A STUDY OF URBAN AFRICAN AMERICAN STUDENTS’ CONCEPTIONS OF SCHOOL AND MEDIA SCIENCE

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A STUDY OF URBAN AFRICAN AMERICAN STUDENTS’ CONCEPTIONS
OF SCHOOL AND MEDIA SCIENCE

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Dissertation

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ABSTRACT

In order to inquire into the persistent underrepresentation of urban minority students in the sciences, this study explored three urban African American students’ conceptualizations of school science and media science, with emphases on the representation of science in *Crime Scene Investigation (CSI)*. Based on the data collected from interviews, classroom observations, student journals, focus groups, concept maps, and artifacts, the study shows that the student participants conceptualize school science as a compilation of observed chemical reactions, utilizing specific laboratory apparatus, and laboratory experiments. The study also shows that student participants conceptualize media science as an accrualment of evidence collection, observation, photography, analyses of evidence on and off site, and taking safety precautions. While the student participants did not find school science to be applicable in their daily lives, they believed that they had acquired usable and accurate scientific knowledge from media science. Two major themes emerged from the student participants’ voices: student participants’ acute awareness of their limited access to the scientific world, and student participants’ inadequate accrualment of scientific knowledge through school and media science. By attending to the student participants’ voices, this study lends support to advocating for and developing culturally responsive pedagogy in science education that will facilitate urban students’ active engagement and improve their achievement in science education.
ACKNOWLEDGEMENTS

Jabez cried out to the God of Israel, "Oh, that you would bless me and enlarge my territory! Let your hand be with me, and keep me from harm so that I will be free from pain." And God granted his request - 1 Chronicles 4:10

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CHAPTER I
INTRODUCTION

My interest in science began many years ago. In junior high school, my Biology teacher exclaimed with excitement, “Eugenia, today we will be learning about you!” As I walked into the classroom, my interest peaked even more as the numerous rows of microscopes were displayed. During that year, we learned about many multi-cellular animals and plants, but nothing could prepare me for the specimen we were about to study. In class that day, we learned all about the one-celled specimen, Euglena. I was anxious to roll the diaphragm on the microscope up and down, to see the exotic looking specimen, whose name was similar to my own. The specimen was very small and I was amazed at how easily I could maneuver the microscope with my small hands. I smiled during that entire class; Euglena had forever sparked my interest in science..... I had found my calling.

Educational excellence, especially in the science disciplines, has been an important issue in the United States. The world is increasingly becoming influenced by science and technology and yet many students are not receiving the education to adapt to the transformation. Parents are concerned that their children will not obtain useful information to become successful adults. Companies need educated adults knowledgeable in the science, technology, engineering and mathematical fields. *Science for All Americans* (sic) is a publication created by scientists and educators that defines the scientific themes and habits of minds that all scientific literate adults should possess. Students need a firm foundation in science, technology, engineering, and math literacy to become aware of and to make informed decisions about the world. However, since science curricula do not focus on the knowledge summarized in *Science for All*
Americans and due to low teacher expectation and teachers’ inadequate knowledge of African American students’ culture, students in urban classroom are at a disadvantage.

Over 300 years ago, through the enslaved efforts of their ancestors, African Americans began their quest for basic literacy and it continues today (Marshall, 2002). Many African Americans regard education as the gateway to achieving liberation and promoting racial equality (Gates & West, 1996; Washington, 1901). The study by The National Center for Public Policy and Higher Education (2000) found that African American parents believe that higher education is the key to pursuing upward economic and social mobility and overcoming racial prejudice. However, there have been persistent achievement gaps between African American students and White students. Standardized test scores of African American and Latino students are much lower in science than their European American counterparts (Campbell, Denes, & Morrison, 2000). The Nation’s Report Card, National Assessment of Educational Progress (2005) found the science score gaps between fourth grade European American students and their African American and Hispanic American peers were smaller in 2005 than in 2000. The science score gap between European American and African American 12th grade students widened during the same time period. Atwater (2000) identified poor quality science instruction as one critical factor leading to underrepresentation of these groups in science when compared to their European American counterpart. In many urban science classrooms where funding is limited, the teaching staff’s knowledge is also limited. As noted by Campbell et al. (2000), “disproportionate numbers of minority and poor students are taught during their entire school careers by the least qualified teachers” (p. 70). Teachers have low expectations of themselves and the students they teach. The role
that racism plays in influencing administrators’ and teachers’ beliefs concerning who will, who can, or who should do science (Barton, 2000) is also a factor. Considering the combined effect of the aforementioned factors, it is not surprising that researchers find that African American students appear to be uninterested in the fields of science, mathematics, and engineering when compared to the interest of European American students (Atwater, 1986; Atwater & Simpson, 1984; Atwater, Wiggins & Gardner, 1995). The study by Atwater et al. (1995) further found that there is a significant increase in the negative attitudes toward scientific learning during the middle and high school years among African American students. As a result, African American students continue to perform lower in science when compared to their European American counterparts (Ikpa, 2003).

The pursuit of equity and excellence in education has been an educational and ethical ideal in a democratic society. African Americans, Latinos, and American Indians are the three groups substantially underrepresented (Campbell et al., 2000) and underserved in the field of science.\(^1\) Numerous science reform efforts have taken place with the goal of creating educational accessibility and measurable successes among diverse populations (National Assessment of Educational Progress, 2009; the National Report Card, 2005; National Science Foundation, 2009; Science and Mathematics Education Policy Advisory Council, 2007). In 1996, the National Research Council (NRC) created the National Science Education Standards with the goal for all students to become scientifically literate (National Academy of Sciences, 1995). In urban schools

\(^1\)If members of a profession comprise a much smaller proportion of people from the population group than exists in the total population they are considered underrepresented (Campbell, Denes & Morrison, 2000, p. 8)
across the United States, over the last 20 years, many science curriculum reforms have taken place (Barton 2001; Tobin, Roth, & Zimmerman, 2001; Rodriguez, 2000; Rodriguez, 2001). Despite many reform efforts for at least three decades, there has been little success in increasing the numbers of underrepresented minorities in science, technology, engineering, and mathematical related fields (Gilbert & Yerrick, 2001; Tapia & Lanius, 2000).

Unsuccessful educational reforms can be attributed to schools’ failing to attend to differences in students and to create a high standard science curriculum for all (Tobin, Seiler, & Walls, 1999). Rodriguez (1998) found differences in science test scores between 9-year-olds, 13-year olds, and 17-year-olds of African American and European American and found the disparity increases throughout the middle to high school years. As a result, schools have been ineffective in preparing African American students to enter the field of science. Many African American students remain uninterested and unexcited about science.

