls and between white and non-white students in the areas of math and science (NRC, 2000). According to the National Assessment of Educational Progress (2000),

> Males showed higher composite average scale scores in science than females at grades 4 and 8. The average scale score for males in fourth grade was 153.3, while females scored 147. The average scale score for eighth-grade boys was 154 while females scored 147. (p. 15)

All students are entitled to an opportunity to attain equity in science by being provided with equal opportunities, resources, and outcomes.

Of the myriad performance standards required in the science classroom, the primary premise for inquiry-based science is to promote students' motivation for science, not just in the classroom, but also as an area of interest and enjoyment outside academic settings. When students enjoy learning about science in their science classes, they will most likely engage in the tasks at hand and try to persevere in behaviors that should promote their learning and understanding.

Most science teachers advocate that all students should have fair and equal opportunities to attain high levels of scientific literacy (Barton, 2000). Most often, the challenge for science teachers is finding a way to help all students feel connected to science. By connecting curricula to issues that interest students or affect them directly, students can see that science relates to their lives and will be relevant to them outside the classroom and after the class has finished.

Incorporating investigations, technology, and collaborative group activities is believed to foster interest and motivation in addition to supporting and enhancing learning.

> The primary goal of a pluralistic curriculum process is to present a truthful and meaningful rendition of the whole human experience. This is not a matter of ethnic quotas in the curriculum for "balance"; it is purely and simply a question of validity. Ultimately, if the curriculum is centered in truth, it will be pluralistic, for the simple fact is that human culture is the product of the struggles of all humanity, not the possession of a single racial or ethnic group (Hilliard, 1989, p. 21).

Science literacy has become the cornerstone by which science education has restructured and strengthened its foundation in the educational community. According to the American Association for the Advancement of Science (AAAS), science literacy includes understanding key concepts, principles and ways of thinking drawn from the natural and social sciences, mathematics and technology. Science literacy also implies being familiar with some of the ways in which the science endeavor connects to other human endeavors such as literature, history, the arts, work and governance (AAAS, 1997).

To be effective in our society, science literacy should be useful in everyday ways that would enhance one's employment prospects and ability to make personal decisions.

Science literacy should help citizens participate intelligently in making social and political decisions on matters involving science and technology (AAAS, 1997). "Knowledge of science should, like great literature, contribute to the ability and inclination of people to ponder, on occasion, the enduring questions of human meaning our origin, place in the universe and significance" (Hirsch, 1988, p.35). To be scientifically literate is to possess, at least to a degree, some of the values, attitudes and skills characteristic of science. The National Center for Educational Statistics (1993), states that, science literacy consists of a respect for the use of evidence and logical reasoning in making arguments; computational skills, including the ability to make certain mental calculations rapidly and accurately; communication skills, including the ability to express basic ideas; and critical-response skills that enable people to judge carefully public assertions, especially those that invoke the mantle of science.

Self-perceptions are an essential component of a student's academic achievement and success. Self-perceptions also play an important role in science and math achievement, especially for girls. Research shows that self-esteem and academic achievement among girls begin to decline during middle school (Backes, 1994). Girls often exhibit a loss of self-confidence by age 12 (Orenstein, 1994). As a result, many girls underachieve in science and math simply because they choose to participate in activities in which success is almost assured. Attitudes also contribute to the underachievement of girls in science and math. "Although middle school girls take more high-ability courses than boys and make comparable or higher grades, their attitudes toward science and math are less positive, and they are less likely to participate in related extracurricular activities" (Heller & Martin, 1992, p. 47).

Unfortunately, since research shows that social attitudes tend to become fixed during middle school and early in high school, girls who develop negative attitudes toward science and math during this period of development are unlikely to acquire the academic background necessary for careers in science, math, or engineering. In essence, girls' and boys' abilities are the same; their self-perceptions and attitudes are different.

Interestingly, self-efficacy researchers have focused nearly exclusively on the academic areas of language arts and mathematics, and they have paid scant attention to the critical area of science, particularly at academic levels at which these sorts of self-beliefs begin to take root. This may be due to the priority placed on language arts and mathematics achievement and to the more clear-cut, criteria-based measures available in mathematics. However, this is an unfortunate omission. Science courses hold a prominent place in the academic curriculum, and academic success in these courses is especially imperative in this age of rapid scientific and technological progress. Moreover, it is at the middle school level that academic self-beliefs become more pronounced and gender differences begin to appear.

Purpose of the Study

The purpose of the present study was to investigate African American eighth-grade female students' perceptions and experiences as learners of science literacy. Framed by the constructivist theory and social learning theory, this investigation was guided and conceptualized within the framework of the literature on Ancient African females in science, African American female middle school students, science achievement, science literacy, self-concepts, student perceptions, gender differences, and student motivation in literacy. This investigation considered how students' perceptions and experiences as learners affected their learning of science literacy. Through a case study approach, data collection from participant interviews, participant questionnaires, researcher observation and field notes were employed. This study presented a view of African American female eighth-grade students and served as an instrument to amplify their voices and add invaluable vision into African American female eighth-grade students' perceptions and experiences as learners of science literacy.

Rationale of the Study

The information gathered through this inquiry provides a wealth of information that adds to the knowledge and literature in the field of science education. This investigation accentuates the budding research that whispers the voices of eighth-grade African American female students' perceptions and experiences as learners of science literacy. This information is extremely worthwhile and is a crucial development in understanding the delicate balances of the classroom environment including the teacher and student relationship; the student and student relationship; and the student and content relationship.

This study was limited to eighth-grade African American female students because research reported the achievement gap existing between minority and majority students and gender. Since I am an African American female science educator, and mother of two African American daughters and one son, this issue has a great deal of importance to me. On a daily basis in my classroom, I see science achievement by female students ranging the spectral extremes from high to low, but the majority of females exhibit greater achievement than their male counterparts do. Although there has been research conducted on students' self concept and motivation in science achievement and science literacy in urban elementary science classrooms (Osborne & Calabrese-Barton, 2001), there is little about African American female eighth-grade students' perceptions and experiences as learners of science literacy. This research study investigated eighth-grade African American female students' perceptions and experiences as learners of science literacy in an urban public middle school classroom located in an upper middle socioeconomic community that services a lower to upper socioeconomic African American population.

Theoretical Framework

The theoretical framework is an integral aspect of an investigation, especially in qualitative research. Each type of qualitative research has its own theoretical perspective, its own approach to the gathering of data, the types of data that constitute viable areas investigation, and the appropriate types of analyses for these data. Social Constructivist Theory and Social Learning Theory were used as frameworks and lenses that guided this inquiry. The research conducted in this study recorded the perceptions and experiences of African American eight grade females as learners of science literacy. The concept of when learning occurs was crucial when the study was conducted. In the broadest sense, "learning occurs when experience causes a relatively permanent change in an individual's knowledge and/or behavior" (Maurer, 2000b, p.52). Over the years, many theories have been developed in an attempt to understand and explain human learning, including behaviorism, information processing, constructivism and generative learning. "When the theories and the strategies derived from them are combined, they have greater potential for improving students learning" (McInerney & McInerney, 1998, p. 65).

Albert Bandura's Social Learning Theory (1986) seeks to expand the traditional learning theory by stating that learning is a three-way process where environmental events, personal factors, such as thinking and motivation, and behavior interact, each influencing the others in the process of learning (Maurer, 2000b). One of the central principles of the Social Learning Theory is observational learning.

According to Bandura (1986), human learning occurs in a social setting and is a function of observing the behavior, attitudes and emotional reactions of others. Other researchers support Bandura's beliefs of human learning, "Observational learning is governed by four elements: attention, retention, reproduction and motivation" (Cobb, 1998, p 5). Attention and motivation are affected by one's self-efficacy including the beliefs about one's own abilities in certain situations (Berk, 1997 & Woolfolk, 1995). Self-efficacy expectations can include views of task difficulty, verbal persuasion, vicarious experiences, and beliefs about the perceptions of others, past performance, attribution and abilities (Maurer, 2000b).

The constructivist view of learning emphasizes that learners are active and create or construct their own knowledge through acting on and interacting with the world. Jean Piaget (1984) influenced this view of learning by focusing attention on mental processes and their role in behavior. According to Piaget, cognitive development is dependent upon maturation and the individual's exploration of the world. "Real learning occurs when old information is restructured or replaced by new information or experiences" (Piaget, 1984). Learning occurs almost independently of other individuals, social practices and the cultural environment. Lev Vygotsky, a Russian psychologist and contemporary of Piaget has, challenged this view by proposing a theory that viewed learning as occurring through the individual's interaction with the socio-cultural environment and it is this theory that is generally the focus of current thinking. Vygotsky's theory has been called the Social Constructivist Theory because it considers the social context in which learning occurs and emphasizes the importance of social interaction in cognitive development. "Vygotsky believed that all higher cognitive functions have their origins in the social interaction with more competent partners, that is, people learn from and with other people" (Woolfolk, 1995, p. 67).

Guiding Research Questions

Two research questions guided this study:

1. What are African American eighth-grade female students' perceptions and experiences as learners of science literacy?
2. In what ways do the perceptions and experiences of African American eighth-grade female students influence their learning of science literacy?

Methodological Overview

This study addressed the guiding research questions through use of a naturalistic qualitative design. Individual case studies were used by applying a variety of data sources. These included interviews, observations, field notes, and participants' journal entries and work samples. I used purposeful sampling (Merriam, 1998) and researched four African American eighth-grade female students who were selected as participants for this study. Data collection and analysis occurred from February to August in a single year. Data sources included an open-ended questionnaire, two in-depth interviews with each participant (Seidman, 1991); classroom observations, participant reflective journals, student artifacts, and a researcher's log.

Data were analyzed through the constant comparative method (Glaser & Strauss, 1967), and richly descriptive participant portraits and qualitative case studies (Merriam,

1998) revealed the findings. Trustworthiness and rigor were established through adherence to guidelines for establishing credibility, confirmability, dependability, and transferability (Lincoln & Guba, 1985).

Human as Instrument

The human construction of knowledge is under constant scrutiny. To gauge the generation of knowledge in those other than ourselves includes the consideration of unfamiliar and differing world-views. "Knowledge of the other is generated by research that takes a category of person, such as student, and seeks to describe, analyze and interpret the world-view of a sample of people who represent that category" (McCleod, 2001, p. 34). This form of knowledge is highly useful. All individuals are socialized into stereotyped views of many groups and may have little access to the groups to explore feelings and perceptions of these groups, and occasionally, alternate epistemological universes. Additionally, there may be barriers of class, gender, ethnicity, race, sexuality, and power that inhibit gaining a rich understanding of the world of others. Qualitative research; therefore, gives these groups of individuals a "voice," and thus potentially empowers them.

Qualitative research involves systematic inquiry that is designed to collect, analyze, and interpret data. The researcher is the instrument in qualitative inquiry. Qualitative research, according to Lincoln and Guba (1985), is characterized by the fact that the researcher constructs the reality that he or she sees. Along with this idea is the notion that each person involved in the inquiry, as either participant or subject, constructs his or her reality as well (pp. 70-91). Lincoln and Guba also argue that the epistemological foundations of qualitative research are based on values and value judgments, not facts.

In a common view held in the field of qualitative research, qualitative researchers claim that the researcher's values guide and shape the research conclusions because the researcher is busy constructing the reality of the inquiry. At the same time, the researcher has to be sensitive to the realities created by others involved and the consequent changes and differences in values. All findings in a qualitative study, and; therefore, all "truth" claims, are socially negotiated.

In conducting this study, I was engaged as a research instrument. I had to identify my biases and my perceptions about African American eighth-grade female students' perceptions and experiences as learners of science literacy. I had to establish my belief system that my science colleagues were expert educators, and each female student was receptive to the instruction. The participants were not my students, but the students of my colleagues. My colleagues were graciously allowing me a view into their classroom and their teaching practices. In my career as an educator, I have been an advocate of the African American students, the education of African American students, and science literacy.

This study is important to me because of my concern of the academic achievement of African American students where science achievement is documented as falling below the proficient level and where female science achievement falls behind their male counterparts. The perceptions of student achievements are well documented from the teacher perspectives, but the students' perceptions of themselves as learners of science are not as well documented in their own voices. In order for students to take greater responsibility for their own learning, they need to hear their voices resonate through their lessons and through their achievements. As an educator of African American students, I am interested if eighth-grade African American female students' perceptions and experiences as learners of science literacy influence their learning of science literacy.

Students' lives and experiences have become more integral to classroom practice since the constructivist paradigm in science education started to gain supporters in the 1980's. During the last fifteen years constructivism in general and radical constructivism in particular have been advocated as an epistemological and pedagogical framework useful for thinking through and using the experiences of students as means for instruction in science. "Advocates of this framework take the position that knowledge is constructed and legitimated whenever it makes sense to an individual in a particular experiential context" (Eisenhart, Finkel & Marion, 1996, p. 112). Here, the emphasis in learning is not on the correspondence with an external authority but on the construction by the learner of schemes, which are coherent and useful to him or her.

The purpose of this study was to explore the perceptions and experiences of eighth-grade African American female students as learners and to investigate if these perceptions and experiences influenced their learning of science literacy. Science education, based on conceptual change theory reports Stepans (1995), requires assessments of what knowledge students bring to instruction. However, there is little research that supports the perceptions and experiences African American children bring into the science classroom that may influence their learning of science literacy.

Science education can no longer ignore the experiences brought to the science classroom by others. This investigation was able to determine what scientific knowledge and skills do African American eighth-grade female students use in their daily lives, and how this knowledge is associated with what the students have already been exposed to in previous school experiences. This investigation possibly provided a window lighting how the cultural assumptions, frames of reference, perspectives, and biases within a discipline influence the ways in which others culturally construct knowledge. The goal of this study was to observe and record the sense-making African American female eighth-grade students bring into a science learning situation and how this knowledge informs science literacy.

Assumptions

My assumptions as I developed and implemented this study involved my relationship with the participants and their involvement in this study's progress. I assumed that the participants were chosen through purposeful sampling would be cooperative, open, and honest in their forthrightness and their willingness to provide information necessary to gain knowledge about various aspects of their personal and classroom identities. I assumed as an African American female educator relating to African American female eighth-grade students, there would be a comfortable and welcoming interaction between us. These assumptions included the ideas that the participants' belief structures would inform their perceptions, knowledge, and learning practices.

My own lens and biases were also instrumental in this investigation. I would use the conceptual framework of social constructivist theory as it related to African American female eighth-grade students prior knowledge and the constructs the students created in their learning and achievement in science. Making meaning involved situating encounters with the world in the appropriate cultural contexts. Culture assigned meanings to things in different settings on particular occasions. “Although meanings are in the mind, the meanings have their origins and their significance in the culture in which they are created” (Bruner, 1996, p. 28).

The notion of culture, as related to science, concerns language, attitudes, beliefs, and values that predicate how people act, judge, and solve problems, but social and cultural factors influence science (Lederman & Abd-el-Khalick, 1998). Children have constructed views about topics of science from a young age and prior to formal learning of science. As an African American educator of African American students; a science educator; an advocate for the academic excellence of African American students, constructivist learning, and a mother of three African American children, I examined these constructed views in my classroom and in my home. My attempt in this study was to acknowledge my assumptions and biases, and that I entered this investigation the sum of my beliefs, perceptions, experiences, life history, and desires, as did the participants.

Limitations

The limitations in this study were breaking through the guardedness of 12 to 13 year old African American females to get to their true thoughts in response to my interviews and questionnaires. The participants were not my students, so I attempted to establish a rapport to collect truthful data. Much of the data that were collected and used for this study involved student interviews and student questionnaires. The researcher’s observations and reflections provided information for triangulation. The participants in this study were volunteer African American females and the researcher was an African American female. Although this study provided a glimpse into the instructional practice of another teacher's classroom, the intent was to give a voice to the African American eighth-grade female students who had been quieted through the maelstrom of reform, curriculum revisions, and standardized testing.

Definitions of Terms

Science Literacy

The National Science Education Standards (1996) offered the following definition for scientific literacy to be used by both researchers and practitioners: "Scientific literacy is the knowledge and understanding of scientific concepts and processes required for personal decision making, participation in civic and cultural affairs, and economic productivity" (NSES, p. 67). This means that a scientifically literate person can ask for, find, or determine answers to questions derived from curiosity about everyday experiences. A scientifically literate person is able to:

1. Describe, explain, and predict natural phenomena.
2. Read with understanding articles about science in the popular press.
3. Engage in social conversation about the validity of the conclusions of these articles.
4. Identify scientific issues underlying national and local decisions.
5. Express positions on current issues that are scientifically and technologically informed.
6. Evaluate the quality of scientific information on the basis of its source and the methods used to generate it.
7. Pose and evaluate arguments based on evidence and apply conclusions from such arguments appropriately. (1996, p. 68)

In addition, the goals of science should include developing the ability to inquire and gain new knowledge through inquiry. The National Science Education Standards (NSES) identified seven abilities students need in order to inquire:

1. Identify questions and concepts that guide scientific investigations.

2. Design and conduct scientific investigations.
3. Use technology and mathematics to improve investigations and communications.
4. Formulate and analyze alternative explanations and models.
5. Recognize and analyze alternative explanations and models.
6. Communicate and defend a scientific argument.
7. Develop understandings about scientific inquiry. (NSES, 1996, p. 70)

The American Association for the Advancement of Science (AAAS) advocates that, “The goal of science instruction is the achievement of scientific literacy” (AAAS, 1997, p.78). In science the instruction is often designed to develop the skills of inquiry or understanding the inquiry process. Literacy instruction has many goals but a major goal is enhancing the student’s comprehension of the content he or she is reading, writing, listening to, speaking, or viewing. The challenge of classrooms today is to bring the supportive skills from literacy and inquiry science together in a truly integrated way to support the goal of learning science content. These classrooms would use an integrated approach that effectively combines learning from text, discussions, and encounters with real world laboratory investigations, field trips, and classroom projects.

Language of Science

“Science education reform efforts around the world are focusing on teaching and assessing science learning with emphasis on inquiry where the learners construct their own knowledge” (NCERT, 2000, p.45). This concept of knowledge construction, often called constructivism, has revolutionized teaching and learning of mathematics and science. Glasersfeld (1992) emphasizes that the foundation of any learning process is language and the meaning different people assign to objects, events, and experiences. Mental abstractions of sensory materials construct concepts.

Bloom (2001) further explains how this process of inquiry and knowledge construction is language dependent “Discourses that happen in a science classroom are distinctly apart from day-to-day life discourses and may even be categorized as a discourse in a "new" language – the language of science" (Lemke, 1990). "Language of science is like an "Auntie-Tongue" – the language of the elite" (Dasgupta, 1993, p.82). "These discourses influence the inscriptions (written descriptions) of both the learner (student) and the learned (teacher)" (Arora, 1997, p.75). Ultimately, these discourses and inscriptions establish the assessment and evaluation practices and their results. By recording and analyzing the above described experiences, educators and researchers are able to shed more light on the complex process of learning and teaching and hopefully be able to help ourselves and others in becoming better learners and teachers of science.

Self-Efficacy

Social learning theorists define self-efficacy as a sense of confidence regarding the performance of specific tasks. Bandura (1986, p. 391) defines "self-efficacy" as people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. Self-efficacy is not concerned with a person's skills but with the judgments the person employs when exhibiting the skills he or she possesses.

Self-efficacy influences aspects of behavior that are important to learning. "Some behavioral learning aspects are the choice of activities that a student makes, the effort put forth and persistence in accomplishing a task" (Bandura, 1977, p.322). Bandura theorizes that individuals develop general anticipation regarding cause and effect based upon experience, and that individuals develop particular beliefs about their ability to cope with situation-specific constructs. If such theories were applied to the study of children's beliefs about learning, it would be logical to predict that children with high academic self-efficacy would be likely to demonstrate greater success.

Bandura, in his social cognitive theory (1986), argues that self-referent thought mediates knowledge and action and is consistent with others who argue that an individual's beliefs are a "filter through which new phenomena are interpreted and subsequent behavior mediated" (Pajares, 1996, p. 544). Therefore, self-efficacy beliefs can determine if learning environments are perceived positively or negatively.

Middle school students have to manage changes in biological, educational, and social roles. Lorsbach and Jinks (1998) record Bandura stating that, adolescents must manage not only pervasive pubertal changes, but difficult educational transitions as well. The transition to middle level schools involves major environmental change that taxes personal efficacy. Adolescents move from a personalized school environment of familiar peers to an impersonal, departmentalized one with curricular tracking into college preparatory, general, or vocational paths.

Under these new social structural arrangements, they have to reestablish their sense of efficacy, social connectedness, and status within an enlarged heterogeneous network of new peers and multiple teachers in rotating class sessions. "During the middle school adaptational period, young adolescents sense some loss of personal control, become less confident in themselves, are more sensitive to social evaluation, and suffer some decline in self-motivation" (Eccles & Midgely, 1989, p.234).

Students' Perceptions

Students' perceptions of their educational experiences generally influence their motivation more than the actual, objective reality of those experiences. A history of success in a given subject area is generally assumed to lead a student to continue persisting in that area. However, researchers point out that, students' beliefs about the reasons for their success will determine continued success (Weiner, 1985). Students' attributions for failure are also important influences on motivation.

When students have a history of failure in school, it is particularly difficult for them to sustain the motivation to keep trying. Students who believe that their poor performance is caused by factors out of their control are unlikely to see any reason to hope for an improvement. “If students attribute their poor performance to a lack of important skills or to poor study habits, they are more likely to persist in the future” (Weiner, 1985, p.187).

Bandura (1986) has long argued that competence beliefs best predict achievement outcomes when the beliefs assessed carefully correspond to the outcomes with which they are compared. Findings regarding the strong competence beliefs of African American students have resulted primarily from studies in which the beliefs assessed or self-concept of ability did not carefully match the achievement outcomes. When the beliefs assessed closely correspond to the outcomes in a study, results can differ.

Pajares and Kranzler (1995) found that the mathematics self-efficacy of African American students was lower than that of their White peers, and Pajares and Johnson (1996) found that the writing self-efficacy of Hispanic high school students was lower than that of non-Hispanic, White students. In each case, minority students reported positive mathematics self-concepts. Pajares (1997) has suggested that the assessment of beliefs at differing levels of specificity might help explain the relationship between perceptions of competence and academic achievement, how these perceptions are related to other motivation constructs, and whether the origins of these beliefs differ for minority children and across socioeconomic levels. Graham (1994) acknowledged that self-efficacy is an important component of academic motivation but noted that it has been too sparsely examined in studies of minority students.

Significance of Study

Investigations of the perceptions and experiences that eighth-grade African American female students have about their learning and if this influences their learning of science literacy is negligibly represented in the vast research on students and their science literacy acumen. The continuing widening of the achievement gap in science literacy demonstrates the need for further study in this area. The absence in the literature of the voices of the African American students and their perceptions and experiences of their learning of science literacy resonate the need to garner clearer understanding about this. This study may employ the voices of the African American eighth-grade female students to echo poignantly the importance and the dire necessity of incorporating the student's perceptions in the academic arena to enhance science literacy.

CHAPTER 2

REVIEW OF THE LITERATURE

The purpose of my study was to investigate African American eighth-grade female students' perceptions and experiences as learners of science. My investigation was guided by two research questions:

1. What are African American eighth-grade female students' perceptions and experiences as learners of science literacy?
2. In what ways do the perceptions and experiences of African American eighth-grade female students influence their learning of science literacy.

To prepare myself for the investigation I conducted, I reviewed the literature focusing on three specific areas.

The first area of investigation was student perceptions of themselves as learners. Specifically, I looked for published studies that related students' perceptions of themselves as learners with their success or failure in school. In the first part of this chapter, I present an overall discussion of students' perceptions of themselves as learners and then two more focused discussions of research describing (a) students' perceptions of themselves as learners of science and (b) African American students' perceptions of themselves as learners. I focused in these particular areas because my participants would be African American students in science classes.

The second area of investigation was student achievement and science literacy. Both of these can be seen as measures of success (or failure) of students, and I expected there would be a relationship between student achievement in science and science literacy. Additionally, I intended to assess my participants' science literacy through my interviews with them.

The third and final area of investigation involved a review of Social Cognitive Theory (Bandura, 1986, 1989), with a focus on the influences of self-efficacy on learning. As I discussed in Chapter 1, Social Cognitive Theory is a salient element of my theoretical framework with regard to the study of learning. Prior to interviewing the participants in my study, I expected that they would have a high sense of self-efficacy because they were successful in their science classes.

Students' Perceptions of Themselves as Learners

Perception is influenced by one's mental state, experience, knowledge, motivations, and many other factors (Slavin, 1988). Research on students' thought processes promises to enhance understanding of teaching and its outcomes by providing information about the perception of students as learners (Whitrock, 1986). Children's perceptions of the causes of their academic successes or failures develop from a relatively undifferentiated state to more analytic conception of the relations among ability, effort, and achievement.

For example, Whitrock (1986) states that at age six, children do not separate ability, effort, and achievement, but at about seven to eight years of age, children distinguish these three concepts from one another and causally relate effort, but not ability, to achievement. Whitrock (1986) continues that at about ages nine to 11, ability also becomes a cause of achievement, but these children still believe that people who work hard are also intelligent or able individuals. Beginning about 11 years of age, children realize that effort and ability are relatively independent of each other and are causally related to achievement (Whitrock, 1986). Students' perceptions about their own abilities to perform a task are believed to affect their learning (Debacker & Nelson, 2000). Eccles and Wigfield (1997) indicate that students' self-perceptions of their academic ability decline as students make the transition from elementary to junior high school.

Students' attitudes toward school learning and achievement become increasingly negative as they progress through the school system (Boggiano & Pittman, 1992). As students progress through the grades, the school environment becomes more impersonal, more formal, more evaluative, and more competitive. The educational process shifts from the process of learning to an evaluation of products or outcomes (Brookover, Beady, Flood, Schweitter, & Weisenbaker, 1979).

Students' Perceptions of Themselves as Learners of Science

Students' perceptions of their experience of school science have rarely been investigated (Osborne & Collins, 2001). Of the studies that have been conducted, many have used questionnaires to collect student information. A student's self concept of his or her ability to perform in science is positively correlated with achievement (Oliver & Simpson, 1988). Osborne and Collins (2001) report that because attitude is an unstable construct that should be evaluated in the context of the object of inquiry, relatively few studies of pupils' attitudes to science have adopted a qualitative approach seeking to explore in some depth pupils' view and their rationale. Osborne and Collins (2001) also believe that adopting a qualitative, interview-based approach to explore in some depth the students' view of their experience of school science offers fresh insights into its nature and quality. These findings are important because they reveal what experiences engage and interest students, and they also offer an explanation of the root causes of successes and failures.

If educators are going to engage students in learning science, educators must attach as much importance to student beliefs and how different teaching practices affect those beliefs as they do to the content.

> Educators must recognize that when materials are presented in formal, abstract ways, using unnecessary technical jargon, and when the assigned homework and exam problems are correspondingly abstract and can be completed by following memorized recipes, we are teaching more than just content. (Wieman, 2005, p. 101)

To a student who does not share a teacher's experience and expert insight, their perceptions are reinforced that science is a subject that is abstract and disconnected from the real world, that problem solving is basically rote memorization, and that there is no use for solving a science problem other than to pass a course.

Consideration of students' perceptions and experiences can help teachers create literacy learning environments that are more student-focused and engaging to the learner. Certainly, a better understanding of the type, extent, and direction of teacher-student perception discrepancies can provide content teachers with valuable insights into their students' views of the literacy learning process and sensitize teachers to their needs. Without assigning blame to either side of the teacher-student perception dichotomy, we must accept that discrepancies exist (Wieman, 2005).

In a recent study using the Colorado Learning Attitudes about Science Survey, Wieman (2005) found that students who believed strongly in personal responsibility for learning, learning for understanding, and the tentativeness of scientific knowledge were more likely to be better learners of science. Students with high levels of belief, such as those taking responsibility for their own learning and those with a preference for learning for understanding, have a view that scientific knowledge changes over time in the light of new evidence. At the other extreme students with low levels of belief were characterized as expecting others to take responsibility for their learning, preferring to memorize facts when learning and regarding scientific ideas as fixed and unchanging (Wieman, 2005).

African American Students' Perceptions and Learning

In a narrative review of published studies of African American students and their achievement motivation, Graham (1994) found little support for the general hypothesis that African American students should have lower expectancies for success or lower self-concepts of ability because of their poor school achievement or general economic disadvantage. In terms of expectancy for success, Graham reviewed 14 experimental studies that used a common format of presenting a task to African American and White children and then asking them to predict their likelihood of success. In addition, some of the studies involved asking the students to make judgments of their expectancy for success after being told they had succeeded or failed on the exercise irrespective of their actual performance. In 12 out of the 14 studies, African American students had higher expectations for success than White children. Graham also reviewed 18 studies that examined self-concepts of ability. Again, she found very little evidence for the idea that African American students have lower self-concepts of ability. Only two of the 18 studies reported group differences in favor of White children, seven favored African American children, and the remaining nine had mixed or no significant differences between the two groups. Graham interpreted these "counterintuitive" findings for the deficit hypothesis for

African Americans in terms of the adaptive nature of maintaining optimistic expectancies and self-concept beliefs in the face of relative social and economic disadvantage.

Some researchers found that self-perceptions of ability or efficacy are linked to academic achievement in the same fashion as moderate positive correlations for minorities and other groups. However, Graham (1994) noted that in many of the studies she reviewed, the actual performance measures, such as grades or standardized achievement tests, showed that African Americans had lower levels of performance yet they had higher self-perceptions of ability. This would suggest that the relation between self-perceptions of ability and actual achievement is not as strong in African American students as it is in White students. There have been many reasons proposed to explain this weaker relation.

For example, some researchers such as Fordham and Ogbu (1986) and Steele (1988, 1992) have suggested that the motivational dynamics are different for Black children, who may devalue academic achievement, a task-value belief, because of their repeated school failures. In this case, they may have relatively high self-perceptions of competence or relatively low perceptions, but perceptions of competence are not linked as closely to actual achievement as they are in White children. Other reasons include the use of different social comparison groups. For example, African Americans compare themselves to other African Americans rather than the more advantaged White group, thereby maintaining high self-perceptions (Rosenberg & Simmons, 1971). They may also attribute their lower performance to external factors such as prejudice, thereby maintaining high self-perceptions (Crocker & Major, 1989).

Student Achievement and Science Literacy

Gender and Science Achievement

In most research studies when a gender difference is found, the difference is that female participants have lower self-perceptions of ability than male participants (Wigfield, Eccles, & Pintrich, 1996). This is particularly surprising because many studies that have involved actual achievement or performance (e.g., Linn & Hyde, 1989) show that there are few gender differences and that in many cases, female students actually outperform male students. Although this discrepancy between actual achievement and self-perceptions of ability may be due to a response bias, with boys being more self-congratulatory and girls being more modest (Eccles, Adler, & Meece, 1984; Wigfield et al.), the difference appears often enough to be taken seriously.

Eccles and Wigfield (1997) and their colleagues have consistently found gender differences in self-perceptions of ability. Boys have higher self-perceptions in math and sports, whereas girls have higher self-perceptions of their ability in English (Eccles, 1983; Eccles et al., 1989; Wigfield et al., 1996). Marsh (1989) also reports gender differences in his data on self-concept. Although he finds that the gender differences only account for 1% of the variance in self-concept, he finds that boys have higher self-concept scores for their self-ratings of physical appearance, physical ability, and math, whereas girls have higher self-ratings for verbal and reading tasks and general school self-concept (Wigfield et al., 1996).

Phillips and Zimmerman (1990) also found that girls had lower perceptions of their competence than boys had of theirs, although the gender difference did not emerge with third and fifth graders, only with ninth graders. However, other researchers have found that gender differences in ability perceptions do emerge at earlier grades. For example, Entwisle and Baker (1983) and Frey and Ruble (1987) found that even in early elementary age children, girls were more likely to have lower self-perceptions of ability than boys. Clearly, there is a need for more research into the nature of these differences as well as more programs to change school and classroom practices that may give rise to these gender differences.

Science Literacy and Science Achievement

U.S. students in grades K-12 perform below average in both science and mathematics compared with students in other developed nations by the time they reach high school (Third International Mathematics and Science Study, 1996). Contemporary high school graduates know less science than did their counterparts 30 years ago (The Nation's Report Card: Science, 2000). The levels of achievement among members of some ethnic minorities are even more disturbing. For example, only 3% of African-American students achieve at or above proficiency compared with an already unacceptably low 23% of White students.

Many teachers are uncomfortable teaching science because of the inadequacy of their own science literacy. The result is a populace that is poorly prepared to understand and participate in an increasingly science- and technology-based society. This hurts the United States because its prosperity, security, and health depend on the educational achievements of the general population, not just those in science and engineering. "Science continues to fall out of favor with the public, and this creates a potential disaster for our science-based needs and enterprises" (Westerlund & West, 1996, p. 89).

The major purpose of standardized testing in science today is to determine the level of scientific literacy in the United States (NAEP, 1996; NRC, 1996). The 21st century has arrived, yet many U.S. citizens lack even the most rudimentary knowledge about scientific concepts that were established in the nineteenth century (NSF, 1996). Carl Sagan (1995) very aptly described why scientific literacy, "a candle in the dark," is essential in modern society.

> For much of our human history, we were so fearful of the outside world, with its unpredictable dangers, that we gladly embraced anything that promised to soften or explain away the terror. Science is an attempt, largely successful, to understand the world, to get a grip on things, to get hold of ourselves, to steer a safe course. Microbiology and meteorology now explain what only a few centuries ago was considered sufficient cause to burn women, accused as witches, to death. (Sagan, 1995, p. 26)

To assess scientific literacy in the United States, international and national science assessments have been conducted. These assessments have consistently ranked the United States low in comparison to those of other developed countries (Medrich & Griffith, 1992). For example, the Third International Mathematics and Science Study (TIMMS) ranked the performance of U.S. eighth-grade students 17th out of the 41 countries studied in science (TIMMS, 1996). The TIMMS was repeated four years later as The Third International Mathematics and Science Study Repeat (TIMMS-R). The TIMMS-R found no change in eighth-grade science achievement in the United States (National Center for Education Statistics, 2000). National science tests that were conducted in 1996 by National Assessment of Educational Progress (NAEP) indicated that 43% of high school seniors did not meet basic standards of science knowledge as adopted by the National Assessment Governing Board (Bourque, Champagne & Chrissman, 1997). Thus, international and national standardized tests in science have indicated a need for improvement in science literacy in the United States.

The Language of Science

With a constructivist paradigm dominating the field, language is being explored for its role in facilitating and assessing learning and in understanding complex interactions related to science teaching and learning (Kamen, 1997). Science education standards at national and state levels have an increased emphasis on meaningful discussions between students. The National Science Education Standards (1996) includes a statement that teachers should orchestrate discourse among students about scientific ideas.

Discourse is a highly complex phenomenon that requires multiple perspectives to understand. Jay Lemke (1995c) discusses the variety of approaches that can be involved in trying to understand language.

> To study the role of language in science learning, researchers need access to a variety of tools and conceptual perspectives on language itself. Language can be conceptualized as a purely formal system of syntactic and semantic units, or as a system of resources for making meaning in context, an aspect of human social behavior, a communicative code, a mediational means in activity, a form of cultural capital, a tool for social action, a semiotic system, etc. We can study it analytically, developmentally, historically, interactively, socially, psychologically, culturally, comparatively, dynamically, politically, philosophically, educationally, and even biologically and physically. Each of these perspectives produces tools and research methods that may be of use in analyzing and interpreting particular kinds of data on science learning. (Lemke, 1995, p. 2)

The role that language plays in the science classroom is not simple, and there are numerous ways in which the interaction between language and learning is important to the classroom teacher. Teachers encourage children to use language for both learning and assessment. Authentic assessment advocates make claims that these language-based assessment strategies help to give teachers a more complete picture of what children understand (Kamen, 1996), that linguistic demands of assessment can put some students at a disadvantage (Rudner, 1993), and there is a need to allow children to find a variety of ways to express their thoughts. (Hein & Price, 1994)

In addition to exploring how language facilitates learning, it is important to understand ways in which language may be a barrier to understanding. Osborne and Freyberg (1985) discuss problems created by the different meanings that children and adults may have for specific words. Science teachers must be very careful with their assumptions about how students understand words. This is further complicated by the increasing linguistic diversity in classrooms.

As children are given increasing opportunities to talk during science class, there is a corresponding increase in focus on the importance of the role of language in science learning and an on-going need to explore and understand it from a variety of perspectives. The issues that surround research on language and learning are complex.

As researchers explore the role of language in science learning, it is important to go beyond teacher-student discourse and to learn from the interactions between students.

> In classrooms where science is effectively taught, important learning is often forged from verbal negotiations as well as from evidence and experience. The teacher has traditionally been the focus of research by focusing on the language of questioning and student responses. However, interest in the role of language in teaching has grown beyond teacher-directed discourse to include student discourse in small groups as well as teacher-student interactions in a wide variety of contexts." (Flick, 1995, p. 10)

Students' Experiences and Motivation for Literacy

In a classroom in which students' voices are honored, the teacher gains access to information about children's perspectives and subjective experiences that promotes responsiveness to children's educational, social, affective, and physical needs (Dewey, 1904; Erickson & Shultz, 1992; Oldfather, 1991; Weinstein, 1989). Penny Oldfather

(2002) suggested that language is at the heart of the process of becoming literate. Oldfather (2002) stated that participants in classroom cultures collaboratively construct understandings about the nature of literacy, the values of literate activity, and ways that individuals and groups participate together as the curriculum is enacted. Reciprocally, Oldfather (2002) continued, through participation in these interactions, individual students construct a sense of self as readers, writers, and thinkers within the culture of each particular classroom. These constructions are salient to students' development of motivation for literacy learning (Johnston, 1992). Oldfather (2002) suggested that if literacy is a social accomplishment, the roots of motivation for literate activity are deeply embedded in the socio-cultural contexts of literacy learning, and the trans-active processes occurring in those particular contexts.

Oldfather (2002) goes on to say that researchers cannot assume that adult or ‘outsider’ perceptions will coincide with those of students within classroom cultures. In fact, Le Compte and Preissle (1992) state that ethnological analysis of interpretive studies that focus on children's experiences in school indicates that what students view as significant in the classroom is likely to be quite different from what adults see. In Oldfather’s (2002) research on motivation in literacy, she notes that caring for the student is more important than that of the subject. She mentions Nel Noddings’ suggestion of educators viewing the student as infinitely more important than the subject, at that time, eduators will be more likely to respond to children's motivational struggles in ways that empower and motivate them, rather than in ways that make them feel powerless and alienated. Oldfather (2002) determined that the responsive classroom environment has the potential to nurture students' ownership of learning. She continues to mention the work of Belenky, Clenchy, Goldberger, & Torule in Women's Ways of Knowing (1986) further exploring the concept of caring and nurturing in education and articulating the process of connected teaching.

It is essential for teachers to develop an atmosphere where students feel comfortable and respected while at the same time challenged and engaged in their own learning. Providing a nurturing yet challenging environment will allow students to contribute to their own knowledge in the classroom. Connected teaching is based on a constructivist epistemological stance that all knowledge is constructed and that the knower is an intimate part of that which is known (Belenky et al., 1986). The constructive process of each individual learner is respected. The teacher shares the ownership of knowing (Oldfather, 1992). This stance changes the power relations in the classroom. Connected teachers create a caring community of learners that encourages risk taking. Everyone in the community (including the teacher) teaches as well as learns. Connected teachers invite students' collaboration in the construction of meaning, and they nurture students' voices by facilitating the having of wonderful ideas (Duckworth, 1987). In such an environment, students become more fully engaged in their learning.

Social Cognitive Theory

Social Cognitive Theory stemmed from the Social Learning Theory, which has a rich historical background dating back to the late 1800s. Albert Bandura began publishing his work on Social Learning Theory in the early 1960s. In 1986, Bandura officially launched Social Cognitive Theory with his book, *Social Foundations of Thought and Action: A Social Cognitive Theory*. Social Cognitive Theory has its origins in the discipline of psychology, with its early foundation being laid by behavioral and social psychologists.

Social Cognitive Theory defines human behavior as a triadic, dynamic, and reciprocal interaction of personal factors, behavior, and the environment (Bandura, 1977, 1986, 1989). According to this theory, an individual's behavior is uniquely determined by each of these three factors. While Social Cognitive Theory upholds the behaviorist notion that response consequences mediate behavior, it contends that behavior is largely regulated antecedently through cognitive processes. Therefore, response consequences of a behavior are used to form expectations of behavioral outcomes. The ability to form these expectations gives humans the ability to predict the outcomes of their behavior before the behavior is performed. In addition, Social Cognitive Theory posits that most behavior is learned vicariously. “The Social Cognitive Theory's strong emphasis on one's cognitions suggests that the mind is an active force that constructs one's reality, selectively encodes information, performs behavior on the basis of values and expectations, and imposes structure on its own actions” (Jones, 1989, p.189).

Through feedback and reciprocity, a person's own reality is formed by the interaction of the environment and one's cognitions according to Bandura. In addition, cognitions change over time as a function of maturation and experience, ability to form symbols. An understanding of the processes involved in one's construction of reality enables human behavior to be understood, predicted, and changed so that learning can begin to take place.