To bridge the achievement gap in science, Campbell et al. (2000) point out that educators must understand the problems facing underrepresented and underserved students. As an African American, Christian woman working with the Jewish Community as a K-12 Health and Science Resource Specialist, I became more aware of the impact of culture on one’s learning, especially in the subject of science. Pursuing a doctoral degree and teaching at the university level, I have developed a deeper appreciation of the multicultural science education movement which is composed of at least three things: an idea or concept, an educational reform movement, and a process (Atwater, 2000). Through this deeper appreciation, my journey progresses in reading
numerous studies examining achievement among different student populations in the United States.

Based on my experiences, I concur with existing literature. Rodriguez (1998), Pinar (2000), and Apple (1996) posited that the educational system in the United States, to a large extent, is structured to benefit groups currently in power. Moreover, the United States educational system consists of many different cultures. However, many of these cultures are not depicted or covered in school curricula, textbooks, and other teaching materials where the focus is on European Americans (Banks, 1997). This dominant cultural group in U.S. society is often called mainstream Americans. A curriculum that focuses on the experiences of mainstream Americans and largely ignores the experiences, cultures, and histories of other ethnic, racial, cultural, and religious groups has negative consequences for both mainstream American students and students of color (Banks, 1997).

Many students enter the classroom with prior knowledge. Using students’ prior knowledge from their communities and families provides a foundation upon which new knowledge can be built. Allowing urban African American students to bring to life experiences into the science classroom that relate to their lives provides an impetus for students to learn. As noted by Barton (2001), urban settings provide the resources, the people, and a neighborhood provide a distinctive character. Using these poor often ignored settings could be capitalized upon by a culturally rich and diverse science curriculum. Students construct new science knowledge by connecting the information to their personal knowledge and experiences (Arroio, 2010). In this study, the urban students’ prior set of experiences, cultural perspectives, and intimate knowledge of
criminology alluded to their interest into the field of forensic science. In the research setting, EuCarlene students provided many stories and examples of crime scene knowledge which allowed me to build new science information on their prior knowledge. Urban students’ prior knowledge and experiences can provide the “hook” to have students connect to the lesson. Alas, underdevelopment in science knowledge for poor urban students will impact our society greatly when one half of our student population consists of these students living in the poverty-stricken segments of the United States.

**Statement of the Problem**

As Ladson-Billings (1995) noted, education cannot stand alone, but must be connected to larger issues such as national defense, crime, technological and economic competitiveness, global warming, and energy conservation. Science education must connect students in authentic and relevant ways of understanding the world. A scientifically literate population is an important component in a world becoming increasingly technical and complex (Singham, 2000). To this end, it is critical to examine the factors impeding African American students acquiring science knowledge. Such a critical examination will yield valuable insight on exploring and developing innovative ways to make science applicable to underrepresented and underserved students and bridge achievement gap in science.

**Western Science versus School Science**

Science has affected every facet of our daily lives to such an extent that it isolates anyone who does not possess some understanding of scientific knowledge (Hogben, 1960). All those who achieve the understanding of scientific knowledge will have a
deeper insight into the circumstances that shape our world. Hogben (1960) further asserted that the need for scientific knowledge is great and a person cannot hope to understand technological changes without some knowledge of science. Science is a wonderful way to learn about our world, as the learner makes observations to produce a body of facts. Questions arising about the earth and surroundings to how humans arrived on this planet develop into deep questioning for more information and are the building block of science (Emdin, 2010). In order to explain what is observed one must propose a theory and predict future observations. Once the theory has been tested and agreed upon by others in the field, it becomes a truth in a system to show how natural laws operate (Kuhn, 1962). Simply stated, science is the field of study that tries to describe and understand the world in which we live.

Different views of science have developed from many cultures throughout history. There has been a widespread assumption that science is a universal discipline. In the world of science there are many ways of looking at science. Harding (1994) argued for science to be viewed not as transcending culture but rather as having multicultural origins and symbolizing Western values and beliefs. Harding (1994) indicated that science can lead to more accurate and richer understandings of European culture as well as the scientific legacies of other cultures. Science should reflect a multidimensional view of cultures and transcend traditional cultural boundaries.

Greg Cajete, a Native American researcher who studied indigenous knowledge in education has found native science does not follow Western science rules. Native science implies a comprehensive whole of all sciences, as we would understand in Western disciplines, with the inclusion of philosophy and spirituality (Cajete, 1999). Western
science, which is different from Native science, is studied separately from the culture that created it. Native science labors to connect science to spirituality but Western science has historically attempted to remove spirituality from its study. Cajete describes Native Americans as having created a very detailed framework for how things work, how things move, and how things happen in the universe, but these Native Americans do not think such things are measurable through Western science. The traditions of Native American people define science as structures of knowledge that refer to the diverse world of nature and how one may maintain a relationship with this world (Cajete, 1999). Cajete suggested that Native science is reflective of the abstract mind and is rooted in an ingenious sharing with nature. Western science does not share Native science’s framework or acknowledges its ideology.

Formal science education in the United States, to a large extent, focuses on the Western science. “In the case of school science, particularly in urban schools, the teacher functions as the power wielder and the representative of not only the power structure of the school, but that of ‘Western science’” (Emdin, 2010). In many classrooms, urban students are provided with a philosophy on what science is, how science is performed, and what a scientist looks like. Learning comes from canonical pure science content and is conveyed by a conventional science curriculum (Aikenhead, 2006). Aikenhead provided four failings of the traditional, canonical science curriculum. One, a student feels science is not applicable to one’s life and so does not enroll in any science career. Two, certain student groups cannot help feeling being alienated. Three, too many dishonest and mythical images are depicted and presented in courses. Four, science is simply not relevant and lacks meaning. Teaching canonical science or Science-As-Usual
leads to distorted definitions and descriptions of science. So, one must seek revisions that will incorporate the essential aspects of science to society and society to science (Harding, 1991). Science instruction is limited and proscribed, especially in teaching urban African American students. Transforming traditionally-based science to include other views of science, such as indigenous science, permits students to investigate the world that affects their everyday lives through various cultures. Integrating urban African American culture into the science curriculum allows urban students to see and observe science which include authentic cultural perspectives in the curriculum.

An example of a lesson teaching forensic science may include having students discuss what they know about the subject from home, school, and community. During the discussion students have the opportunity to express their ideas about forensic science and collaborate with peers to understand the subject. After the discussion, students write down what they would like to know about forensic science. The students' prior knowledge and interests will be the springboard for future lessons. Rather than talk about forensic scientists or police officers, parents or guardians of students are invited to talk about their jobs. If parents or guardians are unavailable, finding a police officer or forensic chemist from the community would be suitable. Through hands-on activities students observe and investigate the many areas of forensic science. Finally, students read and investigate current real crime cases in the news and discuss.

**Science in the Media – Media Science**

Media has infiltrated our lives in expanding ways. Science in the media involves various programming on television depicting science. Espinoza (2009) found mass
media, particularly television, influence public conceptions and attitudes toward learning science” (p. 458). As students begin to understand the world, media facilitates the learning students use to construct their knowledge. Salleh (2001) stated ―Understanding how such factors impact on the communication of science can aid in the wise use of media science in educational and other contexts‖ (p. 29). Miller (2006) examined how students‘ knowledge of cloning was impacted by mass media and found the students had many inaccuracies. For example, students had media-created myths about cloning. As noted by Miller (2006) ―It became obvious very quickly that public media was the sole source of students‘ knowledge about this very important topic‖ (p.71). Identifying students‘ scientific knowledge obtained from the media is important in understanding their misconceptions and helping students to construct accurate knowledge.

Media science is observed through many mechanisms which include television, Digital Versatile Disks (DVDs), movies, and the internet. Examining science through television in the classroom is a perfect location for students to begin to decipher messages the media portrays (Thier, 2008). Many teachers find media science a resourceful tool but hesitate incorporating in the classroom due to the challenges. The challenges include lack of funding to purchase materials, classrooms with audiovisual capabilities, and technology trained personnel (Windschitl & Sahl, 2002) and inappropriate content or images. Jenkins (2007) suggested since students consistently use popular culture, albeit media science, pedagogy in the science classroom should promote science literacy skills. In Murcia‘s (2009) study of first-year university Australian students more than 50% surveyed failed to demonstrate the ability to critically engage with media science. The
study's findings indicated a need for explicit science teaching to develop a student's ability to critically examine science media.

Media science has become one of the dominant genres. Given the prominence of popular culture in our technologically rich society Cavendar and Deutsh (2007) indicated media science, especially crime scene science, presents a crime with a quest for justice. In presenting the crime, various elements are integrated for the viewer, such as a hero-police or a chemist and a villain-lawyer or a perpetrator who are intertwined for social justice to be carried out by the end of the show (Cavendar & Deutsh, 2007). Science teachers need to be aware that what the media states as looking, doing, and representing science can have a huge impact on students' acquisition of science knowledge. Barnett et al. (2006) concluded “to teach science effectively, educators need to understand how popular culture influences their students' perception and understanding of science” (p. 179). Students' views on science are shaped by a various out-of-school influences and media science is a strong influence. However, Frank (2003) investigated society's understanding of science and argued that media science is particularly effective at distorting the distinction between real and fake.

Given the distorted scientific images and information provided by the media, the achievement gap will continue. In media science, students receive a blurring vision of what is real and fake, by technological imagery, story lines, content, and expectations of scientists which distorts their knowledge. The achievement gap will continue if students are not provided opportunities to understand the scientific distortions being portrayed in the media. Teachers need to be aware of the ideas presented in media science as they may be a substantial source of students' misconceptions. Engaging students in a critique of the
science depicted in media science programs may allow students to present their own ideas and compare.

**African American Students’ Experiences in Science Education**

The Western view of science contains much that is relevant to groups in power and appeals to mainstream students. An example of evidence significant to groups in power includes the inaccessibility of science to laypeople. Science is seen as closed and only for the privileged. The appeal is lower for African American students. Due to other influences such as home-life, parents, and experiences, suburban middle and upper class students think science is most relevant to their lives. Students in urban settings often think otherwise and their thinking undermines school science reforms that are trying to reduce the disparity between how African American students and European American students learn science.

The American educational system has not provided African American students with a quality education (Fordham, 1996). Many urban underrepresented students in science are faced with inadequate learning resources in poor public schools. At the same time in the research community, there have been troubling beliefs that African American students are not only different, but inferior to their European American counterparts (Pittman, 2009). Existing research tends to focus on the differences between African American students and European American students while neglecting the reasons why the differences occur. Duncan-Andrade and Morrell (2008) noted that "The unique lives and conditions of urban youth deserve an education system that accomplishes two goals in concert with one another: preparation to confront the conditions of social and"
economic inequity in their daily lives and access to the academic literacies (computational and linguistic) that make college attendance a realistic option” (p. 7). Teachers hold the key for making differences in science classrooms and Haycock (2001) found minority students do not have access to the most qualified teachers. Research shows if students from disadvantaged backgrounds are exposed to high quality instruction, they will succeed in the classroom (Haycock, 2001). As discussed by Darling-Hammond (2000), Marzano (2003), and Deming (2009), three or more consecutive years of a highly effective teacher can expunge the achievement gap between disadvantaged students and their more favored peers. Simultaneously, if the same students are exposed to one year of an ineffective teacher, the gains can and will be diminished. In addition, Clotfelter, Ladd, and Vigdor (2007) found:

> Given that more advantaged students are often deemed easier and more rewarding to teach than those from disadvantaged backgrounds, highly qualified teachers have an incentive to move away from schools with large proportions of disadvantaged students in favor of schools with more advantaged and easier-to-educate students. (p. 13)

All students deserve high quality instruction and steps must be taken to make it happen in urban schools.

In science education and science-based occupations, both historically and currently, there is a shortage of underrepresented women and men (Hanson, 2008). Bianchini, Cavazos, and Helms (2000) studied underrepresented groups in science and deduced, “Women and ethnic minorities are far from having the same opportunities in science education as White men” (p. 516). Therefore, the achievement gap, which exists between African Americans and European Americans students, as reviewed by Norman, Ault, Bentz, and Meskimen (2001), is one of the main factors impeding science learning. An
examination of achievement data uncovers an imbalanced gap between African American and European American students who also exceed other minority groups; Latinos, Asians, and American Indians, in most cases (NAEP, 2005). Regardless of African American students’ socioeconomic status, they fall behind as they progress through primary and secondary school when compared to their European American counterparts (Steele, 1992). Steele further stated, “[S]omething depresses Black achievement at every level of preparation even the highest” (p. 62). Steele’s remark uncovered that teachers (a) disaffirm interpersonal relationships and (b) teach in an un-engaging learning environment that impedes the academic success of African American students, which some scholars suggest is contributing to their underachievement in science (Marshall, 2002).

**Understanding the Persistent Achievement Gap for African American Students in Science**

The reasons for the African American students disinterest in science are multifaceted. Researchers found that students are not given or provided with opportunities to explore technology and science in their K-12 education (Public Agenda, 2007). African American students are not exposed to role models in STEM-related fields and thus are not encouraged or motivated to enter such fields. Despite being immersed in a technology-rich society, including access to cell phones, DVDs, videocassette recorders (VCRs), and games, many African American students are reluctant to explore technologically focused career paths.
Despite all the science education reform efforts, disparities still persist between socioeconomic groups of students. Researchers maintained there should be incessant inquiry on why underrepresentation among African American students in science continues as an ongoing problem in our educational system (Campbell et al., 2000). This study aimed to inquire into the plight of urban African American students on their low interest in science.