Self-efficacy theory grows out of Bandura's original social learning theory (Bandura, 1969, 1977) and has some behavioral and mechanistic aspects. Bandura (1986) suggested that outcome expectations are heavily dependent on efficacy judgments: "If you control for how well people judge they can perform, you account for much of the variance in the kinds of outcomes they expect" p. 393). Bandura (1986) noted that outcomes are connected to actions: How one behaves largely determines the actual outcome and, in the same way, and beliefs about outcome expectations are dependent on self-efficacy judgments. In the academic domain, students' self-efficacy beliefs are very likely to be highly positively correlated with outcome expectations. Bandura related that there can be occasions when students are high in efficacy but low in outcome expectations because of structural constraints in the environment such as grading curves. An example of this high efficacy-low outcome expectation pattern would be the case of institutional discrimination on the basis of race, ethnicity, or gender. Bandura (1986) continued that students in the affected group such as minorities in any school or classroom where they are discriminated against and women in math and science classes, might feel that they can master the material, high efficacy, but can not succeed due to the discriminatory practices in the setting. Bandura (1986) noted that outcome expectations are beliefs, and in keeping with the general constructive perspective, students may perceive low outcome expectations due to discrimination when there may be very little actual discrimination in the setting.

Bandura (1986), following all the other expectancy models, noted that people tend to avoid tasks and situations they believe exceed their capabilities, but they take on tasks and activities that they believe they can handle. This type of choice behavior can have a dramatic influence on personal development. His theory predicts that when self-efficacy perceptions are high, individuals will engage in tasks that foster the development of their skills and capabilities, but when self-efficacy is low, people will not engage in new tasks that might help them learn new skills. In addition, by avoiding these tasks, an individual will not receive any corrective feedback to counter the negative self-efficacy perceptions. In general then it is most adaptive to have self-perceptions of efficacy that slightly exceed actual skill level at any given time.

Grossly optimistic efficacy beliefs that lead to tasks and situations that are far beyond the level of individual skill can result in quite aversive consequences. Bandura (1986) shared that in the academic domain, individuals who take on academic tasks far beyond their level of actual skill can suffer needless failure and subsequent debilitating efficacy beliefs. In classrooms, students who grossly underestimate their efficacy, although the consequences might not be as aversive as in overestimation, will limit their potential for learning and development and, if they do undertake the task, will probably suffer from unnecessary anxiety and self-doubt that can increase the possibility of failure (Bandura, 1986).

Besides choice, self-efficacy has been related to the quantity of effort and the willingness to persist at tasks (Bandura & Cervone, 1983, 1986; Schunk, 1991b). Individuals with strong efficacy beliefs are more likely to exert effort in the face of difficulty and persist at a task when they have the requisite skills. Individuals who have weaker perceptions of efficacy are likely to be plagued by self-doubts and to give up easily when confronted with difficulties. However, there is some evidence that self-doubt, weak efficacy, may foster learning when students have not previously acquired the skills. As Bandura (1986) notes, "Self-doubt creates the impetus for learning but hinders adept use of previously established skills" (p. 394). Salomon (1984) found that students high in efficacy were more likely to be cognitively engaged in learning from media when the task was perceived as difficult but they were likely to be less effortful and less cognitively engaged when the media were deemed easy.

Summary

In this chapter, I have provided a review of the literature undergirding my thinking as I conducted my research. In the first section, I described students' perceptions of themselves as learners and included specific focuses on students' perceptions of themselves as learners of science and on African American students' perceptions of themselves as learners. In the second section, I discussed student achievement in science and its relationship to science literacy. In the third section, I described Social Cognitive Theory, emphasizing the element of self-efficacy.

In the following chapter, I describe the methodology I used for conducting my research. In Chapter 4, I present the data I collected from each of my four participants. Finally, in Chapter 5, I provide a cross-case analysis and summary of the data and suggest possibilities for further research in this area.

CHAPTER 3

METHODOLOGY

This chapter presents a description of the methodological design that I used to conduct this study. There are several considerations when deciding to adopt a qualitative research methodology. Strauss and Corbin (1990) claimed that qualitative methods can be used to understand better any phenomenon about which little is yet known. They can also be used to gain new perspectives on things about which much is already known or to gain more in-depth information that may be difficult to convey quantitatively. Thus, qualitative methods are appropriate in situations where one needs to first identify the variables that might later be evaluated quantitatively or where the researcher has determined that quantitative measures cannot adequately describe or interpret a situation.

The ability of qualitative data to describe more fully a phenomenon is an important consideration not only from the researcher's perspective but also from the reader's perspective. "If you want people to understand better than they otherwise might, provide them information in the form in which they usually experience it" (Lincoln & Guba, 1985, p. 120). Qualitative research reports, typically rich with detail and insights into participants' experiences of the world, "may be epistemologically in harmony with the reader's experience" (Stake, 1978, p. 5) and thus more meaningful. The purpose of qualitative research in this study was to understand, describe, and report the participants' experiences and perceptions of their science learning that influence their science literacy.

Qualitative Research

Merriam (1998) stated that a qualitative research design helps researchers to understand and explain the meaning of social phenomena with as little disruption of the natural setting as possible. Merriam continued that the primary criterion that guides qualitative research is "the view that reality is constructed by individuals interacting with their social worlds" (p. 6). In this inquiry, I sought to identify four female African American eighth-grade students' perceptions and experiences of their learning in a science classroom where project-based learning techniques were employed to help in the learning of science literacy. These students' perceptions were formed from their home culture and language, their community, and their social interactions, connections, and interpretations of their world. The use of case study as a form of reporting the inquiry of qualitative research was essential to this investigation. Merriam explained case study design as a qualitative tool to "gain an in-depth understanding of the situation and meaning for those involved. The interest was in process rather than outcomes, in context rather than a specific variable, and in discovery rather than confirmation" (p. 6). Data collection included interviews, questionnaires, observations, and reflective journals. Thick descriptions provided an illuminating portrayal of each participant.

The case study design allowed for the "face-to-face" exploration of perceptions and experiences as they were cultivated during verbal and written discourse and for the exchange of ideas with the participants. This case study report presents a description of the students' perceptions and experiences of their learning of science literacy.

Two questions guided this research:

1. What are African American eighth-grade female students' perceptions and experiences as learners of science literacy?
2. In what ways do the perceptions and experiences of African American eighth-grade female students influence their learning of science literacy?

Limitations

There are several limitations to this research that resulted in findings unique to this study. This qualitative study was conducted with volunteer participants, and they were all students in one teacher's class. The four volunteer participants were all from affluent homes, and they were all academically above average. An additional limitation to the study was the specificity of the gender and ethnicity of the participants and the researcher of the study. The participants and the researcher are African American and female. The intent of this study was to record the perceptions and experiences of African American eighth-grade female students in their learning of science literacy. The scope of this study was limited to four volunteer eighth-grade female African American students' perceptions and experiences as learners of science literacy. The research indicates a void of research on African American eighth-grade female students in the science literacy literature and necessitates a need for further research in this area. The results of this study do not lend themselves to many other areas of science literacy concerns other than to the population to which it was designed, African American eighth-grade female students.

Context of the Study

This study involved discussions with students who attended an urban public middle school in a large southeastern city. The school serves students from a primarily

African American population with diverse socioeconomic backgrounds. The four participants who volunteered to participate in this study had similar backgrounds and academic situations.

Townsend Middle School opened recently with approximately 1,100 students redistricted from seven older schools within its system. Three Title I elementary schools currently feed into Townsend Middle School. The school system's service area continues to grow in population, and many residential facilities are being developed as a result. Because of the extensive socioeconomic range, Townsend services a diverse group of students with different backgrounds and experiences. This diversity directly affects the school climate. At the time of this study, Townsend was the largest middle school in the system, with over 1,400 students.

Located within 10 miles of a major airport, the community surrounding Townsend Middle School includes 95 or more subdivisions, some still in development. The price range of these homes is from $150,000 to $1 million. Census data reveal that the Townsend attendance zone contains owner occupied and rental units. Business development is concentrated in office, retail, and industry with many new businesses currently under development.

With a school motto of "Failure is not an option, and mediocrity is not the standard," Townsend uses a selection of popular middle-school organizational models, such as block scheduling, Learning Focused Schools teaching strategies, power writing, and power thinking, to accommodate all students' learning styles. The state-of-the-art facility has several computer rooms, mobile laptop labs, and individual computers in each classroom. An experienced staff from far and near, experienced leadership, and parental involvement are characteristics of the learning environment at Townsend Middle School. African American students comprise 84% of the student body. Only 20% of the teacher population is male. The school offers educational programs that help students transition from the general instruction in elementary to the highly focused instruction in high school. At Townsend Middle School, all grade-level content areas are team taught, and in the eighth-grade, there are three teams of Language Arts, Math, Science, Social Studies, and Reading. The 510 eighth-grade students of Townsend Middle School are divided among these three teams of teachers, and each eighth-grade teacher has a homeroom with an average of 30 students.

Lastly, the school offers various clubs, intramural sports, and extramural teams to round out students' educational experiences. Clubs include drama, student government, chess, robotics, Beta club, and academic bowl. Students also can take part in connections courses, such as band, chorus, dance, orchestra, computer literacy and diversified technology. Townsend's budding athletes can participate in volleyball, soccer, basketball, tennis, and track.

Participants

I used purposeful sampling to select information-rich cases for in-depth study. Size and specific cases depend on the study purpose (Patton, 1990). My purpose for the sampling of African American female participants was to enhance the limited research available reporting the views of African American eighth-grade female students and their perceptions and experiences as learners of science literacy. The representations of African American eighth-grade female students represent echoes in the canyon of research of student perceptions and experiences as learners of science literacy. The four participants were chosen from a purposeful sampling of volunteers. This method of sampling is very strong in quality assurance (Fridah, 2000).

The first step in selecting my participants was meeting with the Townsend Middle School science teachers to explain my project and ask for their assistance. I provided the Principal and the teachers with a hand-out summarizing the project, its need, and my expectations. The Principal and the teachers supported the research; however, only one teacher volunteered to have me come to her classroom to speak to her students about their potentially participating in my study.

The second step of my selection process involved visiting the participating science teacher's classes and providing a summary of my research proposal to her students. Eighth-grade female African American students who expressed interest in participating met with me in a separate classroom during their lunch period, and I explained the research project to them in greater detail. Ten of a total of 75 female students in the teacher's science classes expressed interest in participating.

Each student received an assent form to read and sign (see Appendix A). The assent form explained the guidelines for her participation. Additionally, each student was given a consent form to be signed by a parent or guardian. I communicated with parents or guardians through e-mail, telephone, and the consent form to clarify the extent that their daughters would participate in the project. Of the ten potential volunteers, four received consent from a parent or guardian to participate in the study. The participants are described in detail in Chapter 4.

Data Collection and Analysis

Data collection and analysis often occurred simultaneously during phases that extended from February through August in a single year. The phases of data collection and analysis included: identification of volunteer participants; questionnaire, initial interviews, and observations; reflective journals and second interviews; and formal analysis of data.

Phases of Data Collection

Phase I (February) of the study focused on identification of volunteer participants. As described above, I explained the study to the school's Principal and the eighth-grade science teachers. I then explained the study to students in the participating teacher's science classes. I met with the 10 potential participants and explained the study in more detail, and then I communicated with parents or guardians of the potential participants to gain their consent for their daughter to participate. Four students read, signed, and returned the assent and consent forms.

Phase II (February–April) of the study focused on the initial collection of data regarding the young women's experiences. The participants were asked to complete a questionnaire (see Appendix C) and then participate in an initial interview. Interviews were conducted at the school in a vacant classroom. During the times of the initial interviews, I also observed the students within their science classes, arranging ahead of time with the teacher to be able to observe the students engaging in a lecture, an activity, a lab, and a chapter project.

Phase III (April–May) of the study focused on the secondary collection of data. During Spring Break, the participants completed a reflective journal. When they returned to school, they participated in a second interview and, finally, all four participated in a group interview in May.

Phase IV (May–August) of the study focused on formal analysis of the data. Some analysis of the data was on-going, as, for instance, responses from the questionnaire and initial interview had been analyzed to construct questions for the second interview. During Phase IV, I coded and categorized data and began my written report of my findings. I also submitted early drafts of my report to the young women for their review and feedback, and I revised and rewrote the report as called.

Formal data collection began in February and continued with written revisions continuing through August. I used a combination of qualitative methods including questionnaire, classroom observations, reflective journal, semi-structured interviews, and a researcher's log. I also attended school functions and PTA activities and would casually communicate with the participants and their parents throughout the year.

Data Sources

The primary data sources were participant questionnaires, semi-structured interviews, field notes of classroom observations, reflective journals from students, and researcher's log. The participant questionnaire was created to begin to investigate the learning, science literacy, and literacy practices in science of the partipants. The responses to the investigative questionnaire were classified as *Absolutely*, *Usually*, *Sometimes*, and *No Way, Not Me* (see Appendix C). The participants received the questionnaire in February. The participants returned the questionnaire to me within a week, and I used their responses to construct the interview questions that were used in our initial interview (see Appendix D). The interview questions were tailored to the questionnaire responses that investigated the participants' learning, science literacy, and their literacy practices in science. The total questionnaire response percentages are represented in Table 1.

The interview sessions for each participant took place the following month. They were conducted in a vacant classroom during lunchtime. Each participant was audiotaped during her 20-minute interview sessions. The interview sessions held in my classroom allowed the interaction to progress without interruption while the remaining eighth graders were dining in the cafeteria. The interview sessions progressed smoothly with each participant and were subsequently transcribed and coded by the researcher.

The responses of the questionnaire and the initial interviews resulted in additional guiding questions to refine my study. These questions were the following:

1. In what ways do the participants connect the lessons to their personal lives?
2. Is collaborative group work helpful to the participants' perceptions and experiences as learners of science literacy?
3. In what ways do labs change the participants' perceptions and experiences as learners of science literacy?
4. In what ways would the participants teach a science lesson to enhance their perceptions and experiences as learners of science literacy?
5. Is the family influential in the participants' perceptions and experiences as learners of science literacy?

Table 1

Participants' Total Response Percentages to the Student Questionnaire

Response	Learning	Science Literacy	Literacy Practices in Science
Absolutely	60%	9%	15%
Usually	20%	36%	20%
Sometimes	10%	45%	35%
NoWay Not Me	10%	9%	30%

These questions were then used as foundational questions to the second interview (see Appendix E) and the journal entries (see Appendix F). The participants' responses to the second interview were transcribed and coded, and journal entries were coded according to the system presented in the following section. All interviews with the participants were audiotaped, then transcribed verbatim. Important and useful information and direct quotations from the participants were developed to frame the study and to illustrate various aspects of the participants' perceptions and experiences as learners of science literacy as they pertained to the research questions.

Data Collection Procedures

After the participants were identified, they and I established interview times that would spread out through March and straddle Spring Break in early April. We also established a group meeting time after Spring Break on April 11 to discuss and to clarify any concerns. During Spring Break, the young women agreed to reflect on their Science learning and lessons and record their reflections in binders I provided to them. Before the first interview, each participant received a questionnaire to complete and return during her scheduled individual interview time. A second interview time was also established for late April to strenghthen the data collected through the initial interview and questionnaire and to clarify further the themes that would emerge through the data analysis. Thus, Each participant was asked (a) to complete a 20-item questionnaire (see Appendix C) asking about her science ideas and how they relate to her life outside the class; (b) to participate in a one 20-minute audio taped individual interview (see Appendix D) based on the individual responses of the questionnaire; (c) to write her perceptions and experiences of science lessons and activities in a reflective journal (see Appendix F) twice a month (a 10-minute activity); and (d) to participate in one 20-minute, audiotaped, individual interview (see Appendix E) to get any clarification of her experiences and perceptions of learning science literacy

Data Analysis

Data analysis involved the process of putting meaning to the information that was collected from the participants through the transcribed and coded data sources of the participant questionnaire, the two semi-structured interviews, the journal entries, and the researcher's observations and log. Merriam (1998) reported that "making sense out of data involves consolidating, reducing, and interpreting what people have said and what the researcher has seen and read. . . . It is the process of making meaning" (p. 178). Grounded theory was used to analyze and generate themes from the data. By using the grounded theory in collecting the data, I was confident that the data would produce a full and accurate description of the participants' perceptions and experiences as learners of science literacy.

Data were analyzed using the constant comparative method (Glaser & Strauss, 1967). According to Goetz and LeCompte (1981), this method “combines inductive category coding with a simultaneous comparison of all social incidents observed. As social phenomena are recorded and classified, they are also compared across categories” (p. 58). Thus, hypothesis generation, relationship discovery, begins with the analysis of initial observations. This process undergoes continuous refinement throughout the data collection and analysis process, continuously feeding back into the process of category coding. “As events are constantly compared with previous events, new topological dimension, as well as new relationships, may be discovered" (p. 58).” I consulted with peers who were and were not experts to discuss and clarify the collected data. I would discuss with them the content of the data that was collected and coded constantly.

I began data analysis after the questionnaire was administered in February, and the analysis continued through the initial interviews in March, and the journal entries and second interview in April and May, respectively. The data analyses were organized and coded through the use of word processing on the computer. I made hard copies of the interviews and questionnaire.

The initial questionnaire (see Appendix C) given to the participants was separated into three categories. The first category was learning where I asked questions that investigated how the participants learned. I assigned codes to the questions pertaining to the participants’ learning, and I was able to identify their responses with the corresponding codes and categories:

L - sa	Learning through science activities
L - pl	Learning through performing labs

L - txt	Learning through textbook
L - wk	Learning through worksheets
L - yr	Learning from year to year
L - ni	Learning new information

The second category of the questionnaire provided an insight into the participants' instances of science literacy. This investigation shared knowledge of how the participants related science to their real life for an understanding of science concepts. The categories and codes for the science literacy responses are as follows:

SL - el	Science literacy for everyday life
SL - ca	Science literacy for things concerned about
SL - hd	Science literacy for health concerns
SL - uw	Science literacy for understanding of the world
SL - ao	Science literacy for activities outside the school
SL - rf	Science literacy to relate to friends
SL - ol	Science literacy to make observations of life
SL - sf	Science literacy and show family
SL - tf	Science literacy and tell friends about the lesson
SL - mu	Science literacy and make up own experiments
SL - pc	Science literacy to pursue a career

The third and final category that the questionnaire explored was literacy practices in science. This category investigated how the participants used reading, writing, and vocabulary in their science classes for understanding. The categories and codes for this section are as follows:

LP - ob	Literacy Practice with outside books
LP - lo	Literacy Practice and learning through outside books
LP - mn	Literacy Practice through reading magazines and newpapers
LP - tt	Literacy Practice through technology

The initial interview questions (see Appendix D) that were used with the participants were designated into the same three categories as the questionnaire of learning, science literacy, and literacy practices in science. These questions and responses were designated by additional codes and categories.

<u>Learning – How Do You Learn?</u>

HL - ml	How do you learn through a memorable lesson
HL - ks	How do you learn and know when you know science
HL - fa	How do you learn through favorite activities in science
HL - ui	How do you learn to understand new information
HL - de	How do you learn through doing experiments
HL - si	How do you learn through sharing information
HL - ah	How do you learn through doing activities at home
HL - wg	How do you learn through working in groups in class
HL - so	How do you learn through attending science venues outside

<u>Science Literacy – Relating Science to Real Life</u>

RS - lo	Relating science to real life outside of school
RS - oy	Relating science to real life and an “Oh Yeah” moment
RS - do	Relating science and making decisions outside of school on what you have learned in class

RS - ih	Relating science to new information at home
RS - sh	Relating science is science hard
RS - ts	Relating science and how to teach science to relate the information to real life for understanding

<u>Literacy Practices in Science – Reading, Writing, and Vocabulary</u>

RW - to	Reading and writing textbooks outside of school
RW - sf	Reading and writing science fiction
RW - ws	Reading and writing in science
RW - uv	Reading and writing for understanding of vocabulary
RW - wd	Reading and writing words you don't know
RW - gr	Reading and writing being a good reader
RW - gw	Reading and writing being a good writer
RW - gbr	Reading and writing are girls better readers than boys
RW - gbw	Reading and writing are girls better writers than boys
RW - ts	Reading and writing talking science at home
RW - dm	Reading and writing discovering meanings of words in science
RW - tx	Reading and writing using the textbook

The second semi-structured interviews with the participants were transcribed and coded accordingly.

L - t	Lecture thoughts
A - t	Activity thoughts
SF - t	Science fair thoughts
SL - t	Science lesson thoughts

S - ln	Science learning
T - il	Teaching ideal lesson
Pl - ho	Perfect science lesson – hands-on
S - d	Science decision

The coding for the journal entries was indicated by:

PL - rl	Participants' learning with real life
LS - o	Learning science from outside sources
R - sp	Reading science for personal connection
W - sp	Writing science for personal connection
T - sl	Teaching a science lesson
F - d	Family decision

Three themes were created from the analysis of the coded and transcribed data of the initial and second interview, reflective journals, observations, and questionnaire results according to the system I established. Sometimes these codes were not adhered to because they did not fit neatly into any category, but this data were useful because it provided information for a description of the young women and their interactions.

Establishing Rigor

To establish rigor, I used a variety of measures to ensure credibility, transferability, dependability, and confirmability as outlined by Lincoln and Guba (1985). These questions of rigor were addressed through the thorough completion of a process that enabled me to meet the challenge of trustworthiness in the data presented as well as the process under which the investigation was conducted.

Credibility was ascertained through member checking and peer debriefing. Triangulation of the data occurred across time using extended engagement with the participants and multiple data sources, such as the questionnaire, two semi-structured interviews, participant journal entries, and the researcher's observations and across the data through member checking and peer debriefing. Member checking would occur after the transcriptions of the interviews were completed. I invited the participants to my classroom during lunchtime and had them review their transcribed interviews to ensure the accuracy and clarity of their thoughts and words. Peer debriefing would occur during regular email communications and meetings with my colleagues about my study. These events would enable me to approach my study from multiple perspectives and to create a more thorough analysis.

Transferability is defined as the ability of the readers to understand the context of the study from a detailed description so they can determine if the findings fit their context and can therefore be transferable to their situations (Merriam, 1998). Transferability refers to the degree to which the results of qualitative research can be generalized or transferred to other contexts or settings. From a qualitative perspective, transferability is primarily the responsibility of the one doing the generalizing. The qualitative researcher can enhance transferability by doing a thorough job of describing the research context and the assumptions that were central to the research (Merriam, 1998). The person who wishes to "transfer" the results to a different context is then responsible for making the judgment of how sensible the transfer is. Thick description provided a great deal of detail to the participants in the data collection process, the data sources, the data coding, the data analysis, the data management, and the data reporting in the study.

Dependability was addressed by my thoroughly exploring the factors that shaped the findings as the process of data collection and analysis was carried out in a reliable way. The idea of dependability emphasizes the need for the researcher to account for the ever-changing context within which research occurs. The researcher is responsible for describing the changes that occur in the setting and how these changes affected the way the researcher approached the study (Merriam, 1998). The dependability of this study was enhanced by triangulating the findings across multiple data sources, across time, and across participants as well as my keeping a reflective journal, researcher's log, and the use of peer debriefing.

Qualitative research tends to assume that each researcher brings a unique perspective to the study. According to Merriam (1998), confirmability refers to the degree to which the results could be confirmed or corroborated by others. Confirmability was assured by my provision of a written report that fully portrayed every aspect of the findings. In this study, a researcher's log was maintained in order to document any decisions and rationales for methodological changes from the original plan. I would journal regularly about the progressions and frustrations of the study's process. This project permeated every aspect of my life. This log also included lesson plans and projects, descriptions of the peer debriefing sessions, and the addition of personal reflections. Confirmability was met through a variety of triangulation methods.

Data Management Procedures

The data were managed through the use of notebooks. One notebook contained information related to interview schedules, discussions with parents and participants, and information and reflection about contacts and meetings with the parents and participants.

The second notebook contained reflections and initial analysis from interviews. The third notebook contained observation field notes, post observation interviews, and initial analysis and reflections from observations. A fourth notebook was employed to keep notes and reflections from the debriefing sessions as well as thoughts and information about the analysis process. Lastly, a fifth notebook housed lesson plans, transcripts from interviews, participant consent forms, questionnaire, and sample artifacts. In conducting this investigation privacy and confidentiality were important aspects to maintain for the ethical aspect of this inquiry. Each participant was given a pseudonym to protect her identity. I identified through the coding prescribed, each response of the transcribed interview, questionnaire, journal entries, researcher's log, and field notes themes that began to emerge from the data.

Researcher's Role

As the main instrument in collecting data and analyzing the material that was gathered, I played a significant role in the process. As the researcher, I was able to have the flexibility and the ability to modify any aspect of the investigation to fit the situation and explore circumstances and various components as they came into play. In a qualitative study, the researcher's role is intimately important in how the study is carried through. As a participant observer, I was allowed in the lives of the participants by the nature of the interviewing process, questionnaire, and classroom observations. With their permission, I participated in the participants' thoughts, beliefs, experiences, personal histories, and memories as they recalled and reflected on their perceptions of their learning of science literacy.

As an African American educator, I was interested in how African American female eighth-grade students related their perceptions and experiences to their learning of science literacy. Science is a content of abstract thinking, and research has shown African American female students' having difficulty relating to the concepts and lagging behind in science achievement. My goal in this study was to investigate through the voices of the participant the experiences and perceptions of four African American female eighth-grade students as learners of science literacy and how these perceptions and experiences did or did not influence their learning of science literacy.

Ethical Considerations

The participants who volunteered for this study allowed me to enter into their lives for a brief period of time. It was important to assign anonymity to the participants so that they were able to maintain their own lives without any embarrassment or apprehension. In this research investigation, I portrayed each participant as accurately as possible and in an ethically responsible manner while conforming to research standards and the guidelines of this study. I distributed and retrieved signed assent forms from the participants and consent forms from the parents of the participants. The participants reviewed their transcribed interviews for accuracy and clarity. All data including audio tapes, written transcripts, and field notes were secured in my home office to provide security and confidentiality.

The participants benefitted from this study by meeting and associating with young women who were not in their usual clique. They went beyond their social comfort zones and shared their lives with unknown peers. When the participants and I would meet in my room during lunchtime to review the transcriptions, they were initially very timid. As the participants became more familiar with one another from meetings and discussions together, a bond began to form where the participants would talk and laugh among themselves. It appeared they began to enjoy the camraderie of our shared journey. If my transcribing was taking too long in between meetings, one of the participants would surely remind me of the delay in our meetings. Another participant benefit from this study was a ticket to a nearby educational entertainment attraction. I provided each participant with a ticket as a thank you for sharing her stories.

CHAPTER 4

RESULTS

Rutherford and Ahlgren (2000) described a scientifically literate person as one who is aware that science, mathematics, and technology are interdependent human enterprises with strengths and limitations; understands key concepts and principles of science; is familiar with the natural world and recognizes both its diversity and unity; and uses scientific knowledge and scientific ways of thinking for individual and social purposes. Science literacy then encompasses three dimensions. The first dimension is functional science literacy, which includes knowing the vocabulary or the technical words of science and technology. The second dimension is conceptual and procedural science literacy, where learners should relate information and experiences to conceptual ideas that unify the disciplines and fields of science. In addition, literacy in science includes abilities and understandings relative to the procedures and processes that make science a unique way of knowing. The third dimension of science literacy is where learners develop perspectives of science and technology that include the history of scientific ideas, the use of the scientific method, the nature of science and technology, and the role of science and technology in personal life and society.

The purpose of this study was to provide an emic perspective of the perceptions and experiences of eighth-grade African American female students as learners of science literacy. Four eighth-grade African American female students volunteered to participate in this study. They were each assigned psuedonyms to protect their anonymity. Two questions guided this research:

1. What are eighth-grade African American female students' perceptions and experiences as learners of science literacy?
2. In what ways do the perceptions and experiences of African American eighth-grade female students influence their learning of science literacy?

During the initial analysis of the data through coding and collection, I developed the following additional questions:

1. In what ways do the participants connect the lessons to their personal lives?
2. Is collaborative group work helpful to the participants' perceptions and experiences as learners of science literacy?
3. In what ways do labs change the participants' perceptions and experiences as learners of science literacy?
4. In what ways would the participants teach a science lesson to enhance their perceptions and experiences as learners of science literacy?
5. Is the family influential in the participants' perceptions and experiences as learners of science literacy?

The student questionnaires (see Appendix C) provided the foundational information demonstrated in the interview questions (see Appendixes D & E), and the journal entries (see Appendix F). I tallied the coded participant interview responses into a table to show frequency (see Table 2).

Table 2

Frequencies of Responses to Questionnaires and Interview Questions

Emerging Terms	Learning	Science Literacy	Literacy Practices in Science
Family Influence	4	10	6
Collaborative Groups	2	8	3
Designing Projects	3	9	8
Labs and Activities	2	7	10
Reading Textbooks	0	1	3
Outside Research	3	1	4
Connecting Science at Home	4	6	5
Personal Importance to Science	5	7	9

Note. The numbers represent the frequency that the words or phrases were used in response to the questionnaire and the initial interview.

Before the initial interview with each participant, I visited Ms. Steim's classroom to make 20-minute observations of the participant in her science learning environment. Ms. Steim's classroom arrangement is mapped Figure 1. Through these observations, I was able to record the actions and responses of the participants in a lecturing activity, a lab activity, and a project activity. The notes accumulated in the observations allowed me to solidify additional questions for the interview to the foundational questions provided by the questionnaire.

Ms. Steim was an amiable, yet stern, vibrant young woman. She greeted students and teachers alike with a warm smile and welcoming greeting. She busily prepared her classroom for the lessons she had prepared. Her board was responsibly labelled with the

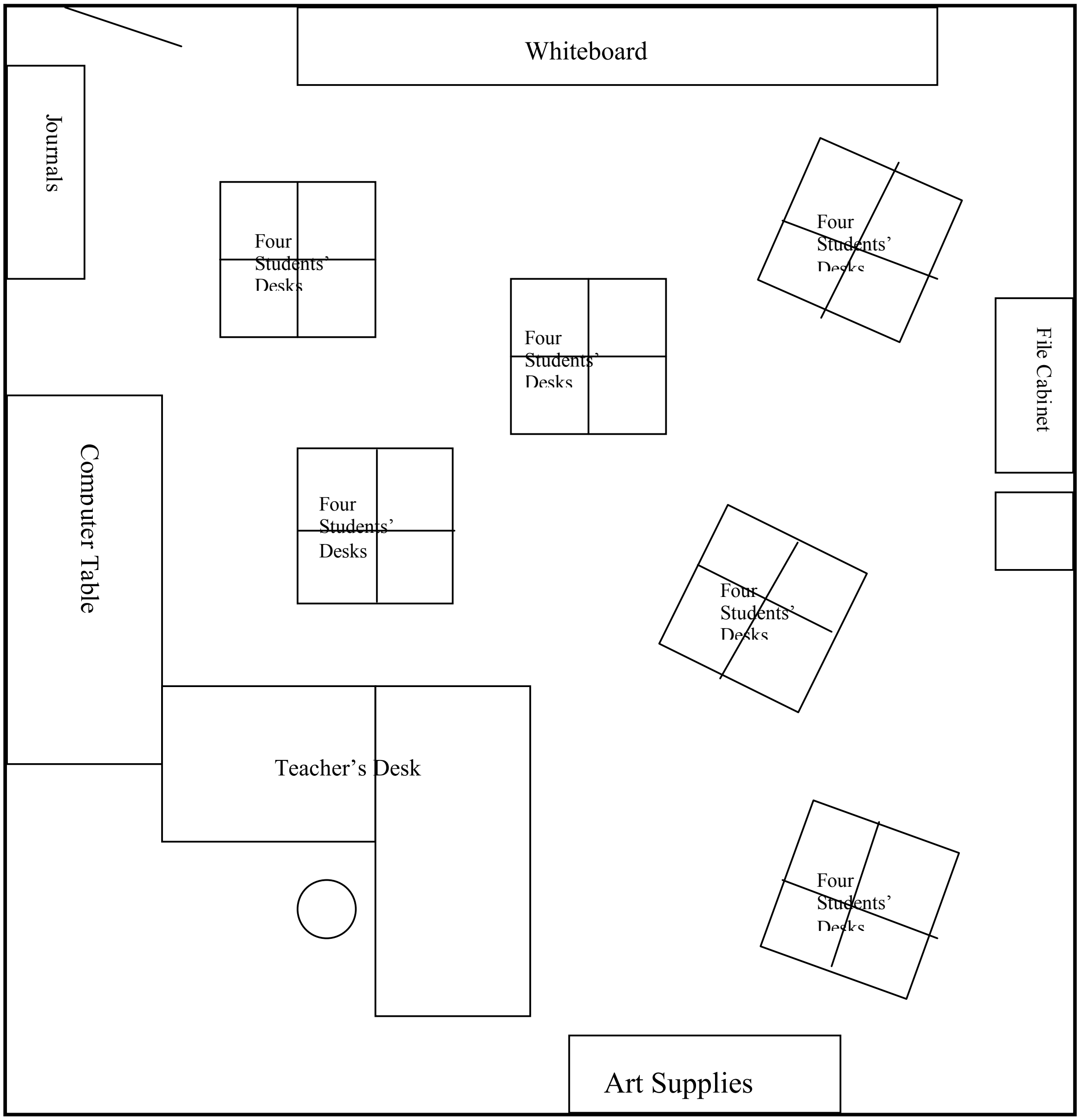

Figure 1. Ms. Kristine Steim's Classroom Arrangement

"Essential Question" of the lesson of the day, the agenda of activities of the day, the homework for the current night, and the problem of the day. The students filed into her classroom and found their assigned seats and prepared their notebooks for the procedure of the day. The students wrote down the essential question for the day and got out their science books. Ms. Steim began her lesson from the back of the room with a question from the previous night's homework, and the "Oh, no, I left it in my locker" began. Ms. Steim's reactions ranged from a rolling of the eyes, "I don't believe you," to the hands on the hips, "Let's call your mother." Either way, the students got the point. Her room was designed for student movement and activity. The lesson began with a PowerPoint presentation, and the students were allowed to move from their seats to a place closer to the TV.

Karen

Encountering Karen's Science Literacy

Karen, a 13-year-old young woman, greeted me for our interview with a quick smile and questioning glances. She had carried her lunch to the room for this first interview. She situated herself in a chair at the front table and took a keen interest in the chicken sandwich before her. Karen had completed her questionnaire before our initial interview. The questionnaire investigated Karen's perceptions and experiences in her learning, her science literacy, and her literacy practices in science. The participants' questionnaire responses helped comprise the initial interview questions.

Sharan:	How does science fit in to your life?
Karen:	I am able to recall science information and relate it to real experiences.
Sharan:	How do you mean?
Karen:	For example, I know the names of the different types of clouds.
Sharan:	That's good, anything else?
Karen:	Yes, I know how seeds pollinate, and I know the different types of weather conditions.
Sharan:	You are using scientific words. Is it hard to learn science vocabulary?

Karen: Sometimes, but sometimes in class, Ms. Steim plays vocabulary games with us to help us learn new science vocabulary words.

Sharan: What does she do?

Karen: Well, if we are starting a new chapter, the night before, she will give us the assignment of defining the words in the chapter we will be starting in the next class.

Sharan: Is there anything else?

Karen: Yes, when we come in the next day, she may place an index card on our backs with either a vocabulary word, or the definition on it. We then have to find out . . . first, what is on our backs, and then we have to find either the matching definition or vocabulary word.

Sharan: How do you like that?

Karen: That's fun.

Sharan: Do you remember all of the words?

Karen: No, not all of them, but I remember mine.

Sharan: What about the other vocabulary words in the chapter?

Karen: I'll have to study those.

Sharan: How do you study the vocabulary words?

Karen: I create flash cards with the words on the front and the definitions on the back, and then I have my mom quiz me on them.

Sharan: Is there any other way that you study science?

Karen: Well, if my mom isn't at home, then I'll use the science book as a guide.

Sharan: What do you mean as a guide?

Karen: If I have a question from the notes we may have taken in class, then I'll go to the book and look up in the chapter words or stuff Ms. Steim talked about in class that I didn't understand.

Sharan: What do you do when you come to a science term that you are not familiar with?

Karen: When I come to a word that I don't know, I read the entire sentence and look for content clues, or use the book glossary or a dictionary.

Sharan: Do you read the science textbook outside of homework?

Karen: No, I don't read my science book for pleasure, but I do like to watch the Discovery Channel.

Sharan: Do you like to read any type of science fiction or anything other types of magazines or books dealing with science outside of school?

Karen: No, I don't read science fiction or science books or magazines, but I do like to read poetry.

Sharan: How do you use writing in science?

Karen: I use writing in science when we are writing assignments, when we are gathering information for research, like when we were doing the Science Fair projects, or when we are writing up labs and experiments.

Sharan: How do you use reading in science?

Karen: When I need to learn more information, I use reading to re-read the material in a chapter.

Sharan: Are you a good reader and writer?

Karen: Yes, I am.

Sharan: What makes you a good reader and writer?

Karen: Practice.

Sharan: Do you think boys or girls are better readers and writers?

Karen: I think girls and boys read and write about the same. Some girls read and write better than boys, and some boys read and write better than some girls.

Sharan: What do you like about learning science?

Karen: I like the experiments and activities in science.

Sharan: Why?

Karen: Because they allow me to be directly involved in the lesson.

Sharan: Does "doing" the experiments and activities help you remember the information you read about in the chapter?

Karen: Sometimes I get so involved in what we are doing and making sure we are doing it right, that I don't think about the information in the chapter at all.

Sharan: Do you like working in groups in science class?

Karen: Yes, I like working in groups in science class because people have different ideas and we can learn from each other.

Sharan: How do you know when you know science?

Karen: When I am able to explain the information to another person. (Taped interview, March 2, Lines 3-75)

After our 20 minutes were up for the interview, I told Karen that I appreciated her honesty and straightforward answers. She said that, "That wasn't bad at all." She gave me a bright smile and asked if I could give her pass to class. I told her that I would walk her to class instead. When I walked her to class, the students said, "Ooh, are you in trouble?" Karen answered, "No, I'm not in trouble. Ms. Crim just wanted to ask me something."

When Karen was answering the questions, she would take a second or two to digest the question and would then give me her answer. Karen was deliberate and thoughtful in her responses, she did not appear nervous or apprehensive at all, and she appeared very confident in her answers. Her responses guided me in choosing the journal questions (see Appendix E) I used for the participants.

Karen and Her Family

Karen lived with her parents and a brother in a neighborhood near Townsend Middle School. The homes in the neighboring subdivisions ranged from $180,000 to $500,000. Karen's parents were both college educated, and her brother was attending college. Karen's mother worked for a Georgia school system, and her father worked for a prominent insurance company. When I contacted her mother about Karen's participation in my study, her mother was very inquisitive yet cooperative about the prospect of her daughter's opinions of her learning science literacy being shared. As a matter of fact, Karen's mother expected Karen's and my establishing such a relationship during this research study that she wanted me to mention to Karen the advantages of attending Spelman College.

Karen's Parents' Influence in her Learning of Science Literacy

Karen recalled two memorable lessons that came to mind about her science learning. In the first, "I failed to bring my books home for a test, and as a result, I failed the test by making a 68." In the second, "I did not complete my homework. My parents found out about it and placed me under strict punishment." She continued, "That has not happened since." (Taped interview, April 24, Lines 14-17)

The eighth-grade science curriculum included a weighted 20% portion of the first semester final grade based on the completion of a Science Fair project. The Science Fair project assignment is a project that culminated the first four months of science instruction that included designing experiments using the scientific method, completing labs and activities reinforcing science concepts, and traditional and authentic assessments. Karen's parents provided support and structure to her study time, thereby helping her orchestrate the completion of her Science Fair Project:

> I didn't know what to choose to do for my Science Fair project. Ms. Steim suggested that we look in the book for some topics that might interest us. I looked through the book and saw something on sound. We hadn't covered this yet in class, but my mom found some books about Science Fair projects and I found an easy one on sound. My father helped me with setting up the experiment and the different trials I had to do. I couldn't have done it without them. (Taped interview, April 24, Lines 4-10)

Several of Karen's "Oh, yeah, I learned this in science class" moments occurred at home.