Urban students underrepresented in science come to school with pre-constructed scientific knowledge, including language and cultural values. This pre-existing knowledge has a profound impact on students’ learning. Lee and Luykx (2007) suggested that racial, ethnic, gender, and class variations are visible in most of the science outcome measures. Research suggested an urban teacher’s preexisting beliefs and attitudes towards underrepresented students in science inadvertently impacts the students’ achievement (Delpit, 1995). Finding ways to help teachers realize their influence and creating ways to engage urban students will be essential to closing the science achievement gap.

**African American Students’ Attitudes Toward Science**

Research has shown that students underserved in science, primarily urban students have negative attitudes toward school science as compared with their White and nonurban counterparts (Atwater et al., 1995; Zacharia & Barton, 2004). Due to the disparity in teachers’ background and cultural knowledge, lesson topics, and the culture of the classroom, urban students find school science boring. Students’ attitudes toward science are determined by how well they like or work with teachers, climate of the
classroom, and curricula (Atwater et al., 1995). Zacharia and Barton (2004) posited “In short, students’ attitudes, both at the middle- and high-school level, appear to be affected by the students’ interest levels in science, their abilities in school science, the curriculum and the learning climate, their access to extracurricular science experiences, their family, their teachers, their own self-concept, and their peer groupings” (p. 199).

All levels of the educational system are needed to be involved to close the achievement gap for urban African American students in science. The House Bill Advisory Committee found five challenges and solutions for the achievement gap for African American students:

1. Teacher quality – knowledgeable professionals who effectively meet the academic, cultural and social needs of students

2. Teaching and learning – structured, rigorous and culturally responsive curriculum and instruction

3. School and district leadership – a commitment to high achievement for all students that intentionally guides policies and practices

4. Student support – academic, social, psychological and cultural resources students need to succeed

5. Family and community engagement – partnerships that inform and support academic achievement. (HB 2722 Advisory Committee, 2008)

Exploring African American urban students’ conceptualization of school science is necessary in understanding their disengagement in science. Involving school districts, teachers, student support, family, and community members in closing the achievement gap will provide a way to help urban students succeed in science.
Culturally Responsive Science Education

In many urban classrooms across the United States, students are learning in environments where the culture of the school is very different from their own (Emdin, 2010). Many of the teachers in these urban classrooms are European American whereas the students are mainly African American or Latino American and their cultures are different. The curriculum being taught does not reflect the ethnic and cultural past of the minority students. As Gilbert and Yerrick (2001) discussed,

Although some efforts are intended to incorporate more diverse populations and discourses into definitions of educational success, many convey disparaging cultural messages regarding the school’s role to compensate for the children’s presumed lack of socialization and [their deficiencies in] cultural resources. (p. 575)

Culture embodies the values, beliefs, and lessons that humans use to experience, interpret, and respond to the world (Marshall, 2002). Urban African American students find their culture is different from the urban science classroom (Emdin, 2010) in which they are taught. The urban science classroom possesses cultures that set the goals of the classroom. Emdin (2010) suggested these cultures are grouped into four categories: (1) the culture of science, (2) the culture of urban students, (3), the culture of urban teaching, and (4) the culture of the urban teachers.

The *culture of science* involves the scientific method, scientific terminology, and the use of scientific tools. —The dense vocabulary, complex systems of nomenclature, and unique nature of scientific argumentation provide a lens for examining students’ assimilation into the culture [of science]” (Brown, 2004). The *culture of urban students* comprises relationships, language, and a mixture of races and cultures. *Culture of urban teaching* involves teaching in a racially segregated school, personally purchasing many
science teaching materials, and having few or no current technological resources. *The culture of urban teachers* consists of teachers whose backgrounds may not mirror that of their students. In many urban science classrooms, the aforementioned cultures impact the teachers’ goals.

Research has identified that many urban teachers are not engaging students in science due to their deficient knowledge of the students’ culture (Emdin, 2010). A shift in science teaching is needed to engage African American students in urban science classrooms. “Opportunities to learn are informed by teachers’ perceptions and interpretations of how students perform in the classroom” (Marshall, 2002, p. 95). Urban science teachers need to gain an understanding of the culture of science, the culture of urban students, the culture of urban teaching and the culture of themselves. Urban pedagogy appreciates cultural references, and takes into account the social conditions and hardships that many urban children face” (McKinney, Flenner, Frazier, & Abrams, 2006). All students need to know they are valued, to be taught in an engaging way, to be acknowledged, and to have their culture respected (Emdin, 2010).

Howard (2004) developed four tenets to create a more effective race-conscious curriculum to let students know they are valued which included: to problematize race, to acknowledge the historical legacy of racism, to engage students in critical conversations, and to have a commitment to democracy. Howard further suggested if the science curriculum continues to exclude the histories and cultures of students, then the gap in underrepresented students’ academic achievement will increase. Thus, presenting science within the students’ culture through a culturally responsive pedagogy that is context
specific, reflective of what one believes, values, and thinks worth knowing—students will respond accordingly (Stephens, 2000).

Researchers found teachers who learn culturally responsive pedagogy have the self-efficacy to be effective in their instruction of diverse children (Pang & Sablan, 1998). Creating and using a culturally responsive curriculum empowers students in the classroom. Integrating a culturally relevant curriculum provides an opportunity to modify the omissions or distortions misrepresented in science that have devalued the contributions of minorities in science. Incorporating a cultural relevant curriculum would positively affect the self-esteem, motivation, and resiliency of historically underrepresented African American students in science. African American students need to know and understand the social structural causes of inequality.

Stephens (2000) defined a culturally responsive science curriculum as a way to integrate [African American] and Western knowledge systems around science topics with goals of enhancing the cultural well-being and the science skills and knowledge of students” (p.7). Culturally responsive education integrates the student’s culture (using experts), standards, teachers’ pedagogical content knowledge, continuous authentic assessment, science inquiry, and the knowledge of local people from the community (Stephens, 2000) into the curriculum. Also, it provides pedagogy and curricula that lend immediate relevance to school in the lives of urban youth” (Duncan-Andrade & Morrell, 2008).

While working in an urban elementary school with a high population of African American students, I found most were unable to identify any African American scientists (including a famous African American chemist for whom the elementary school was
named). All of the students named Albert Einstein as a famous scientist they knew but they did not identify themselves as scientists. According to Aikenhead (2006), a large population of African American students was unable to identify themselves as scientists. Barton (2001) indicated that as long as urban African American students are the “outsiders within” and the dominant framework fails to reflect their interests or voices, they will continue to be unengaged in science.

This disengagement between African American students and science in urban schools is due to many factors. Talbert-Johnson (2004) argued African American students have limited access to quality science education programs in urban settings and face persistent barriers in pursuing a science, technology, engineering, and math (STEM)-related academic career. Urban schools are generating academic failure at an alarming rate (Duncan-Andrade & Morrell, 2008). Many suburban schools have more materials and resources than urban schools in order to succeed.