> When my mom boils water and the liquids change to gas, I tell her that is because of the phases of matter. I know not to stand under a tree when it is lightning. I also learned not to take medicine that is not prescribed to you. I tell my mom to get her car fixed so she won't contribute to the pollution. Now when I'm walking in the neighborhood and I'm eating chicken, I will throw the bones in the garbage rather than throwing them on the ground, so I wouldn't leave a mess and contribute to the pollution. (Taped interview, April 24, Lines 26-32)

Karen in Class

Karen perceived herself as a hands-on learner and as a very visual learner; consequently, I was interested in observing Karen in a variety of science learning situations. My observation of Karen in her science class was carried out through the coordinating efforts of the teachers on my team. I entered Ms. Steim's classroom as unobtrusively as possible, yet Karen greeted me, "Hey, Ms. Crim!" I gave her a quick wave and a "Shhh," and Ms. Steim gave her "the look," to which she quickly responded and returned to her work. Ms. Steim was in the middle of a PowerPoint presentation of the phases of matter, and I observed Karen's diligently writing down the notes from the PowerPoint. Karen began giggling with her neighbor when Ms. Steim shared additional information about the elements and the compounds they form. Ms. Steim reprimanded her about her talking, and she immediately stopped. Karen seemed to have a sense of humor and was forthright in sharing her amusement. I asked Karen about observing her talking to her neighbor during Ms. Steim's lecture, and she replied, "I really don't pay attention to Ms. Steim when she starts lecturing. I start thinking about what I have to do later, or if I finished all of my homework." (Taped interview, April 24, Lines 18-20)

Karen's doing group work. During the same observation, Ms. Steim began to instruct the students on a mural activity the class conducts next. Ms. Steim picked the group members for the activity. Karen obediently picked up her books and moved to the group of students she had been assigned. The students in the group began discussing the assignment, seemingly to check that they had the assignment correct. The students decided their roles in the group. Karen had chosen herself to be materials manager. She gathered the materials that were needed for the assignment and returned to the group. The students realized they needed more space and set the materials on the floor and started their mural. Karen retrieved resource materials that related to the group's chosen example of phases of matter.

Karen used her reading skills to choose which books that served the purpose of the group for their assignment. The group depended upon Karen's literacy skills to choose the right science resource materials used to proceed with the assignment. The members determined which one of the group drew the best and this member was designated the group's artist. Discussions were carried out, and before I took my leave, the mural began taking shape.

Karen, the laboratory scientist. Karen replied in her journal that when a lab is assigned, "I think about what the lab is about and why the teacher is asking us to do the assignment." Labs and experiments were the types of science lessons that stayed with Karen:

> The lessons that stay with me are the lessons that get me active. I have to be in the lesson in order to learn the lesson. That's why doing the Science Fair Project was so good. I had to come up with a topic, research it, and design the experiment. I learned a lot from that. (Taped interview, April 24, Lines 15-20)

The labs and experiments allowed Karen to be the laboratory scientist. She got to use the laboratory apparatus, to use the scientific method, to set up the experiment, to make observations, and to record the data. Karen's involvement in the experiments in science class enabled Karen to transform from observer to participant. This exchange in roles was essential in the internalization of science learning for Karen. She considered herself a visual learner and a hands-on learner, so experimentation was the perfect vehicle for Karen to exercise her learning muscles and gather the greatest science literacy information.

Karen as the teacher. Karen was a very amiable participant who had a willingness to share. She was cooperative and funny at times. During her second interview, I asked her to explain what a perfect science lesson would look like that would maximize her science literacy learning. She replied,

> I would take a subject that affects us all today. I think our water is so filthy, so I would do an investigation on that. I would first have hands-on experiment about the water, so the students would know and understand about water. I would have a microscope and check a sample of our drinking water at school, some tap water from home, and some water from some bottled water. I would check if with that little piece of paper that changes colors, the different colors the different samples of water would change. I would find an article about water that would give us actual information about water today what had happened and why. I would give a PowerPoint about water. I would have questions and answers about what had been presented. (Taped interview, April 24, Lines 28-42)

In science classes, Ms. Steim assigned lessons where the students were able to present information that they had learned in a chapter in a classroom forum. The students essentially became the teachers. The information the students presented was prescribed by the science curriculum, so their creativity was limited by the content only. Karen's ideal lesson was based on her concern about water, but her lesson format could be extended to any science concept presented in the class.

Karen's connection. Karen explained in her second interview that in science class, she listened and tried her best in every learning situation, but she did her studying at home. Karen's parents set a daily study time for Karen, and her mother was instrumental in her study process. When Karen's mother was not available for study sessions for a test, Karen relied on her imagination and creativity to make connections to the science material. Karen used her imagination to make connections when ideas were seemingly abstract.

> If I don't understand a science concept, I use everyday things to connect it. For example, for speed, I picture Albert Einstein on a bike going down a hill. He starts to go fast. That makes me think of speed. (Taped interview, April 24, Lines 47-50)

Karen's personal connection to the science lessons was made in the confines of her most comfortable and confident place she knew, and that was her home. Karen was an attentive and inquisitive student in Ms. Steim's classroom. She listened intently to the teacher during lessons and followed directions to the letter during activities. The activities, experiments, and lectures in the classroom are all presentations of science literacy by the teacher, and Karen carried them out without complaint and with enthusiasm. Good study habits and her parents' positive reinforcement were the motivation for Karen's enthusiasm in the classroom. Karen made a personal connection to the science material outside of the classroom privately and creatively in her home for understanding. The teaching repertoire of Ms. Steim was extensive, but the actual learning for this participant seemed to take place in the privacy of the home. Karen made sure that she brought home her books nightly to avoid punishment from her parents and studied from them to avoid failing a test. Karen had parental support when she designed, researched, and created her Science Fair project idea and experiment. Karen connected and applied everyday concerns of littering, pollution, and water quality to her science lessons for science literacy understanding. When I observed Karen's cooperation and collaboration in group work she indicated a tendency of dictating the rules, rather than using the group opportunity of learning from the other members in her group. Her concern in group work seemed to be creating a product that would be positively evaluated by the teacher.

<u>My Reflections of Karen</u>

Karen's case study revealed a perceptive and experienced view of herself as a visual and hands-on learner of science literacy. She connected to the science content in the privacy of her home with the help of her imagination and her mother. When Karen was able to participate actively in her learning in class through experiments, group activities, and projects, her enthusiasm increased as well as her interest in the lesson, and her vocabulary of that concept improved. Active learning helped her internalize and process her learning.

Based on data collected during the case study, I concluded that Karen's perceptions and experiences as a learner of science literacy corresponded to her likes and dislikes in her learning of science literacy. It appeared that Karen was an independent learner who took responsibility of her science learning when she was able to engage actively in her learning, to design her products from her science learning, and to employ the vocabulary of the concept learned in science to explain her designed product. Karen found an interest and a personal connection to the science literacy concepts she learned when left to her own devices at home.

For Karen, it was important to be exposed to the current local and global conditions of society to see where the facts she was learning in classes were related to the experiences occurring in today's world. Moreover, Karen's family and home allowed her to flex her science literacy muscles by relating her learned science concepts to her everyday experiences. She was able to make environmental decisions and observations based on her science literacy. For instance, Karen was able to explain the phases of matter to her mother reinforcing her notion of knowing when she knows science by the ability to explain it to someone else. By her own perceptions and experiences, Karen was a visual and hands-on learner of science literacy. She was caught between the teacher's teaching styles and her perceptions and experiences in her learning styles. If Ms. Steim was conducting a lesson through lectures or notes, Karen would follow directions, but she would be thinking of other things. It seemed that when lessons were congruent with Karen's perception of her learning styles, then her interest in the activity would increase. These styles seemed to converge in Ms. Steim's science class, where Karen maximized her learning of science literacy through the labs and projects that allowed her to exploit her visual and hands-on learning.

Latoi

Latoi was an effervescent, energetic, and pleasant 14-year-old young woman. She walked the hallways with her girlfriends and made a point to greet every teacher that she knew with a smile and a hug.

In Ms. Steim's class, my observation of Latoi revealed her tentative approach to tasks. She followed directions to the letter, deciphered what she could of the task, then asked questions either to her peers or to her teacher. Initially, Latoi sat for our first interview very quietly with her eyes down. She peered up at me with short glances until she felt more comfortable, when the glances extended. She handed me her questionnaire very proudly because she had completed the task. When we met for our interview, she asked me where she should sit. I directed her to the front table and chair.

Latoi and Her Family

I initially communicated with Latoi's mother over the phone to discuss Latoi's participation in the study. I did not get a chance to meet her mother until the eighth-grade dance at the end of the school year. I found her mother to be as well coiffed and as colorfully dressed as her daughter, and she seemed just as guarded. Latoi was from a blended, close-knit family consisting of four siblings. Her "Mommy" was the most influential person in Latoi's life because she pushed Latoi to succeed in her work and to do her hardest at whatever she did. Education played a very important role in her family's life.

Latoi's mother was college educated, and her stepfather was a truck driver. Latoi was the oldest child in her blended family. She often took care of her younger siblings after school and on weekends. Latoi enjoyed reading all genres of information, and she shared it with her siblings. Latoi toiled arduously scholastically. She repetitively reviewed the text and even researched on the Internet when new information was introduced in class.

<u>Encountering Latoi's Science Literacy</u>

Sharan:	How does science fit in your life outside of school?
Latoi:	Science fits into my life outside of school because I use pressure, force, viscosity, acceleration, and more in doing everyday things.
Sharan:	Those are a lot of science concepts and vocabulary you have mentioned. Is it hard learning science vocabulary?
Latoi:	No, it's not hard learning science vocabulary. I read the textbook and use the textbook's glossary when I come to a word I don't know.
Sharan:	How do you know when you are using pressure, viscosity, or force in your everyday life?
Latoi:	Well, I use force everyday when I come out of the house to go to school. I roll my sister's book bag for her.
Sharan:	Is there any other occasion you can think of?
Latoi:	Yes, whenever we go somewhere or someone from the family comes to pick us up to go somewhere, I walk behind

my sister and push the door open for her stroller, and I push the buttons to set the alarm.

Sharan: What is the best way for you to learn new science vocabulary?

Latoi: I pay close attention to what Ms. Steim says in class.

Sharan: How do you know when you know science?

Latoi: I know when I know science because I study and study until I understand what I am studying. Then I give myself a pretest.

Sharan: What are some of the most memorable science lessons you have learned in school?

Latoi: Viscosity and pressure. What made me remember viscosity was me doing my Science Fair project on the subject. I remember pressure because I did a class work assignment in a group, and I enjoyed myself.

Sharan: What are some of your favorite activities on science?

Latoi: The Science Fair project, working in groups or with a partner, labs and experiments.

Sharan: Do experiments and activities help you learn about science information?

Latoi: Yes, it helps me learn about science information because the experiments allow me to see what it is that I do not understand.

Sharan: What kind of learner do you consider yourself?

Latoi: I consider myself a very good learner. I am able to learn things by vision quicker and better.

Sharan: What are some of the ways that you share the science you have learned in class?

Latoi: By helping someone when they don't understand. Also by telling my parents what I have learned in science class when I get home. I could even write a summary and send it to someone.

Sharan: Do you ever have a time when you say, "Oh, yeah, I learned about that in science class?"

Latoi: Yes, I do. When I did my Science Fair project on viscosity, I remembered how the different liquids ran at different speeds. The thicker the liquid, the slower it flowed.

Sharan: What did you think of when you first heard or saw the word viscosity?

Latoi: I didn't have any idea what it meant.

Sharan: What did you do?

Latoi: First, I checked to see if the word was in the glossary. Second, I wrote the word down then I went and asked Ms. Steim.

Sharan: Do you consider yourself a good reader and writer?

Latoi: Yes, I do.

Sharan: What makes a person a good reader and writer?

Latoi: Practice makes an excellent reader and writer.

Sharan: Does being a good reader and writer help you in science?

Latoi: I think being a good reader helps me in science, but I don't think that being a good writer helps me at all in science.

Sharan: Do you ever use writing in science?

Latoi: Yes, I use writing by doing class work and homework. When I am at school and at home, and I always write like one or two paragraphs in a 1,2,2,2,1.

Sharan: Do you read science textbooks outside of school?

Latoi: Yes, because I have to study hard, and especially to do my homework.

Sharan: Do you think girls are better readers and writers than boys?

Latoi: No, because I personally know boys who can read better than me, and I know some boys who can write better that I can.

Sharan: Do you think science is hard?

Latoi: Oh, no, not at all.

Sharan: How can teachers teach science so that students can relate the information to real life?

Latoi: Discovery Channel or National Geographic. (Taped interview, March 6, Lines 3-60)

<u>Latoi Pays Attention</u>

In the classroom, Ms. Steim was working her magic again. The class was beginning a chapter on momentum, and Ms. Steim was showing a video on the topic.

Latoi was seated at a group of desks with three other students. Latoi was dutifully taking notes on the video and was trying to record everything Ms. Steim was adding to the lesson. If Latoi thought Ms. Steim was going too fast, she would raise her hand and ask her to repeat it. Latoi was concentrating on every word and would quiet any one in her group who would begin talking, so that she would not miss a thing. She writes in her journal that, "During lectures, I think 'Okay, she's talking too fast. Let me write faster.'"

During this classroom observation, Ms. Steim told the students of the lab the class would be conducting to reinforce the momentum concept of the lecture she had given. The students would have to build a pendulum with meter sticks and string, including different size and weight washers. The students were asked to time and count the number of swings and heights that the washers swung. The students were working in groups and they had to observe and record the data in their experiment. Latoi stated, "During labs and experiments, I think, 'Let me pay attention so I will know what's going on'" (Taped interview, April 24, Lines 4-10).

Latoi Doing Group Work

Latoi explained why she likes working in groups:

> I like to do group work because we can learn from each other. If there is something I don't understand, someone can explain it to me. If there is something someone in the group doesn't understand then I can explain it to them. (Taped interview, April 24, Lines 23-27)

Latoi's group moved to her quad of desks and began discussing the assignment. Latoi was not clear on something and went directly to Ms. Steim for clarification. Latoi seemed to have gotten a clearer understanding of the assignment because she bounced back to her group and shared the clarity. The roles were chosen for the group and the design was created and the materials retrieved. During the planning stages, Ms. Steim asked the different groups questions to keep the class on track. When Ms. Steim directed her questions to Latoi and her group, Latoi could not answer the question. She replied, "You know you know what it is, but can't quite get it?" She then kind of dazed off, twirling her earring. The group began building the pendulum and discussed how they were going to measure the weight and height of the swings of the washers.

In a lab situation, the group configuration tended to give Latoi strength and reinforcement. Latoi was a hard working student, but she seemed to need some reassurance to complete a task. Latoi seemed to attack an assignment by adhering to the directions, but needed additional clarification from the teacher or other students to bring the task to completion.

<u>Latoi as the Teacher</u>

Latoi's ideal science lesson related to her topic of her Science Fair project of viscosity which deals with the resistance of a liquid to flow:

> I would choose to do a lesson on viscosity. I would start off with a demonstration of different liquids with different viscosities. I would have two beakers or flasks. I would fill one beaker or flask with a liquid that would flow slowly, and then I would fill the other beaker or flask with a liquid that would flow fast. I would pour water with low viscosity and time it and see how long it would take to enter the beaker. I would then pour the different liquid with high viscosity and time it. After the demonstration, I would give a PowerPoint over definitions about viscosity. (Taped interview, April 24, Lines 12-21)

Latoi's confidence in the mastery of the material for the Science Fair project was elevated. Because she considered herself a hands-on and visual learner, the techniques Latoi employed in creating the Science Fair project made the concepts remain with her long term.

Latoi's Connection

Latoi related in our second interview a conversation she had with her grandmother about one of the nation's major medical epidemics, AIDS, as one of her science connections. Latoi related that she would like to direct her academic career toward science to help find a cure for AIDS.

> I do research on things that I don't understand on the Internet. I use "Ask Jeeves" and I have seen some interesting things about AIDS on there. At some point in time I wanted to find a cure for AIDS, but that's going to take a lot. That will take a whole lot of years. I'd have to test blood cells and stuff. I'd have to test a lot of things to check for a cure. (Taped interview, April 24, Lines 36-45)

I ask Latoi as noble as the cause, why such a concern about AIDS. Latoi articulated a lesson of consequences that threaded her grandmother's discussion of AIDS, but she also realized that her heartfelt message often encountered deaf ears. Latoi stated,

> My grandma said that the best way to cure AIDS is to stop having unprotected sex. I think that there is nothing wrong with her doing that. There are a lot of people who are not going to listen. We do things that we know there is a consequence for. We do bad things and we think about it only when there is a consequence. I do it all the time. If I don't ever find a cure for AIDS, then that's the only way I will be a teacher. If I had to be teacher, I would be a teacher, a health teacher. (Taped interview, April 24, Lines 56-78)

My Reflections of Latoi

Latoi perceived and experienced herself as a visual and hands-on learner of science literacy. These perceptions and experiences as a learner influenced her interest and understanding of science literacy. Latoi was a learner who elicited the help of the teacher when challenged with a new concept. I observed Latoi to be more of a dependent learner than an independent learner in classroom settings when new science concepts were introduced. Latoi gained her academic confidence in group settings and with inquiry and project-based learning. She found a strong connection to science literacy when she was able to explore her science strengths by designing and researching her Science Fair project. She needed to design and research a concept to facilitate internalizing and owning the information.

Another theme that emerged relative to Latoi was the prevalence of family involvement and her familial responsibility associated with her learning. Her role as the oldest sibling in a blended family attributed to her daily reading choices and shared learning experiences. Because of this, Latoi's grasp of lessons was limited to those that she perceived and experienced as relevant to her. She grasped concepts through questioning with her teacher and independently researching at home. The lessons I observed and that Latoi reflected in her journal of those presented in class were only recorded and stored but were not learned or committed to memory until she reached home. Latoi had the ability to research independently the science concepts presented in class.

I concluded that over the course of the study, Latoi's perceptions and experiences as a learner of science literacy were positively influenced by independently researching science concepts, designing experiments, and performing hands-on activities. Latoi developed scientifically by utilizing the brilliance of the teacher along with independently researching unclear science concepts, and receiving positive reinforcement through parental involvement.

In the course of learning, Latoi identified her strengths while looking to adults for academic reassurance and guidance. Her peers provided an educational buffer to reinforce her academic acumen. The Internet provided a vast resource of information that encouraged Latoi as a learner of science literacy.

Sabrina

Sabrina was an assured, classy, athletic, and careful 14-year-old young woman. Sabrina had transferred to Townsend Middle School the year of the study from a different middle school. “Coming to Townsend Middle School had given me a fresh start,” she said. Sabrina had dealt with neighborhood “drama” at her previous middle school, and her mother wanted her to be in an environment where she could concentrate on her academics. Sabrina felt the move to Townsend Middle School was “just what she needed.”

Sabrina was determined to present herself “correctly.” She looked me directly in the eye and answered me with a “Yes, Ma’am.” Sabrina’s commanding presence in class influenced the actions and reactions of her peers. Her confidence appeared to intimidate and challenge the young women in the class and piqued the interest and curiosity of the young men in the class. She attacked the lesson with a “What can you teach me?” attitude.

Sabrina and Her Family

Sabrina is a member of a blended family from southern Georgia that included four siblings. I only had the opportunity to speak with her mother over the phone in conjunction with asking for Sabrina’s participation in this study. Sabrina said that her grandmother had been the most influential family member in her life because “she has done a lot for me.” Sabrina perceived and experienced herself as a visual learner where education was the most important thing in Sabrina’s life because she feels, “You can’t go anywhere without education.” (Taped interview, April 25, Line 11)

Sabrina's family emphasized the importance of education in the lives of the children in the household. Sabrina's mother had evaluated her daughter's prior middle school educational experience and recognized the need to change her educational environment to amplify Sabrina's academic success. Sabrina relayed that her mother established a daily study routine that included rewarded science vocabulary acquisition.

Sabrina stated that her mom had been very instrumental in her science vocabulary learning:

> My mom asks me what I learned in school each day. If I say I started a new chapter, she wants me to study the vocabulary words. She gives me 20 minutes to study the words and then we play a type of jeopardy game to match the words and definitions. (Taped interview, April 25, Lines 4-10)

Sabrina felt that there was no better way for her to learn than the way her mother does it. She said, "My mom gives me $1 for every word I get right." (Taped interview, April 25, Line 26)

Encountering Sabrina's Science Literacy

Sharan:	How does science fit in to your life outside of school?
Sabrina:	It fits into my life when I make food or fix things in my house.
Sharan:	Do you think science is hard?
Sabrina:	No, I don't think science is hard. But it can be if you don't pay attention in class and do your homework.
Sharan:	When you learn new information in science, what is the best way for you to understand the information?
Sabrina:	The best way for me to understand science is to assign myself homework and then go home and practice until I get it right.
Sharan:	How do you know when you know science?
Sabrina:	When a teacher can just give you a problem on the board and you can do it without hesitation and no problems.

Sharan: What are some of the most memorable lessons you have learned in school?

Sabrina: When I was in the 7th grade, I learned a little about Pascal's Principle. What made it memorable for me was that it is what I did my best on.

Sharan: What are some of your favorite activities in science?

Sabrina: My favorite activities in science are labs and projects.

Sharan: Do experiments and activities help you learn science information?

Sabrina: Yes, they help me learn by recording data, making hypothesis, making observations, and just by paying attention.

Sharan: Do you do science experiments at home?

Sabrina: Sometimes.

Sharan: Do you ever use the information learned in class at home?

Sabrina: Yes, I do.

Sharan: How?

Sabrina: By what I eat.

Sharan: What are some ways that you share your information of science?

Sabrina: I take notes and also make graphic organizers.

Sharan: How can science be taught so that students can relate the information to real life?

Sabrina: You can do more lab activities and partner projects.

Sharan: Do you like working in groups in science class?

Sabrina: Yes, I do because one person may know more than the other, so we can learn from each other.

Sharan: Do you use the science textbook outside of school?

Sabrina: Yes, I do if it is something that I fully don't understand.

Sharan: What do you do when you come up to a word you don't understand science?

Sabrina: I look the word up and then use it in a sentence.

Sharan: How do you get an understanding of the science vocabulary?

Sabrina: I write down the definitions and I also use them in sentences.

Sharan: Are you a good reader and writer?

Sabrina: Yes, I am a good reader because reading is understanding. Yes, I am a good writer. It helps me because when I read, I also take notes.

Sharan: Do you think girls are better readers and writers than boys?

Sabrina: I think that they can be equal because it is not whether a boy is smarter or a girl is smarter. It is if they both can learn. They both are capable of doing the same thing. I think girls are better writers than boys because I really don't know any boys who like to write.

Sharan: Do you ever talk about science words at home?

Sabrina: Yes, sometimes when my mom asks me what new words have I learned.

Sharan: How do you discover the meaning of words in science?

Sabrina: I look them up in encyclopedias and in dictionaries.

Sharan: What do you do with the textbook?

Sabrina: I take my textbook home every other day because my mom makes me study new words.

Sharan: Do you ever make decisions outside of school that were based on what you learned in science?

Sabrina: Yes, what kind of carbonated drinks that I put into my body. Also what foods that I eat.

Sharan: Do you ever have a time when you say, "Oh yeah, I learned about that in science class."

Sabrina: Yes. It was force. My mom and I were pushing a TV cart through a door. If we both pushed the cart it would go anywhere. But if I pushed and she pulled it would go the way she pulled." (Taped interview, March 8, Lines 2-67)

<u>Sabrina in Class</u>

As I entered Ms. Steim's classroom once again, Ms. Steim had just completed a video on sound and light, and the students were instructed to take notes on the video. Sabrina was sitting with her desk mates in the group of four desks of students in the classroom. Sabrina was not taking notes. She was listening intently and making comments as Ms. Steim was instructing the students on the activity they would conduct.

Ms. Steim gave Sabrina the "teacher's look," and she eventually adhered to proper classroom behavior. The class activity would take place at the running track surrounding the soccer field outside of the classroom. The students would compare the speed that light and sound travel. The students were eager to hit the door to go on their mini-field trip to the track at the soccer field. Ms. Steim made sure the students had the purpose, hypothesis, materials, and data table copied before the students were allowed to move.

During the second interview I had with Sabrina, I asked her to share with me her thoughts on a variety of learning situations. Sabrina reflected her thoughts of learning science information by lecture, by labs, and by doing projects.

> I wonder whether or not the teachers know what they are talking about when teachers give lectures. When teachers explain a lab or activity, I wonder whether or not I can understand what she is talking about. I also wonder whether or not I can perform the experiment or not. When I am doing a project, I wonder if I am doing it right. I also wonder if my teacher will like it or not. I want my work to reflect high school level work. I like my projects to be difficult. (Taped interview, April 25, Lines 35-48)

Sabrina asks Ms. Steim if she could help her with anything as the class walked toward the track. Ms. Steim let her hold the books and flashlight the class uses for the class activity. Sabrina was alert and cooperative. She appeared to want Ms. Steim's approval. The class excitedly performed the activity at the track. Ms. Steim clapped two books together and the sound was calculated compared to the speed the ray of light from the flashlight was observed by students a measured distance away.

Sabrina's Connection

Sabrina was a cheerleader for one of Townsend Middle School's boy's sports teams, and the condition of her fitness and health were crucial to her. Sabrina also had ambitions of pursuing a career as a professional dancer. Sabrina was a hard-working young woman with high expectations and the belief that a good education was essential for her life's successes. Her family furnished the scenes that occupied the canvas of her science understanding by providing events where Sabrina used her science literacy learning.

Sabrina connected science to many real life events in her life. As an athlete, Sabrina's health and fitness were a primary concern for her.

> I use science to take care of my body so that I can remain healthy. I have become aware of what is good to eat and what's not. I want to remain fit. (Taped interview, April 25, Lines 67-74)

Sabrina was a conscientious science student who held high expectations of her work and her work products. Sabrina was a critical thinker who had the ability to apply her science literacy knowledge to her life including events she shared with family members. Sabrina's blended family was close-knit and supportive, and she shared experiences where she applied her science knowledge to family events. Sabrina stated,

> My grandmother has a garden and I help her in it. She showed me what she was planning on planting, and I told her what type of soil she should use, where she should plant, what season she should plant, and how much she should water the plants. (Taped interview, April 25, Lines 87-92)

> My uncle races motorcycles. At the beginning of the year was his last race in Griffin. I checked his speed about how fast he was going. My uncle said to me, "You're suppose to be watching me race, and you're doing class work." (Taped interview, April 25, Lines 93-96)

<u>Differences Between Boys and Girls</u>

Sabrina understood how powerful neighborhood situations infect academic performance. In fact, her presence at Townsend was precipitated by adverse community behavior that Sabrina's mother felt Sabrina should be removed. Sabrina maintained her academic focus in the classroom observations I made of her, but Sabrina scrutinized the learning styles of boys and girls. Sabrina had specific thoughts on how boys and girls learn and how she would execute a science lesson that would effectively reach everyone.

> Girls are more serious about learning. I heard a saying once, "Girls go to college to get more knowledge, and boys go to Jupiter to get more 'stupider.'" Boys play around a lot. I would teach a lesson to both boys and girls the same way. I would start with a demonstration. I would then give examples of what was being given in the lesson. I would then give a PowerPoint and notes. The last thing I would give is a graphic organizer to organize the notes. (Taped interview, April 25, Lines 97-104)

<u>My Reflections of Sabrina</u>

The primary themes that emerged with Sabrina was the importance of her mother's involvement and Sabrina's independent determination that helped her as a learner of science literacy. Her perceptions and experiences as a learner with high expectations of "wanting to produce high school projects" (Taped interview, March 8, Lines 12-14) placed and showed her persistence. Sabrina's feeling of receiving a "fresh start" at Townsend appeared to give her the freedom to extend her academic aptitude to the limit.

Sabrina's determination to excel threaded through all of my observations of her in science literacy learning settings. Although Sabrina exhibited some off-task behaviors in the classroom, Ms. Steim relayed that, "Sabrina always does well on tests and excels on projects." Sabrina was a self-motivated student who questioned whether the teacher's lesson would take her learning to the next level. Sabrina exemplified responsibility and ownership of her learning of science literacy through experiments, projects, lecturing, and group activity work.

Sabrina worked for the approval of her science teacher when the assignments suited her perceived learning style. Sabrina's Science Fair project exceeded the majority of the students in her class and made it to the Townsend Middle School Science Fair. Sabrina was an intelligent hardworking student who wanted to succeed. Labs and experiments did not necessarily have to be fun, but they did help her "see" the important facts that are presented in a lesson. Sabrina knew the importance of education and planned to become a professional dancer or a pediatrician. She had focused her sights on success. Success included education, and Sabrina was determined to work hard to be successful. The financial enticements that her mother provided encouraged her to continue her path.

Nicole

Nicole was a vocal, energetic 13-year-old young woman. She was very talkative, and her voice preceded her physical presence in a room. Nicole was a bright and inquisitive young woman who is one of four siblings. Nicole perceived and experienced herself as a visual learner who could pick things up quickly when she saw them. She perceived and experienced herself also as an independent, hands-on learner.

Nicole considered her mother the most important and influential person in her life. Nicole stated, “My mother has shown me the meaning of family and a classy life style” (Taped interview, March 10, Lines 2-3). In her journal, Nicole had reflections that education was important to her life and was very important in her household. Education made her want to pursue her goals for her career. She frequented the library and realized that reading helped her understand things clearly. Nicole perceived and had experienced in her learning of science literacy that, “I can’t hear you talk about a lesson, but if I can see it, I can understand it” (Taped interview, April 26, Lines 9-10).

Nicole and Her Family

Nicole lived with her parents and her four siblings. Her mother played a very dominant role in her life. I had the opportunity to meet her mother after our initial telephone communication discussing Nicole’s participation in my study. Nicole’s mother was able to empathize with me in my study as she had recently successfully defended her dissertation. Nicole studied and worked independently and was eager to learn. One of Nicole's after school activities was to help her younger sister and brother with their homework. She cherished this role and wanted to be a good role model to her brother and sister.

Encountering Nicole's Science Literacy

Sharan: How do you relate science concepts to your life outside of the classroom?

Nicole: I relate science to my health and what happens to my body.

Sharan: How do you get an understanding of the science vocabulary?

Nicole: My teacher does review games to help me remember.

Sharan: What do you do when you come up to a word you don't know?

Nicole: I ask a question or try to read more about it.

Sharan: Do you ever make decisions outside of school that were based on what you learned in science?

Nicole: Yes, my career choice, where I will go to study the medical sciences.

Sharan: What are some of your favorite activities in science?

Nicole: Experiments and labs.

Sharan: Do experiments and lab activities help you learn about science information?

Nicole: Yes, when they are fun, I want to know more.

Sharan: What are some of the ways that you share your science information?

Nicole: When I do a fun experiment, I tell my friends so they'll be excited about it when they go to class.

Sharan: Do you do science activities at home?

Nicole: Sometimes.

Sharan: When learning new information in science, what is the best way for you to understand the information?

Nicole: When I ask questions and try to obtain information.

Sharan: What are some of the most memorable lessons you have learned in school?

Nicole: Experiments and labs with my 7th grade teacher. She made them fun and easy to learn.

Sharan: How did your 7th grade teacher make experiments fun and easy to learn?

Nicole: She would first show us a demonstration or tell us a story about what we were about to do. We would then have to predict the outcome of the demonstration or the story. She would tell us we were going to do an activity or a lab to see if our predictions were right. That was fun.

Sharan: Do you read the science textbook outside of school?

Nicole: Yes, during homework and maybe reading something that looks interesting.

Sharan: What makes a good reader?

Nicole: When you like to read things.

Sharan: Are you a good reader?

Nicole: Yes, absolutely.

Sharan: What makes a good writer?

Nicole: Writing things with detail and descriptiveness.

Sharan: Does being a good reader and writer help you in science?

Nicole: Yes, usually.

Sharan: Do you think girls are better readers and writers that boys?

Nicole: No, everyone has different reading and writing levels, so no one's really better than anyone else.

Sharan: Do you ever talk about science words at home?

Nicole: No, not really.

Sharan: How do you discover the meaning of words in science?

Nicole: Ask my teacher or look in the book.

Sharan: What do you do with the textbook?

Nicole: Read through the information.

Sharan: How can science be taught so that students can relate the information to real life?

Nicole: It needs to be fun and interesting to keep the students amused so they'll want to learn. (Taped interview, March 10, Lines 4-60)

Nicole in Class

I observed Nicole in class while Ms. Steim was instructing the students on their final review project. Ms. Steim was sharing with the class the concepts that would be covered for the final project. The final project would encompass force, matter, acceleration, speed, sound, light, momentum, Newton's Laws of Motion, and finally the periodic table. Ms. Steim reviewed each of these concepts and the students were to take notes about them as she spoke. Nicole was talking to her neighbors while Ms. Steim was lecturing. In her interview, Nicole reflected that lecturing was not the best way for her to learn.

> Boring!! Who wants to learn by listening? Give me visuals so that I can understand it better and more clearly. (Taped interview, April 25, Lines 5-8)

Nicole Doing Group Work

Ms. Steim's final project was a mural that groups of students would have to produce that would reproduce important facts about each of the concepts taught in the second semester of Physical Science. Nicole was eager to get to the resources Ms. Steim had availed to the students to produce their murals. Nicole immediately opened her book and began looking for information. The group decided how they were going to divide the material to manageable pieces. Nicole and her group decided their roles and their concepts and got to work on their research. They decided to portion off the mural paper to create four individual sections for each member of the group. Nicole was the materials manager in the group, and she took her job very seriously. She hoarded the materials needed for the assignment and decided who got to use what materials and for how long. The group members listened intently and abided by her directions. The mural began to take shape before I left Ms. Steim's class.

Nicole shared her thinking of when her teacher explained a lab or an activity:

> Ooooh, this will be interesting, something fun that we'll be able to learn and experiment with hands-on and visually. (Taped interview, April 25, Lines 12-15)

<u>Nicole, Labs, and Projects</u>

The Science Fair project, along with other projects assigned in science class, was weighted very heavily on the grading scale. A considerable percentage of the project assignment was the design and creating of an experiment or activity. Nicole enjoyed using her imagination in her science assignments. She stated, "Projects are sooo fun. I love coming up with creative experiments" (Taped interview, April 25, Line 16).

The Science Fair project allowed Nicole the opportunity to design and create an experiment that appealed to her sense of curiosity and concern. The title of her Science Fair project was "Which brand of battery lasts the longest?"

<u>Nicole as the Teacher</u>

Nicole considered herself a shy person with the ability to learn things quickly when the material was presented to her visually and with a connection to a hands-on activity. Several assignments allowed her to employ her perceived and experienced science literacy talents in presenting lessons for her class. The lessons were guided by the curriculum, but the presentation of the material was limitless. Nicole's chapter presentations were based on her ideal lesson. Ms. Steim commented that Nicole's presentation was very creative and her lesson included an activity that employed the participation of the class. Ms. Steim included that her lesson was very well thought out and carried out with confidence. Nicole shared her ideal science lesson.

> The best way to teach a lesson is by an experiment. Give step-by-step instruction and go through that step-by-step. I would then give a

> PowerPoint and have the students take notes. I would explain any questions the students may have. (Taped interview, April 25, Lines 18-24)

Nicole's Connection

Nicole had seen how medicine had been very influential in her family's life. Through the observations of doctor's visits with one of her siblings, Nicole has made mental notes of the advantages science can provide. In Nicole's younger years, she had witnessed how physical afflictions affected her family members' quality of life. From these observations, she had formulated a series of life pronouncements.

> I am interested in health sciences. I am very interested in diseases of the ears. When my brother was born he had complications with his ears. He also had bowels problem something wrong with his stool. He had to have his ears fixed. We went to an audiologist during one summer. I saw that there were not many Black people in that field. I feel I will have a good chance in that field. Another instance of interest in science is my cousin can't talk because my aunt smoked during her pregnancy. I thought it through. I know a lot of people my age want to be basketball players. I wanted to be a singer, but I'm very shy, so I had to pick something else. (Taped interview, April 25, Lines 65-80)
>
> I use what I learn in science to make decisions about my health. I want to remain healthy in my life. I want to know what is healthy for me to eat. I like the celebrity Beyonce. She makes me want to improve my shape. I have to know what is good for me and what isn't, and about exercising. (Taped interview, April 25,, Lines 96-102)

My Reflections of Nicole

The primary theme that emerged with Nicole was her perception and experience of herself as a quick visual and hands-on learner of science literacy. Her perceptions and experiences as a visual and hands-on learner permeated her attitudes in her learning of science literacy. Nicole was very enthusiastic when Ms. Steim assigned an experiment, hands-on activity, or a project to the class. Nicole's intermittent off task behavior did not dissuade her concentration and success implementing classroom tasks. Ms. Steim reported that Nicole was an excellent student who tested well and who produced wonderful science products.

Nicole's familial influence in her perceptions and experiences as a learner of science literacy was comprehensive in her undertaking science concept tasks. Nicole has shared that familial physical maladies have contributed to her success in science labs, projects, and group activities. Her enthusiasm for participating in labs, hands-on activities, and projects stems from her curiosity in investigating and finding conclusions in scientific quandaries.

Nicole's family's interest and concerns catalyzed her science academic endeavors and pursuits. She observed the conditions of society and considered where she fit in and where she could contribute comfortably. Nicole's clarity of perceptions and experiences as a learner of science literacy had an effect on her learning of science literacy. Nicole did not internalize or take ownership of her learning when lectured. Instead, she made the lesson hers when she was able to be involved in the lesson. When Nicole was able to design and create an experiment or become involved in an activity with a lesson, she was able to take responsibility for her learning and succeed.

Summary

In this chapter, I have presented the results of my investigation. My participants were four African American female eight-grade students who volunteered to discuss their perceptions and experiences of themselves as learners of science literacy. Data were collected through a questionnaire, multiple semi-structured interviews, a group interview, student reflective journals, and my observations of the students in their science classes. Although these young women came from similar socioeconomic backgrounds and attended school in the same educational environment, I discovered unique characteristics of each related to their relationships with science literacy. I also found several common themes, and these I discuss in Chapter 5.

CHAPTER 5

DISCUSSION AND CONCLUSIONS

The purpose of this study was to investigate African American eighth-grade female students' perceptions and experiences as learners of science literacy. I sought to identify what those perceptions and experiences were and to find out how those perceptions and experiences did or did not influence the students' learning of science literacy.

I used qualitative methods to address the research questions. Four case studies were conducted involving four African American eighth-grade female students (Karen, Latoi, Sabrina, & Nicole). The recorded responses regarding the participants' learning, science literacy, and literacy practices in science gleaned from the student's questionnaire (Appendix C) were extremely valuable to me when planning the interview questions and journal entries for the participants. As the observations and data collection progressed, I adjusted the second interview questions with the goal of recording the full range of the perceptions and experiences of the participants as learners of science literacy. Knowing the perceptions and experiences of each participant allowed me to tailor questions for them and to capitalize on the limited amount of time spent observing and recording them as learners of science literacy.

Limitations were present in this study that limited sampling possibilities and sampling procedures. This qualitative study was conducted with volunteer participants and these participants were all students in one classroom that limited the possibility of the range of students…one classroom - one setting. The four participants were from affluent homes surrounding the middle school where the study was conducted, and the participants were all academically above average. An additional qualifier to the study was the gender and ethnicity of the participants and the researcher which were African American females. The intent of this study was to record and broadcast the perceptions and experiences of four volunteer eighth-grade African American participants in their learning of science literacy. The qualifiers of the gender and ethnicity of the study clearly limit the generalizability of the study. The sampling of the volunteer participants was purposeful and the results of this study are specific to the participants and the areas of science literacy concerns to the population to which it was designed African American eighth-grade female students.

In the remainder of this chapter, I present a discussion of three themes that occurred in each of the four case studies. Subsequently, I describe how I used triangulation as part of establishing the trustworthiness of my findings. Finally, I provide a summary along with recommendations for further study, and I describe implications of this research for educators.

Cross-Case Themes

The four African American eighth-grade female students involved in the case studies demonstrated that the perceptions and experiences of the participants as learners of science literacy positively influence the learning of science literacy. Karen, Latoi, Sabrina, and Nicole each had her perceptions and experiences as learners of science literacy that were comprised of (a) real life connections to science concepts, (b) family influences, and (c) the enjoyment of “doing” science through labs, projects, and group activities. The participants' perceptions and experiences as learners of science literacy have positively influenced the learning of science literacy of the four African American eighth-grade female students. Each of the three themes is discussed in detail below.

Real-Life Connections

Karen, Latoi, Sabrina, and Nicole individually connected various science concepts to events in their lives for true understanding. The findings of the students' making a connection of their lives to presented science concepts reinforces existing research compiled by the American Association for the Advancement of Science (AAAS).

> People have to construct their own meaning regardless of how clearly teachers or books tell them things. Mostly, a person does this by connecting new information and concepts to what he or she already believes. Concepts—the essential units of human thought—that do not have multiple links with how a student thinks about the world are not likely to be remembered or useful. Or, if they do remain in memory, they will be tucked away in a drawer labeled, say, "biology course, 1995," and will not be available to affect thoughts about any other aspect of the world" (AAAS, 1997, p. 197).

Sabrina and Nicole strongly connected their lives to the science concepts encountered in their academic careers. Sabrina relayed her understanding of certain earth science concepts by connecting them to the act of gardening with her grandmother (Taped interview, April 25, Lines 23-25). Sabrina also shared her understanding of the physical science concept of speed by sharing the time she went with her uncle's motorcycle racing where she timed his race (Taped interview, March 8, Lines 13-15), and she applied the science concepts of health and fitness to her perpetuation of her health by regulating her eating habits and maintaining bodily fitness. Nicole's resonation of her connections to science concepts occurred through witnessing the maladies of her brother. She connected her career pursuit to her sibling's related medical challenges. (Journal entry, April 6, Lines 4-10).

Karen employed her connection of learning science literacy to an abstract idea for science concept understanding. Karen connected the concept of speed with the image of Albert Einstein riding on a bicycle traveling down a hill (Journal entry, April 4, Lines 3-7). The AAAS (1997) shared, "Effective learning often requires more than just making multiple connections of new ideas to old ones; it sometimes requires that people restructure their thinking radically" (p. 198).