African American students in urban schools are not being challenged nor shown how science is applicable to their lives through helpful instruction from their science instructors. As a result, many students are ill-prepared to attend college and are disinclined to enter high-level technology or science-related careers. Consequently, African American students in their school years remain disengaged, disinterested, and disconnected with science.

**Purpose of the Study**

To undertake a more in-depth inquiry into the factors contributing to African American students lacking interests and motivation in science education, this study
examined how urban African American high school students construct a concept of science from their experiences with school science and true-crime media science. Specifically, this study focused on the following two research questions:

1. How do African American high school students in urban schools conceptualize school science?

2. How do African American high school students in urban schools conceptualize media as science represented by Crime Scene Investigation (CSI)?

The research questions were refined as the study progressed to the present form based on the relevant issues that emerged during data collection and analysis. Overall, the focus of the study remained constant on gaining a clearer understanding of how urban African American high school students constructed and defined science through school science and media science.

**Methodology of the Study**

In this study, I used a qualitative case study to inquire into how the African American student participants constructed their classroom science knowledge and their media science knowledge. Qualitative research allowed the researcher to examine the rationale behind the phenomenon. "Neither science nor art can exist outside of experience and experience requires a subject matter. That subject matter is qualitative" (Eisner, 1998, p 27). I used a qualitative method to provide a thicker richer view of the subject matter by facilitating the "study of issues in depth and detail" (Patton, 2002, p. 14). In using a qualitative approach, I undertook an in-depth inquiry into why African American students are not engaged in science.
Engaging in a case study allowed the researcher to gain the student’s view. “We cannot give voice, but we do hear voices that we record and interpret” (Creswell, 1998, p. 17). Employing the use of a qualitative study provided the sufficient time and resources to spend on extensive data collection in the field and detailed data analysis of ‘text’ information” (p. 17). Denzin and Lincoln (2000) stressed that the qualitative researcher participates in the constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry (p. 8).

This study examined three African American students in a Forensic Science Law Enforcement course in which the researcher was the instructor. I as the researcher served as the primary research instrument acting as participant observer (Spradley, 1980). Additionally, as participant observer, I used participant observation to determine who to recruit for the study and how best to recruit them. During an iterative process (Denzin & Lincoln, 1994), I, at the early stage, facilitated and developed relationships among teachers, counselors, students, and security personnel within EuCarlene High School, a pseudonym, which were needed to set-up the study, to gain permission from appropriate officials, and to identify and to gain access to study participants. The researcher used data collection to improve the research design and the interviews and to facilitate the focus groups. Finally, continuous consulting of the data throughout the study informed the design, saved time, and prevented errors for the researcher.

Students underrepresented in the sciences need to start to understand how our society is structured, who and why certain groups of people are getting ahead especially in science, and who is falling behind (Buxton, 2003). Buxton further suggested many
urban students, in poverty, have not seen academic achievement and find it difficult to attain. Most parents of high poverty urban schools are working two or three low-paying jobs to make a living. Finding academically successful role models, in science, which represent the culture, ethnicity, race, and religion of high-poverty urban students would help the students to see, hear, and understand the process of attaining educational achievement. The first step, as suggested by Freire (1970), is to raise the critical consciousness of urban African American students who have been oppressed and help them to obtain critical scientific knowledge that will ultimately provide liberation from oppressive ideologies.

In this study, students described the daily, weekly, and yearly inequalities they faced in the classroom. The media, school district, administrators, teachers, and society reminded EuCarlene students of the inequalities. Understanding why scientific knowledge is needed and how inequalities impact scientific knowledge provides the impetus for students to learn science. The knowledge of the barriers and inequalities will help students understand the why. By having teachers provide the how will help students scientifically succeed.

EuCarlene High school, the school setting for this study, was built in 1972 and the school prepares high school students for either a medical or law career or a municipal career. For this study, three African American students, one male and two females, served as separate cases (Merriam, 2002) and the students were chosen using purposive sampling (Patton, 2002). The 17-year-old students on a law enforcement career path were part of an 11th grade Law Enforcement class in EuCarlene, an urban high school where
African American students comprised more than three-fourths (89%) of the student population.

Initially, the law enforcement students were provided journals and created concept maps to generate personal information and express their prior knowledge of Forensic Science. Classroom observations and students’ artifacts were also collected and aided in creating an understanding of how students constructed science knowledge. All interviews and focus groups were audio taped, transcribed, and coded into themes that provided a deeper understanding of the issues surrounding the research problem while developing a rich description of the phenomenon (Elliot, 2005). Member checks, as deemed necessary in research by Lincoln and Guba (1985), were conducted for identifying themes and patterns in the study. Data collection was completed in six months during the 2008-2009 school year.

This study offered an opportunity to hear the voices of African American students, an underrepresented and underserved student population in science. The voices of these African American students shed light on science education reform for all. Throughout my doctoral program, I faced the myriad of inequalities for underrepresented students in urban schools. I agree with the conclusions of Harding (1991) that all students in every social class, race, and culture have a fundamental right to learn, at least, about science and technologies to which they can relate. Thus, the students’ voices are threaded throughout the study to provide a perspective and lens with which to view and to understand typical urban classrooms and to gain an understanding of how science is interpreted through popular media.
Science knowledge is created through our mental processes, and the tools used in this creation are either innate or products of developmental construction (Noddings, 1990). Noddings acknowledged that during the construction of knowledge cognitive structures are stimulated and continuously building and once accepted by someone leads to methodological constructivism. Noddings described the two main characteristics of constructivism: (a) a cognitive position, and (b) a methodological perspective. In a cognitive position, Noddings’ (1990) constructivism holds that all knowledge is constructed and that the instruments of construction include cognitive structures that are either innate or are themselves products of developmental construction” (p. 7).

Noddings (1990) defined methodological constructivism as a way to investigate the student’s perception, purpose, premise, and ways of working things out. Teachers need to know what students are thinking and what students can do with the information provided (Noddings, 1990). This is important to note that teachers need tools that will help uncover students’ pattern of thinking and anticipate the skills needed to construct important science concepts. Using the media as a tool (teaching strategy) will empower both the teacher’s teaching and student’s knowledge in science. The overarching purpose of this qualitative study was to seek a clearer insight into how media science and classroom science may facilitate students’ construction of science knowledge.

National media and many educational entities often present a misleading picture of urban African American students. During the course of this study, I learned that not only do selected African American students’ conceptualization of science in the classroom and media get reflected in their interest in science, but these perceptions are deeply embedded, (Schneps & Sadler, 1987/1992), and are manifested in their daily lives
as members of society. The selected African American students perceived themselves as members of an underprivileged school district. Each of them shared with the researcher that they had negative science learning experiences in high school. It was clear in the students' words that science was a boring subject and they felt it was mainly due to the teachers. The insights students shared about the EuCarlene's science teachers were primarily negative. All of the students focused on the teachers' lack of hands-on activities, negativity towards them and the school, and boredom of the lessons.