Similarly, Latoi developed a genuine concern for AIDS research through conversation with her grandmother. The conversation was pivotal in Latoi's connection of science concepts and real life, strengthening her science literacy.

The National Research Council stated, "Students come to the classroom with preconceptions about how the world works. If their initial understanding is not engaged, they may fail to grasp the new concepts and information that are taught, or they may learn them for purposes of a test but revert to their preconceptions outside the classroom" (NRC, 1999, p. 43). Teachers of science must draw out and work with pre-existing understandings that students bring with them. According to AAAS (1997),

> To incorporate some new idea, learners must change the connections among the things they already know, or even discard some long-held beliefs about the world. The alternatives to the necessary restructuring are to distort the new information to fit their old ideas or to reject the new information entirely. Students come to school with their own ideas, some correct and some not, about almost every topic they are likely to encounter. If their intuition and misconceptions are ignored or dismissed out of hand, their original beliefs are likely to win out in the long run, even though they may give the test answers their teachers want (p. 200).

Strong Parental Support

The second theme in this study is the familial influence that positively affected the participants during studying for tests, the production of projects, and the connections made to science content. Grissmer, Kirby, Berends, and Williamson (1994) found that the single most important factor influencing African American student achievement was parents' education. They reported that changes in the characteristics of families, notably a dramatic increase in the education levels of African-American mothers and smaller family size, account for about one-third of the gains in achievement made by African American youths. Grissmer et al. (1994) reported that students with one or two college-educated parents performed significantly better than students whose parents were not high school graduates. They also found that family size and income were significant in effecting student achievement.

> A student with one sibling could be expected to do better than a student with four siblings, whereas a student whose family earned $40,000 could be expected to outperform one whose family earned only $15,000. Likewise, a child born to an older mother is likely to score higher than one born to a younger mother (p. 27).

The study I conducted included young women of two-parent homes, including natural and blended families. The median household income ranged from approximately $40,000 to $100,000. The mothers were all college educated. The participants were determined, focused, and creative young women, who academically performed well and were eager participants in classroom activities. Their perceptions and experiences as learners of science literacy would support the data gathered by Grissmer et al. (1994).

Additional research from the AAAS (1997) indicated that children learn from their parents, siblings, other relatives, peers, and adult authority figures, as well as from teachers. Students also learn from movies, television, radio, records, trade books and magazines, home computers, and from going to museums and zoos, parties, club meetings, rock concerts, and sports events, as well as from schoolbooks and the school environment in general. The AAAS stated,

> Science teachers should exploit the rich resources of the larger community and involve parents and other concerned adults in useful ways. It is also important for teachers to recognize that some of what their students learn informally is wrong, incomplete, poorly understood, or misunderstood, but that formal education can help students to restructure that knowledge and acquire new knowledge. (p. 201)

Karen, Latoi, Sabrina, and Nicole all mentioned that either their mother or grandmother was the most influential person in their lives. (Taped interview, March 2, 6, 8, 10 (respectively), Lines 19, 12, 40, 32 (respectively). This connection is vital to the young women participants of this study. This is an area where further investigation is required in the science literacy research field.

<u>Instructional Strategies</u>

Group work, designing projects, conducting labs, and performing class activities were entertaining and constructive for Karen, Latoi, Sabrina and Nicole. The researched data indicated that the participant's learning goal was to understand the science concepts presented in every learning situation. Each participant's ability to work in groups provided her peer assistance in grasping concepts essential to science understanding and mastery when she was conceptually unsure.

Karen became the observed leader in her group during the collaborative effort in the classroom. She assessed the educational challenge presented to the group and delegated duties to her peers. The requests Karen presented went unchallenged, so her colleagues respected her academic acumen in the group. She identified the resource materials that were required for the assignment and the organization she outlined to accomplish the assignment.

I observed that Sabrina's science literacy understanding was manifested through her production of high quality academic products and by scoring well on tests. Her performing labs or experiments in class strengthened her confidence in her perceptions and experiences as a learner of science literacy.

Latoi gleaned the concept of viscosity through the design and creation of her Science Fair project. The research she conducted for the project, and the experiment she designed appeared to relay the information to her long-term memory. Each referral to a lesson she would teach or prepare was based on viscosity, the topic of her Science Fair project.

Nicole perceived herself as a quick, visual, and hands-on learner. She became motivated when designing and performing science experiments and projects, but her personal connections were made to science concepts through family interactions. Nicole encountered an assortment of familial medical woes and used these occurences to shape her decisions for her future. She carefully scrutinized her view of her world and conscientiously made career selections that would maximize her societal contributions.

A theme that thread across the case studies was the positive influence of hands-on activities in the participants' science literacy understanding. Each of the participants established in her ideal lessons a component with a lab or experiment to involve the students with the lesson. The hands-on classroom experiences allowed the participants to take ownership and responsibility for their science learning, and they recognized the prominence of active learning in their science literacy understanding.

Figure 2 illustrates the participants' classroom learning situations that led to an increased perceived and experienced learning of science literacy. Ms. Steim's teaching techniques of lecture, video, group work, and lastly doing or designing project are represented from lower to higher participant interest that led to an increase in the participants' perceptions and experiences as learners of science literacy.

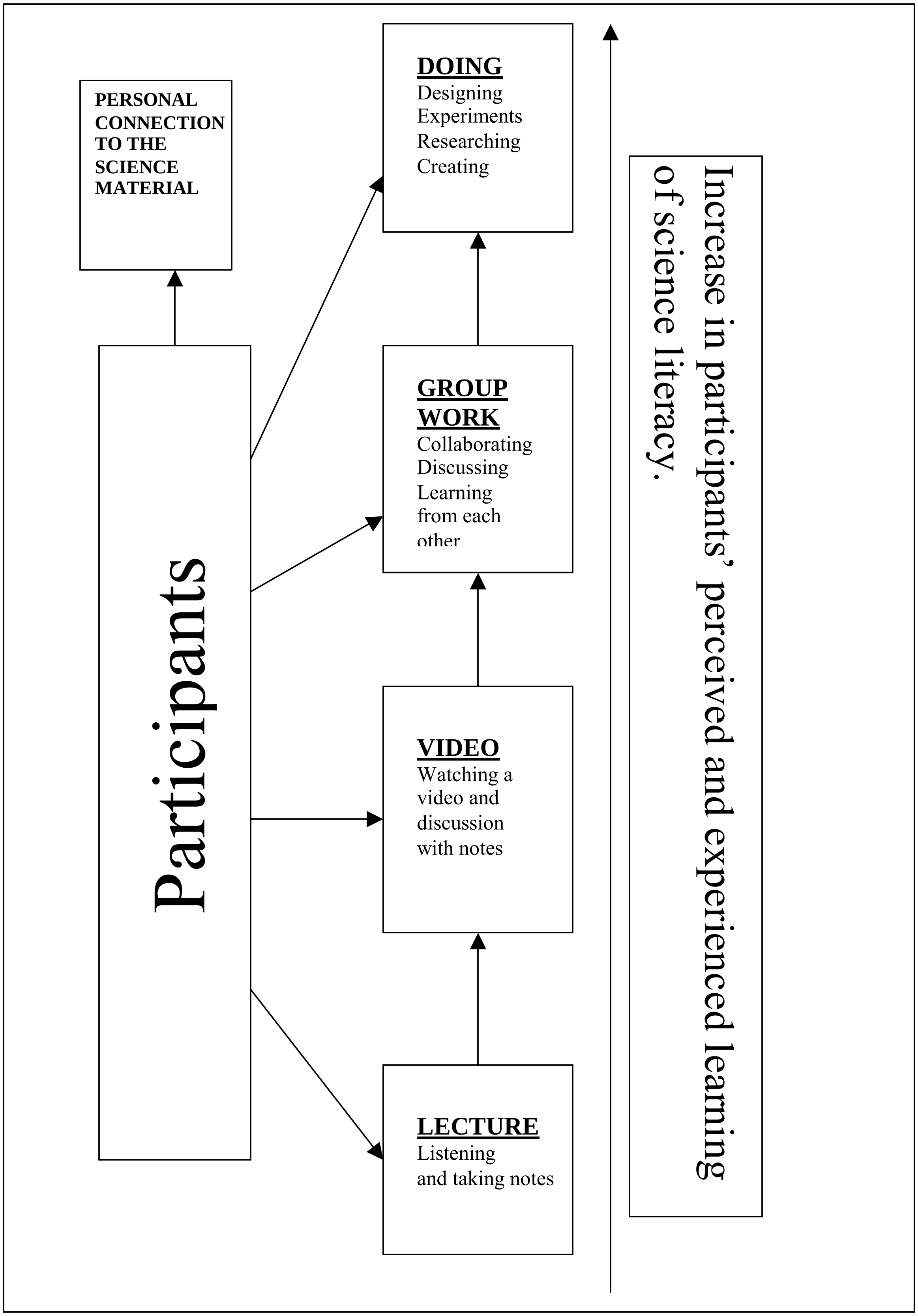

Figure 2. Increase in participants' perceived and experienced learning of science literacy.

My findings of the participants' increased perceived and experienced learning of science literacy through creating, designing, and researching science concepts by engaging in labs, group activities and projects is well documented in science literacy research. The AAAS (1997) reported,

> Students need to have many and varied opportunities for collecting, sorting and cataloging; observing, note taking and sketching; interviewing, polling, and surveying; and using hand lenses, microscopes, thermometers, cameras, and other common instruments (p. 199).

Ms. Steim included in her lessons (see Appendixes G–K) a creativity component to allow the students to employ their imaginations within the constraints of directions to create products of the assignments through group activities, labs, and projects to connect the science concepts to the students' lives. Latoi referred to the viscosity topic of her Science Fair project as the basis of her ideal science lesson. (Journal entry, April 10, Lines 45–60), and Sabrina excelled in her preparation and presentation of her Science Fair project, by producing a medal-winning product. (Journal entry, April 4, Lines 30–33) Nicole excitedly exclaimed, "Oooo, I love designing creative experiments" (Taped interview, April 26, Line 31).

Ms. Steim's active learning teaching techniques maximized the participants' imaginations and creativity by facilitating collaborative group work, designing of projects, and hands-on activities. The AAAS supported students' actively learning science concepts by using their imaginations and creativity that scientists, mathematicians, and engineers prize in their fields. The creative use of imagination and the science classroom should be synonymous with science teacher's lesson preparation and students' activities in the classroom. In science classrooms, it should be the normal practice for teachers to raise critical thinking questions such as, "How do we know?"

"What is the evidence?" "What is the argument that interprets the evidence?" "Are there alternative explanations or other ways of solving the problem that could be better?"

> Thus, science teachers should encourage students to raise questions about the material being studied, help them learn to frame their questions clearly enough to begin to search for answers, suggest to them productive ways for finding answers, and reward those who raise and then pursue unusual but relevant questions. In the science classroom, wondering should be as highly valued as knowing (AAAS, 1997, p. 200).

Ms. Steim's lesson foundations appeared steeped in the tenets of social constructivist theory where the students were able to construct their knowledge through social interactions with each other, the science material, and the teacher. Ms. Steim prepared lessons that were inquiry based, that involved movement, curiosity, research, and discovery. The lessons that I observed in Ms. Steim's class, such as the pendulum building, the mural project, and the sound and light discovery, all posed questions of science concept discovery for the students to solve. She facilitated the learning of the science concepts for the participants by setting the lessons in active inquiry for the students to research, collaborate, conclude, and present. The students were able to move around the classroom during group work and actually walk to the soccer field and track to solve the speed of light and sound. The students were able to use the computers in the classroom and art supplies and additional resources to resolve the questions posed by Ms. Steim's lessons. Ms. Steim's confident mastery of her teaching craft allowed her to switch to facilitator when assigning labs, projects, and group activities. This empowered the participants to explore, create, design, and connect science concepts to their world.

Research of the recognition and use of student's prior knowledge in the learning environment in the classroom is reported in the field of education, but there is an indication of the need of further research conducted in the area of student's content concept connection to their life in the home environment for science understanding.

Triangulation of Findings

The purpose of this study was to explore and analyze if and how the perceptions and experiences of four African American eighth-grade female students affected their learning of science literacy. First, the project involved discovery through a questionnaire investigation of the learning, science literacy, and literacy in science learning of four eighth-grade African American participants who volunteered for this research project study. Second, an initial analysis of the data from the questionnaire supplied a semi-structured interview inquiry by the researcher in which the participants responded to specific questions investigating their perceptions and experiences as learners of science literacy. After this initial analysis was completed, the following strategies were employed: triangulation by observation, peer debriefing, and member checking. These allowed me to triangulate with a different observer and to engage in peer debriefing. Participants' reflective journal entries, a second semi-structured interview, and classroom observations provided additional data for collection and analysis. Finally, the researcher analyzed the findings that were uncovered from the initial analysis, the findings that were uncovered in the second analysis as well as the overall findings that were uncovered after engaging in all five of the strategies aimed at increasing trustworthiness.

Through qualitative data collection and analysis through case studies, I concluded that the four young women's perceptions and experiences positively influenced them as learners of science literacy. In addition, as I reviewed the transcripts, journals, and researcher's log, the data indicated that the participants' perceptions and experiences as learners of science literacy positively contributed to their participation in labs, projects, and group activities. During lectures or video presentations, the participants were presented the concepts of the lessons through the teacher's masterful teaching strategies and techniques. The participants' perceptions and experiences as visual and hands-on learners of science literacy were positively affected as they accessed the information the teacher presented and prepared whatever assignment the teacher assigned to them to Ms. Steim's satisfaction.

Summary and Recommendations for Further Study

The results of this study suggest that various factors contributed to the perceptions and experiences of African American eighth-grade female students as learners of science literacy. Additionally, the results suggest that the perceptions and experiences of African American eighth-grade female students encouragingly affect their learning of science literacy. Findings from the case studies indicated that each of the participants was positively affected by being able to make real-life connections to science concepts, by strong parental support, and by engaging in learning activities, such as group work and independent projects, that involved hands-on experiences and inquiry. Environment, motivation, learning ability, general interest in the content, and a desire to please the teacher also influenced the participants' perceptions and experiences as learners of science literacy.

Through the learning techniques, I observed in the classroom and those the participants described, the participants were able to contribute actively to their science literacy learning, allowing them to understand visually as well as tactilely the science lesson. Each participant perceived and experienced herself as visual and hands-on learners of science literacy. Ms. Steim's active learning teaching techniques maximized the learning strengths of each participant by allowing them to create, design, and research science topics that related to their learning and their lives.

The experiences and learning reinforcements differed for each participant. Karen, Latoi, Sabrina, and Nicole each had strong female figures in their lives who reinforced them to achieve academically. Karen's academic reinforcement stemmed from the fear of punishment, and Latoi's academic reinforcement came from sibling responsibility and her mother's persistence in daily hard work for success. Sabrina's reception of monetary rewards positively reinforced her determination for academic success, and Nicole's mother's example of style and class presented a model from which Nicole took her academic stance.

Now that I have identified three strong influences on these students' perceptions and experiences as learners of science literacy, I encourage researchers to investigate these themes further to clarify their influences and delimitations. For instance, researchers might look to how teachers and parents can facilitate students' making real-life connections to scientific concepts if they do not do so on their own. The young women in my study were strongly influenced by their mothers, suggesting another avenue for future research. The mothers of the students in my study were college-educated, so a study involving young women whose mother's had less educational preparation might produce different results. Additionally, only one of my participants mentioned her father as influential in her science literacy learning. I recommend further study into the relationship between fathers and daughters in an educational context. Also, I recommend further investigation of the effectiveness of instructional strategies, such as group work, projects, and hands-on activities, as well as an exploration of the effectiveness of teacher preparation programs that include instruction in such strategies. Finally, the results that I have collected lend themselves to the creation of a survey that could be used to collect quantitative data to identify the prevalence of the characteristics exhibited by the participants in my study.

Implications for Educators

The results of this study have implications for the practice of science literacy learning for science educators, math literacy for math educators, language arts literacy for language arts educators, and social studies literacy for social studies educators. The data collected relative to the perceptions and experiences of the young women as learners of science literacy may provide educators with additional information on providing activities and teaching strategies that would provide the learner the mechanisms to maximize the science literacy learning of eighth-grade female African American students. Findings in this study indicated that hands-on activities; creating, designing, and researching projects; and conducting labs and experiments were teaching strategies that actively involved the participants and positively influenced their science literacy learning and understanding.

I suggest that science literacy and all content literacy teaching and learning experiences include hands-on activities, creatively designing experiments, projects, or reports, staff development for teachers in the area of active learning. Educators can benefit from the study’s findings of the mother’s involvement in the study process that strengthen the connection the student made to the content material.

The enjoyment of actively performing classroom activities for understanding, and the influence of family involvement in science learning have implications for classroom teachers, curriculum planners, and staff developers. Colleges of Teacher Education might include in their curriculum courses that recognize the crucial links of parental communication, of inquiry and project-based learning, and home environment.

During a teaching day, classroom teachers have a tendency to interact only with the persona of the student who enter through their doors. The new philosophy of teaching the "whole student" is tremendously relevant to the results of this study. The student includes a composition of her experiences, environment, and inherent learning abilities. Educators must design their lessons so that the many facets of the whole student are addressed, not just the physical three-dimensional student who crosses the classroom threshold. Throughout the energy laden busy-ness of the school year, teacher's communication with parents becomes relegated to misbehaviors or undone assignments. Educators must do a better job of maintaining communication with the students' families, especially with the mothers or grandmothers of female students, to provide a clear academic playing ground on which to manage strategic success from every vantage point. Educators must develop an avenue in which to involve more fathers, grandfathers, and uncles in the educational process of their students for content learning and understanding. As a science educator, I know the difficulties and the challenges a school year possesses, and the thought of doing one more thing begins to sway the balance. We, as educators, owe it to ourselves to receive all the help we can get in educating our future by using the family as a hugely viable and available source of commitment and strength that educators must partner.

This study revealed obstacles that prevented some students' success as learners of science literacy. The preconceived ideas that students bring to the content literacy they encounter in class may serve to help or hinder the student in class. Researched and creative lesson planning through staff development with teaching strategies such as active learning, can aid educators in formulating lessons to address many areas of the whole student thereby creating a content literate student. Not all science literacy educators are as nimble as Ms. Steim in her teaching strategies and abilities. Staff development of active learning strategies are in need to enhance the teaching repertoire of new and experienced teachers to create learning environments where students are actively, creatively, independently or collectively connecting the concepts to their lives for greater understanding.

Preservice classroom teachers should experience and compile lessons that incorporate the student as an active learner in the lesson. They must assuredly be paired with a mentor teacher who employs teaching techniques that maximize the connection of the learning concept and the student's lives. Educators must plan lessons that encourage student movement, student shared learning through group activities, projects, and investigation permitting students to take responsibility and ownership of their content area literacy learning by providing an active connection to the lessons. Preservice teacher preparation by colleges of education that continue to support content area literacy and active learning pedagogy further equip preservice teachers as they emerge into classroom educators to encourage literacy expression in their students. In-service teachers should take advantage of professional development opportunities centered on providing more real life activities, additional literacy materials, and projects to capitalize on student interest.

Educational workshops sponsored by the school or the school system detailing the importance of parental involvement need to be created. Educators make phone calls home for recurring academic or behavioral issues. A parental liaison needs to be aligned in every school whose job description includes developing programs or workshops that inform the parents or guardians of the importance of parental involvement in their student's academic life. If parents work at night or during the day, the workshops need to be flexible enough to meet the timing needs of the parent.

Finally, as educators, we must believe that each student is a sum of the academic gifts she has inherited, the motivation her environment has molded, the adaptable parents she has, and the teaching abilities we employ to connect to the brilliance and genius that may lie dormant within each student. Educators have the capability to catalyze the science literacy learning and understanding of each student with rigorous planning, and challenging teaching strategies to intrigue, entice, and interest the whole students who enter our classrooms.

It is my hope that science educators will take an active role in encouraging positive perceptions and experiences as learners of science literacy and the development of multiple facets of science literacy in their students. I also hope that my colleagues in science literacy education and all content area literacy education find the possibilities of this study encouraging. This study will join the growing body of research related to the positive effects of the perceptions and experiences of female eighth-grade African American students as learners of science literacy has on the learning of science literacy.

Ultimately, I am optimistic that this research will lead more parents, teachers, and professional developers to understand that eighth-grade African American female students' perceptions and experiences as learners positively influence their learning of science literacy and have merit for further investigation.

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APPENDICES

Appendix A

Georgia State University
Department of Middle, Secondary, and Instructional Technology
Participant Assent Form

Title: African American Eighth-grade Female Students' Perceptions and Experiences as Learners of Science Literacy.