**Significance of the Study**

The significance of this study was to determine how African American high school students in urban schools conceptualize school science and how African American high school students in urban schools conceptualize science represented by *Crime Scene Investigation (CSI)*. The discussion about whether urban schools provide an education of equal quality to suburban schools has been a topic that many people in the science education field, as well as students and parents, have been debating. This study offered a deeper research-driven understanding of the diverse viewpoints.

Kopetz, Lease, and Warren Kring (2006) argued that minorities comprise a substantial percentage of our population and is growing at a fast rate in the United States. There is a genuine concern for social justice that necessitates an inquiry into the achievement gap in science. Marzano (2003) suggested improving the quality of science instruction can have an influence on bridging the achievement gap for African American students. This study centered on urban African American high school students‘ conceptualization of school and media science. Clearly, this represents a thought-
provoking task for science research regardless of the more specific interests that the research possibly obtained. In this study, this broad and multifaceted phenomenon was studied from a focused perspective. The selection of the case study design naturally brought forth few limitations as far as generalization of the results. Conversely, the design represented the whole idea of making a case study. Through understanding in depth one particular aspect of the case, researchers may learn something more of the general phenomena (Merriam, 1998).

Given the enduring inequities in science achievement now present among African American students, a more thorough understanding of how African American students form scientific knowledge was needed so parents, teachers, and administrators may create scientific opportunities. An understanding of how the science achievement gap occurs in urban science classrooms is warranted. With this understanding, African American student interest in science can be improved. We need to better prepare teachers to work in schools successfully with all cultures of students. Teachers must learn to use media as a teaching tool. Media can engender a deeper understanding of science that means better achievement in schools. More specifically, incorporating media science into science education could possibly influence students to observe the evidence of science in their own lives, in a life lived in society rich and complicated by products of science.

The current framework of school science in many urban schools does not reflect the interests, community, and prior knowledge of the learners. Atwater (2000) confirmed this view in describing urban students’ existing experiences that form their prior knowledge in which to build new science concepts. Incorporating a curriculum that reflects the learners’ prior knowledge with current technological methods would
encourage urban students to become motivated and engaged in science. Due to limited funds, resources, time, educational attainment, and social issues, urban teachers face many challenges integrating new teaching methodologies. There is an argument to be made that changing the status quo would possibly inspire and connect teachers to their students.

Using cultural responsive pedagogy is a relatively new concept for many urban science classrooms. The few schools that have chosen to adopt and implement the concept have reaped the educational benefits. Therefore, this research helped to cultivate an awareness of culturally responsive pedagogy among those who are unacquainted with its promising use and value within the science classroom. The findings from the EuCarlene case study participants provided a step to investigate the pedagogy currently undertaken in urban schools.

Understanding the perspectives of African American students’ construction of science knowledge in school and through media can be a viable tool in understanding the needs of students who are underrepresented in science. The significance of this study was to add African American students’ voice to science education literature, to science education as a whole, and to motivate African American students in urban schools to learn and engage in science. Results of this study are intended to assist those in the education field to better prepare teacher candidates to address the unique needs of underrepresented students in urban schools to advance an interest in science and STEM-(Science, Technology, Engineering and Mathematics) related fields.
Chapter Plan

Chapter II of this dissertation examined research literature concerning the achievement gap, constructivism, conceptions of science, and African American students‘ experiences in science-and culturally responsive pedagogy that is beneficial to African American learners. Chapter III explicates the research methodology (constructivist methodology) including data collection and data analysis. Chapter IV examines and analyzes the results and findings of this study. Chapter V provides conclusions and suggestions that can be made from the results of the study.
CHAPTER II
LITERATURE REVIEW

In high school, my European American chemistry teacher, Mr. Oppenheimer, made science come alive in the classroom. In modern times he would be considered mentally ill because of his unconventional teaching method. However, Mr. Oppenheimer’s teaching methods made science cool and exciting for all. He practiced constructivism before it became the buzzword in education. Mr. Oppenheimer believed that all students were pursing college and prepared them accordingly. One day after class, he told me to consider being a doctor because I had good grades and laughed at his jokes. He told me I could achieve anything. Funny thing is . . . I believed him.

This chapter provides a critical review of the research literature that informed this study. In this chapter, I first review research literature concerning achievement gap in science and African American students’ experiences of science education with emphases on African American students’ experiences of science education in urban schools. Specifically, I examine factors, i.e., race, achievement gap, and urban living, contributing to the achievement gap in science education. Next, I examine varied conceptions of science, science education, school science, and media science that shape African American students’ understanding of science. Finally, I examine the advocacy of culturally responsive pedagogy in science for African American students.

Achievement Gap in Science Education

In The Mis-education of the Negro, originally published in 1933, Carter Woodson examined the ineffective education then being offered to African Americans. Woodson
condemned the non-acknowledgement of the African and African American culture in the educational system. He stated:

"Negroes have no control over their education and have little voice in their other affairs. . . . Negroes are always such a minority that they do not figure in the final working out of the educational program. The education of the Negroes, then, the most important thing in the uplift of the Negroes, is almost entirely in the hands of those who have enslaved them and now segregate them". (p. 22)

In the 1960s the focus on the achievement gap between European American students and African American students began with the publication of the Coleman Report. Initiatives to close the gap were developed with a focus on traditionally underrepresented populations. The achievement gap between European Americans and African Americans narrowed during the next two decades (Lee, 2002). The U.S. educational system today continues to ignore the culture of African American students. In spite of countless education reforms, an achievement gap persists. Anderson, Medrich, and Fowler (2007) defined achievement gap as:

At the school level there are at least two kinds of gaps with particular salience for policy: the internal gap (average differences between distinct racial and ethnic groups and their White peers within a school) and the external gap (average differences between the aggregate school scores for each student subgroup in the school and aggregate scores for White students across the state). (p. 548)

The National Center for Education Statistics (NCES) reported that there is a 36-point gap between African Americans and European American counterparts in the selected science assessments (NCES, 2010) and African American students scored an average 26 points less than their European American counterparts on math tests based on a 500-point scale (NCES, 2011). While the gap is consistent for each of the grade level assessments, the higher the grade-level these students are tested in school the wider the achievement gap.
The National Assessment of Educational Progress found urban African American students tend to perform lower on average than children who live in suburban communities on scientific academic performance (NAEP, 2010). Nationally, 222 points was the math average for African American fourth-graders and 248 points for European American students.

While the “achievement gap” often refers to the disparity between different demographic groups of students, The African American Achievement Gap Report (2008) points out “In actuality, a number of different gaps exist that result in this phenomenon of low achievement. These include an opportunity gap, resource gap, readiness-to-learn gap, and a preparation gap of teachers constituting an overall education gap” (p. 6). Carpenter and Ramirez (2006) examined the student data from the 1988 National Education Longitudinal Study (NELS) and found that race is not as much an indicator as other variables (e.g., socioeconomic status, parental involvement, teacher quality, and mathematics courses). Norman et al. (2001) analyzed the achievement gap between White and Black students and found achievement gaps are complex and change over time, due to changes in populations and contexts. As asserted by Campbell et al. (2000), several factors account for the divergence in school achievement for minorities:

1. racial and ethnic segregation in schools;
2. language and cultural biases in school practices;
3. limited academic achievement of students;
4. dropping out of school;
5. limited school financing;
6. poor-or low-quality teacher-student interaction; and
7. tracking and curriculum differentiation.

Lee (2002) provided variables she found in her research of the Black-White and Hispanic-White achievement gap trends over the past 30 years. Lee stated the variables include parental educational attainment, income, socioeconomic status, single parent
household, youth culture and student behaviors, instructional resources, teachers, course
taking, dropout, and segregation. Researchers have reported an achievement gap exists
among students associated with socioeconomic status and found parents’ higher
educational expectations are higher with their educational attainment (Lee & Bowen,
2006).

The Washington State Legislature passed a bill in 2008 creating a plan to close
the achievement gap for African American students and found the imbalanced education
was confirmed by:

[s]ystem-wide low expectations, ongoing and widening achievement gaps,
under-involvement in school activities other than sports, under-representation
in programs for the gifted, over-representation in special education programs,
disproportionate discipline referrals, resulting in suspension and expulsion,
over-representation in the juvenile justice system, less access and effective
use of technology, low graduation rates, low entry to higher education,
under-representation in programs that prepare African American students for
the world of work and under-representation in gateway courses to college.
(Washington Office of Superintendent of Public Instruction, 2008, p. 7)

Ogbu (2003) and Lee and Brown (2006) found two factors affect minority
students’ school performance: One, society and school (system factors) which include
historical and current treatment of African American students by school and society; and
two, beliefs and behaviors that Black students bring with them to school related to
African American students’ interpretations and responses to their treatment. Ogbu’s
ethnographic study examined the barriers that contributed to African American students’
disengagement from the student’s point of view. Students cited mistrust of teachers, peer
influences and a feeling of not belonging. Byrnes and Miller (2007) and Hogrebe and
Tate IV (2010) have found that three factors: (a) opportunity factors (e.g., coursework),
(b) propensity factors (e.g., prerequisite skills, motivation), and (c) distal factors (factors
that operate earlier in time and explain the emergence of opportunities) as reliable predictors of science achievement.

To bridge the achievement gap, teachers in urban schools need to understand local urban cultures, the urban political economy, the bureaucratic structure of urban schools, and the family, community, and social service support networks serving urban centers (Talbert-Johnson, 2004). Teachers in any school setting need to know and understand the culture of their students to teach. Gaining an understanding of students’ culture allows teachers to develop an engaging curriculum to reach all students.

As noted by the National Center for Education Statistics research data on the Black-White mathematics gap among fourth graders in the U.S., Black student scores showed a greater gain than White student scores, and the gap was narrower in 2007 than in 1992 and no change was noted in the gap (NAEP, 2010). In the study both Black and White students achieved higher math scores in 35 states, and in 15 of these states, the test scores of Black students increased more than White student scores (NAEP, 2010). Johnson, Kahle, and Fargo (2006), in their study that used the Local Systematic Change Classroom Observation Protocol (LSC) Instrument, found that teaching effectively increases student achievement and closes the achievement gap between White and Black students. Also, it should be noted that minority scores were higher than White students. The study further suggested that bridging achievement gap should focus on increasing teachers’ content knowledge and using standards-based teaching practices to reduce the achievement gap for minority students. Thus, the more time science teachers have in professional development greatly impacts students’ achievement in the class.
Educators must become more aware of parents and students’ need to learn “everyday science” in order to become fundamentally scientifically literate. There need to be creative ways to incorporate system and community factors into science classrooms involving parents and students. System and community factors include the home and the community where the student lives, the culture of the school, and the student. In order to close the achievement gap, success depends first and foremost on the quality of schools underrepresented students in science attend, the curriculum they study, and the teachers who instruct them. Additionally, to bridge the achievement gap, personal and institutional changes are needed and should begin with equity thinking (Bensimon, 2005). Equitable thinking consists of educators accepting the belief that ALL students have equal access to educational programs no matter their ethnicity, race, gender, sexual orientation, disabilities, or language.

Using data from the National Center for Education Statistics (NCES), the National Assessment of Education Progress (NAEP), and data from districts that helped urban students succeed, Haycock (2001) proposed four steps for what urban students should learn at benchmark grade levels:

1. First, there should be transparent and community standards for what students should learn.

2. Second, a scrupulous curriculum aligned with standards as part of solving the problem.

3. Third, a process to build in and provide more time and instruction.

4. Fourth and last, the training of teachers in pedagogical knowledge in their subject area and providing the tools to teach the subjects.
Teachers who appreciate the students' community and culture (through life and experiences) tend to use a critical pedagogy (Hyun, 2006). Hyun adds, “in order to provide an equal, fair, and developmentally meaningful, and culturally congruent learning environment for these students, early childhood curriculum must become multidimensional responding to the multiple forms of realities that keep evolving” (p. 11).

**African American Experiences in Science Education**

The United States is experiencing a shortage of students entering science, technology, engineering, and math-related fields (STEM). STEM is needed for national security, militaristic strength, and fiscal vigor to remain competitive in the world (Campbell et al., 2000). Taking into account the shortage of scientists born in the United States, the United States heavily relies on foreign-born scientists. In many high schools in the United States, students do not take high-level courses, especially in science and math. Approximately 21% of United States (6% underrepresented) students take the science and math course of study to enter a STEM-related field (Campbell et al., 2000). STEM-related fields have become pivotal for competitiveness and growth in the United States. Because of the shortage of scientists, engineers, mathematicians, and technologists, the underachievement of underrepresented students attending urban schools should be a national priority (Shealey, 2006). According to the National Science Foundation, underrepresented students comprise three racial/ethnic minority groups (Blacks, Hispanics, and American Indians) whose representation in science and engineering is smaller than their representation in the U.S. population” (Campbell et al., 2000, p. 8).
Students who are members of a group not proportionately represented in a profession wherein the achievement gap is extremely large are identified as underrepresented (Campbell et al., 2000). Campbell et al. (2000) stated that there are three ethnic groups in the United States – African Americans, Latinos, and American Indian – who remain substantially underrepresented and underutilized in science. More specifically, minority groups underrepresented in science comprise 17.4% of the bachelor’s, 13.4% of the master’s, and 7.2% of the doctoral degrees in science (National Science Foundation, 2011). How and why certain groups are underrepresented in science can be attributed to many factors. Atwater (2000) claimed poor quality of science instruction as one factor leading to underrepresentation of these groups in science when compared to their European American counterpart. In many urban science classrooms where funding is limited, the teaching staff’s knowledge is also limited. As noted by Campbell et al. (2000), “disproportionate numbers of minority and poor students are taught during their entire school careers by the least qualified teachers” (p. 70). Teachers have low expectations of themselves and the students they teach. The role that implicit racism plays in influencing administrators and teachers in their beliefs, of who will, who can, or who should do science is also a factor (Barton, 2000).