Principal Investigator: Dr. Mary Penelope Deming
Student Principal Investigator: Sharan R. Crim

You are being asked to volunteer along with three other African American eighth-grade female students to:

a. complete a 20 minute questionnaire asking about your science ideas and how they relate to your life outside the class
b. participate in a one 30 minute audio taped group interview with three other African American eighth-grade female participants based on your responses of the questionnaire
c. write your perceptions and experiences of science lessons and activities in a reflective journal twice a month that will take 10 minutes to complete
d. participate in one 30 minute audio taped individual interview to get any clarification of your experiences and perceptions of learning science literacy
e. participate in four 30 minute monthly debriefing sessions for clarification of any issues of the study and share logged (journal) responses.

These research activities will take place during lunch time in the classroom of the researcher, so they will not interfere with your instructional day. The study will begin in January and end in April. You will not be identified by name or face in the study. Any other facts that might point to you will not appear when we present this study or publish its results. The audio tapes used during the interview will be transcribed, and you will be assigned another name to maintain your anonymity. You will not be identified personally. All information gathered will be secured at the home office of the researcher in individual notebooks.

You will be compensated for participating in this study by receiving a ticket to the Aquarium. The results of this study may not help you directly, but it may lead to a better understanding of African American female eighth-grade students' perceptions and experiences as learners of science literacy and help to improve science instruction.

You may refuse to participate in this study. You may decide to be in the study and change your mind. You have the right to drop out at any time without losing any benefits.

You may skip questions or discontinue participation at any time. Whatever you decide, you will not lose any benefits to which you are otherwise entitled.

Call the researcher, Sharan R. Crim at 404-819-7675 or crim@fulton.k12.ga.us or Dr. Mary P. Deming at 404-651-2510 or mdeming@gsu.edu if you have any questions about this study. If you have questions or concerns about your rights as a participant in this research study, you may contact Susan Vogtner in the Office of Research Integrity at 404-463-0674 or svogtner1@gsu.edu.

We will give you a copy of this assent form to keep.

If you are willing to volunteer for this research, please sign below.

Participant	Date
Parent or Legal Guardian	Date
Principal Investigator	Date

Appendix B

Georgia State University
Department of Middle, Secondary, and Instructional Technology
Parent Consent Form

Title: African American Eighth-grade Female Students' Perceptions and Experiences as Learners of Science Literacy.

Principal Investigator: Dr. Mary Penelope Deming
Student Principal Investigator: Sharan R. Crim

My name is Sharan R. Crim and I am an eighth-grade science teacher at Sandtown Middle School. Currently, I am also a doctoral student in Teaching and Learning concentrating in Language and Literacy at Georgia State University. As part of the fulfillment of my degree, it is necessary that I complete a research study project.

The purpose of this research study is to understand African American eighth-grade female students' perceptions and experiences about learning science literacy. Science literacy includes a person's ability to:

a. use scientific words appropriately and adequately
b. relate information and experiences to the ideas of science
c. understand the procedures and processes that make science a unique way of knowing
d. develop perspectives of science and technology and the roles these play in their personal life and society.

Your daughter is being asked to volunteer along with three other African American eighth-grade female students to:

a. complete a 20 minute questionnaire asking about her science ideas and how they relate to her life outside the class
b. participate in a one 30 minute audio taped group interview with three other African American eighth-grade female participants based on their responses of the questionnaire
c. write her perceptions and experiences of science lessons and activities in a reflective journal twice a month that will take 10 minutes to complete
d. participate in one 30 minute audio taped individual interview to get any clarification of her experiences and perceptions of learning science literacy
e. participate in four 30 minute monthly debriefing sessions for clarification of any issues of the study and share logged (journal) responses.

These research activities will take place during lunch time in the classroom of the researcher, so they will not interfere with your daughter's instructional day. The study will begin in January and end in April. Your daughter will not be identified by name or face in the study. Any other facts that might point to your daughter will not appear when we present this study or publish its results. The audio tapes used during the interview, will be transcribed, and your daughter will be assigned another name to maintain her anonymity. She will not be identified personally. All information gathered will be secured at the home office of the researcher in individual coded notebooks.

Your daughter will be compensated for participating in this study by receiving a ticket to the Aquarium. The results of this study may not help your student directly, but it may lead to a better understanding of African American female eighth-grade students' perceptions and experiences as learners of science literacy and help to improve science instruction.

You may refuse to allow your daughter to participate in this study. You may decide to let your daughter be in the study and change your mind. She has the right to drop out at any time without losing any benefits. She may skip questions or discontinue participation at any time. Whatever you decide, she will not lose any benefits to which she is otherwise entitled.

Call Dr. Mary P. Deming at 404-651-2510 or mdeming@gsu.edu if you have any questions about this study. If you have questions or concerns about your daughter's rights as a participant in this research study, you may contact Susan Vogtner in the Office of Research Integrity at 404-463-0674 or svogtner1@gsu.edu

We will give you a copy of this consent form to keep.

If you are willing to allow your daughter to volunteer for this research, please sign below.

______________________________________ _______________

Participant Date

______________________________________ _______________

Parent or Legal Guardian Date

______________________________________ _______________

Principal Investigator Date

______________________________________ _______________

Appendix C

Student Questionnaire

Please read the questions and place a check in the box that most applies to you.	No Way Not Me	Sometimes	Usually	Absolutely
1. The science I learn in school is useful in my everyday life.			2	2
2. The science I learn in school deals with things I am concerned about.		3		1
3. The science I learn in school helps me make decisions about my health		1	2	1
4. The science I learn in school helps me understand things that happen in the world.		3		1
5. I like to do science related activities outside of school.		2	1	1
6. The science I learn in school I remember from year to year.		1	3	
7. Science helps me relate to my friends.	1	3		
8. Science activities help me understand the vocabulary and information.			1	3
9. Performing labs and experiments help me understand the science information we learn in class.			2	2
10. Using the textbook and worksheets are easy for me to learn science information.	1	2	1	
11. Learning science helps me make more observations of life.		1	2	1
12. After learning something in science, I go home and show my family.	1	2	1	
13. I like to read outside books in science.		2	1	1
14. When I learn something in science, I read outside books on what I learned.	2	2		
15. I look in magazines and newspapers for science items.	3	1		
16. I like to look at science videos and shows like the Discovery Channel.		3		1
17. I talk to my friends about science lessons.	1	3		
18. I make up my own science experiments at home.	2	1	1	
19. I would like to pursue a career in science.			1	3
20. I like learning new science information on my own.		2	1	1

The numbers represent the number of participants who responded accordingly to the question.

Adapted from:
Learner Type Questionnaire
Hood, O. J., Jr., (1991). *Prior knowledge: Its content and sources in a sixth-grade science class* [doctoral dissertation]. Georgia State University, Atlanta.

Appendix D

First Interview Questions

Learning – How Do You Learn?

1. What are some of the most memorable lessons you have learned in school? What made them memorable?
2. How do you know when you know science?
3. What are some of your favorite activities in science?
4. When learning new information in science, what is the best way for you to understand the information?
5. Do experiments and activities help you learn about science information? How?
6. What are some of the ways that you share your information of science?
7. Do you do science activities at home?
8. Do you like working in groups in science class?
9. Do you go to the zoo? Or other science museums?

Science Literacy – Relating Science to Real Life

1. How does science fit in to your life outside of school?
2. Do you ever have a time when you say "Oh yeah, we learned about that in science class?" What was it? and What happened?
3. Do you ever make decisions outside of school that were based on what you learned in science? What was it?
4. Do you ever use the information learned in science class at home?
5. How do you relate the science concepts to your life outside of the classroom? or do you?
6. Do you think science is hard?
7. How can science be taught so that students can relate the information to real life?

Literacy Practices in Science – Reading, Writing, Vocabulary

1. Do you read the science textbook outside of school? (During homework?) Why or why not?
2. Do read magazines, science fiction, or poetry?
3. Do you use writing in science? How? When? What kind?
4. How do you get an understanding of the science vocabulary?
5. What do you do when you come up to a word you don't know?
6. What makes a good reader? Are you a good reader? Does this help you learning science?
7. What makes a good writer? Are you a good writer? Does this help you in science?
8. Do you think girls are better readers than boys? Why or why not?
9. Do you think girls are better writers than boys? Why or why not?

10. Do you ever talk about science words at home?
11. How do you discover the meaning of words in science?
12. What do you do with the textbook?

Appendix E

Second Interview Questions

1. When your science teacher gives a lesson by lecturing… What goes through your mind?

2. When your science teacher explains a lab, or an experiment, or an activity…What goes through your mind?

3. When you are working on a science fair project…What goes through your mind?

4. Which science lesson stays with you? Why those?

5. Why do you learn science?

6. Do you ever have an, "Oh, yeah!!! I learned about that in science class!" moment outside of school?

Learning – How Do You Learn?

1. Describe the best way for you to learn new science information? Is it by a power point presentation? Is it by lecture? Is it by reading an article? Explain.
2. Describe learning the perfect science lesson. Describe what it would look like step by step.

Science Literacy – Relating Science to Real Life

1. Describe how you use what you have learned in science to make decisions in your life outside of school.
2. Describe other instances when you use science to make decisions for you outside of school.

Literacy Practices in Science – Reading, Writing, Vocabulary

1. Describe how you become familiar with new science vocabulary words.
2. Describe you would have teachers teach you new science terms and concepts.
3. Describe the best way to use the science textbook.

Appendix F

Journal Entries

Learning – How do you learn?

1. What is science to you?
2. Do you ever learn anything in science that concerns you in everyday life? Share some examples.
3. How do you know when you are learning science?
4. Describe a science lesson in which you learned the best.

Science Literacy – Relating Science to real Life

1. How is science important to you in everyday life?
2. Do you ever relate anything you have learned in science to your real life? How? Why?
3. Do you ever make a decision in your life that was based on something you learned in science?
4. Do you ever go to Fernbank, Discovery Store, Georgia Aquarium, or Six Flags and say, “Oh, yeah!! I learned about that in science class?”

Literacy Practices in Science – Reading, Writing, and Vocabulary

1. Do you read anything dealing with science for your own enjoyment?
2. What do you do with the textbook?
3. Are you a good reader? Does that help you in learning science? How?
4. Are you a good writer? Does that help you in learning science? How?

Appendix G

Ms. K. Steim's Mural Project

Physical Science Mural Project

This will be your final performance assessment, in lieu of a formal Science Final.

Materials

Students will use markers, crayons, paint, and butcher paper.

Activity

Part 1: Concept Analysis:

Student questions:

1. What are the main concepts we studied this year? (All Units not just the recent study of Matter and the Periodic Table of Elements)
2. What are the other terms or ideas from this year that you feel are important? Try to limit the number to fewer than twenty, but more than fifteen.

Complete a concept map that shows the relationships between these concepts. Bring the concept map to your teacher for an "OK" before you continue. All group members will attach okayed concept map to completed project. The initial concept maps are an individual assignment and will be worth 50 points.

Part 2: Mural Construction:

On a 4-6 foot piece of mural paper, which I will furnish, your group will design a mural illustrating the concepts that you have found to be important this year.

1. You are to show a relationship between the concepts of you choose using drawings and a minimum of words.
2. A topic from each group member's concept map must be included.
3. Your grade will be determined by the following criteria: accuracy of concept relationships, use of space on the mural paper, creativity in expression, the amount of contribution that you make to the group effort, scientific accuracy, and punctuality in meeting the project deadline.
4. You may work with up to three others in a group. You will complete a peer evaluation form assessing your contribution to the group as well as the other group members' contribution.

Assessment: Students will be evaluated using the rubric provided.

Appendix H

Ms. K. Steim's Mural Rubric

Physical Science Mural Rubric

Please read the criteria for each point value to determine what level of excellence you will attain.

	0	3	4	5
Use of Space	Student did not contribute to the mural due to lack of effort.*	The group did not use the space given adequately.	Group used half of the space given or had too many open spaces throughout the mural.	Group effectively used each portion of the mural and left no blank spaces.
Scientific Accuracy	Student did not contribute to the mural, due to lack of effort.*	The content on the poster board is not scientifically accurate.	The content on the poster board only represents a small portion of information covered this year.	The content on the mural is scientifically accurate and robust.
Creativity	Student did not contribute to the mural, due to lack of effort.*	This mural lacks creativity and a unifying theme.	This mural either lacks creativity or a unifying theme.	This mural is highly creative and contains a strong unifying theme.
Individual Participation Within the Group	Student did not contribute to the mural, due to lack of effort.*	Student was spoken to more than twice about his/her participation. Student did participate but other students in the group did more work.	Group worked well together, but student needed some teacher assistance to become motivated.	Student contributed equally with group members. Student was able to work well with others and give hints to others to improve mural.
Correct Grammar and Spelling	Mural is plagued by frequent grammar and/or spelling errors.	A few grammar and/or spelling errors are present.	Mural contains only one or two errors in spelling/grammar.	All grammar and spelling are correct.

* Alternative assignment will be required for credit.

Scale: •150-135 A Excellent •134-120 B Good •119-105 C Needs Some Improvement
• Below 105 will be given an additional assignment that will be required for credit.

TOTAL:_______X 6 =_____/150

Appendix I

Ms. K. Steim's Acceleration Lesson Plans

First Name: Kristine Last Name: Steim Class: Physical Science Unit: Motion Date: 9/26/05-9/30/05

Essential Question:	How does velocity differ from acceleration?
Activating Thinking Strategies:	Add to Class Motion K-W-L – What do we think we know about acceleration?
Teaching Strategies:	1. Review Speed and Velocity KWL. 2. Lecture Acceleration – PPT with hand-outs will serve as the organizer graphic. 3 Lab Conducted Outside: Acceleration
Summarizing Strategies:	Three Things I Learned Today. . . .Ticket out the door
Assignment and/or Assessment:	Acceleration Practice Problems

Appendix J

Ms. K. Steim's Acceleration Problems

Acceleration and Velocity Problems

1) The head of a rattlesnake can accelerate at 50.0 m/s^2 in striking a victim. If a car could have the same acceleration, how long would it take for it to reach a speed of 100.0 km/h from rest?

2) An airplane traveling southward is landing with a speed of 75 m/s. As it touches down, it has 800 m of runway to reduce its speed to 8.0 m/s. What is the acceleration of the plane as it slows down? (Make sure to give the sign too)

3) A skier, starting from rest, accelerates down a slope at 2.2 m/s^2. How far has she gone after 5.0 s?

4) A soccer player, running at a speed of 3.2 m/s, decides to accelerate. For the next 20.0 m, he speeds up with an acceleration of 0.50 m/s^2. What is his speed at the end of the run?

Appendix K

Ms. K. Steim's Velocity Lesson Plan

Essential Question:	How does speed differ from velocity?
Activating Thinking Strategies:	Add to Class K-W-L about speed – What do we think we know about velocity and acceleration?
Teaching Strategies:	Lecture—Review Speed / Present new information on Velocity Lab—Motion—Pasco kits
Prompts:	Daily Journal Topic taken from Science Journal Topic book.
Summarizing Strategies:	Three Things I Learned Today. . . .Ticket out the door
Extending/ Refining Activity:	<u>BLOOM'S TAXOMONY</u>—Application Level—5 Knowledge/Comprehension Application— Lab Activity—Analysis/synthesis/evaluation
Assignment and/or Assessment:	Speed/Velocity Practice Problems and Graphs
Power Thinking/ Power Writing	Daily Journal Topic is a Power Writing.

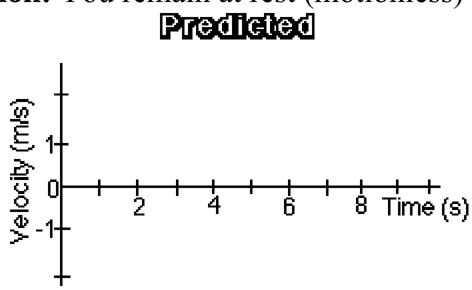
Appendix L

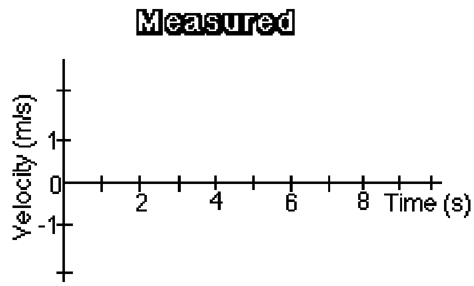
Ms. K. Steim's Kinematic Velocity Problems

Kinematics Graph Activity

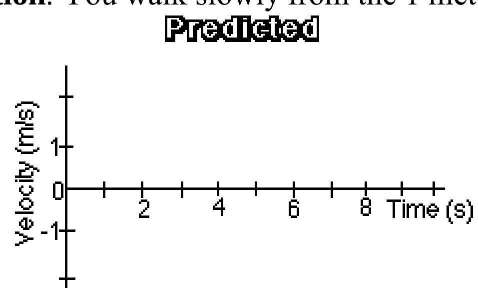
Velocity vs. Time Graphs: Use with the PASCO Kits. *For each motion below, sketch your prediction for its velocity vs. time graph on the axes on the left. Then perform the motion and sketch the graph produced by the motion detector on the axes on the right.*

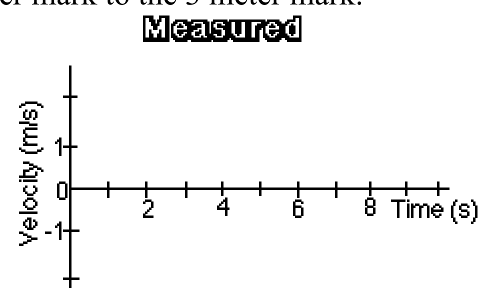
1. **Motion:** You remain at rest (motionless) at the 2 meter mark from the detector.



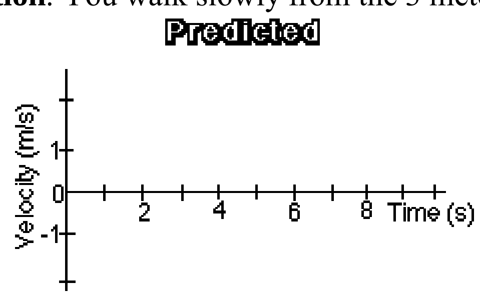


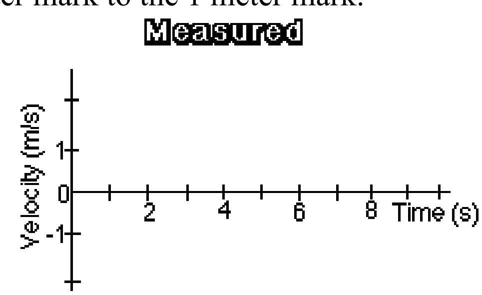
2. **Motion**: You walk slowly from the 1 meter mark to the 3 meter mark.



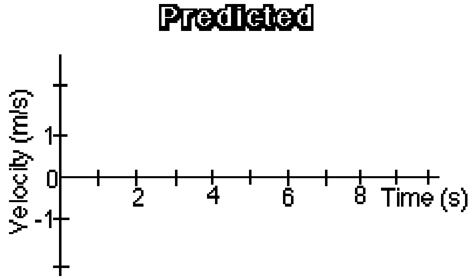


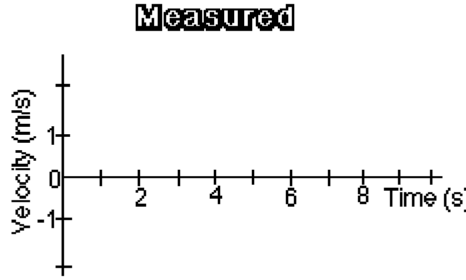
3. **Motion**: You walk slowly from the 3 meter mark to the 1 meter mark.





4. **Motion**: Starting at the 1 meter mark, you walk slowly to the 3 meter mark, then quickly back to the 1 meter mark.





5. **Motion**: Starting at the 3 meter mark, walk quickly to the 2 meter mark. Wait there for 2-3 seconds, then walk very slowly to the 0.5 meter mark.

Appendix M

Ms. K. Steim's Science Fair Project Lesson Plan

Essential Question:	How do we do a Science Fair Project?
Activating Thinking Strategies:	Science Fair Packets distributed
Teaching Strategies:	Review the Science Fair packet and discuss with students.
Prompts:	Daily Journal Topic taken from Science Journal Topic book.
Summarizing Strategies:	Assign HW
Extending/ Refining Activity:	BLOOM'S TAXOMONY—Application Level—1-4 Knowledge/Comprehension/Application/ Analysis/Synthesis/Evaluation
Assignment and/or Assessment:	Get science packet signed by parents.
Power Thinking/ Power Writing	Daily Journal Topic is a Power Writing.