Science education should include school and through scholarly venues. The school venue includes classroom lessons, activities, and lectures. Scholarly venues include field trips, speakers, informal science institutions, research projects, and community leaders. For many African American students attending urban schools science education by nature is memorizing facts. They have very limited opportunities of using or participating in hands-on learning activities (Emdin, 2010). As a result, they are unable to
connect topics to current science advancements. According to Emdin (2010), scholarly science is a community of members with similar beliefs and symbols to investigate and communicate with one another. By looking at scholarly science and school science as separate subjects, each with different participants and approaches, it becomes easy to see the ways in which actors from both fields intersect with each other in the urban science classroom (Emdin, 2011). The actors in scholarly science are students, scientists, researchers, and politicians. In the urban classroom, the actors are students, teachers, and school administrators. Teachers need to know and acknowledge the ways actors in urban classrooms and scholarly venues interact with students in the teaching of science. Having an understanding of the actors is deemed crucial as reasons for understanding African American students' underrepresentation in science. The negative attributes of scholarly science and school science are not because of the flaws of science but because of the way science is taught (Emdin, 2011).

**Urban Factors**

Nationally, the educational system is facing many challenges and urban schools are impacted severely. There are many factors that negatively influence the urban school system. African American students' experiences are affected negatively whereas they do not feel scientifically competent nor were they accepted in the field. The factors include: (1) a single accepted definition of urban, (2) teachers working and students learning in stressful situations (Hewson, Kahle, Scantlebury, & Davies, 2001) (3) teachers instructing and students learning in a pedagogy of poverty (Haberman, 1991) and (4) classroom overcrowding, little or no resources and funding, and dilapidated buildings.
Consequently, these factors all impact the teaching and learning in urban science classrooms, which has a dire effect on African American students’ academic achievement especially in science.

Settlage and Meadows (2002) asserted that —no single definition of urban exists.” (p. 120). As noted by Schwartz-Crooks and Broadway (2007), one understanding that does seem to appear in mostly all of the research articles is the idea that —urban” has something to do with people of lower income or in poverty. The definitions of —urban” are not only confusing but demonstrate the deficiency and understanding of the term. Norman et al. (2001) stated that "the overwhelming majority of Black students attend urban or inner-city school, whereas White students attend largely suburban schools" (p. 1102). Southerland, Kittleson, Settlage, and Lanier (2005) defined urban by offering a variety of characteristics such as non-English speakers, large number of immigrants, poor groups of people or diverse populations. —Urban schools are not the wasteland commonly presented in the popular press but are complex systems which defy a simple description” (Settlage & Meadows, 2002, p. 116). In Wirth's (2000) view of the urban environment:

…not only are individuals challenged as much by a sense of loneliness as by an awareness of freedom, they are equally divided in their response to outside influences. Thus whereas traditional groups—or indeed any groups—fail to hold a determining influence on the lives of persons within an urban setting, those individuals are more vulnerable than their rural counterparts to the appeal of mass movements. (p. xx)

Many teachers feel stressed but urban teacher tend to be more stressed. Abel and Sewell (1991) examined 51 rural and 46 urban secondary school teachers and found urban school teachers experienced more stress from poor working conditions and poor staff relations than did rural school teachers. Causes of stress included
classroom management, administrative support, lack of parental support, and culture differences (Haberman, 2004). Stress felt by urban teachers impacts their enthusiasm and commitment to their students and classroom, leading to professional fatigue causing many to leave the field.

In many urban schools there is an accepted mode of teaching that Haberman (1991) defined as pedagogy of poverty. Pedagogy of poverty includes acts the teacher demonstrates in the classroom that the community, parents, and the general public perceive as teaching (Haberman, 1991). Examples include yelling, writing on the chalkboard, lecturing, and setting rules. Due to many urban administrators‘ expectation of being a direct authoritarian versus a facilitator, stimulator, model, or guide, teachers burn out rather quickly in the urban classroom (Haberman, 1991). Many teachers would be disappointed to find themselves as a disciplinarian versus a catalyst for change.

Due to major funding cuts urban classroom face classroom overcrowding, little or no resources and funding, and dilapidated buildings. Teachers tend to have more education in urban schools thus requiring higher pay; hence, there are less funds available for other science education resources. Students‘ needs are diverse and demand numerous specialized resources. Educational spending from taxes is difficult to obtain when the community consists primarily of wage earners who are living at or below poverty. Most states provide a minimum amount of money to aid urban districts in providing a basic education but not enough for classroom overcrowding, specialized resources, and to build new buildings.
Media Science

Media science embodies valuable learning artifacts that aid in a specific infrastructure of learning science (Fenichel & Schweingruber, 2010). Society’s cultural perceptions and interests are infused through media science. Media includes the Internet, media players, radio, and television. Cavendar and Deutch (2007) suggested that television circulates images which convey cultural meanings about many facets of social life, including crime” (p. 78). Fenichel and Schweingruber (2010) pointed out that developing an understanding of how scientific knowledge evolves can be conveyed . . . by media through the creative reconstruction of the history of scientific ideas and the depiction of contemporary advances” (p. 29). As noted by Fenichel and Schweingruber (2010), some issues explored by understanding the science construction that occurs from media science in all of its complexity and then examining how to benefit for learning science in urban classrooms can be beneficial. Media science can be explored through popular culture albeit Crime Science Investigation (CSI) which is a part of the true crime genre. Brisson et al. (2010) posited, Popular culture is the expression of society’s ideas, attitudes, and perspectives. . . . Popular culture can stimulate people to think about issues in science in a non-threatening, enjoyable environment.” Many schools have used various true crime media shows to motivate students into the field of law (Neumann, 2011). Gaining knowledge of students’ fascination with true crime genre will help to develop a better way of connecting science to their lives.
Popular Culture - True (Crime) Genre

True crime drama is a sensational genre that shapes society's view of science and technology (Brewer & Ley, 2010; Cavender & Deutch, 2007) through popular culture. The true crime drama provides a perspective that can shape thought processes on crime and reflect society’s cultural beliefs. Cavender and Deutch (2007) found in the last half century that crime drama has changed from story-lines of detectives and lawyers protecting innocent clients to police officers apprehending the guilty, which represents the social change of our society.

According to Allen (2007), *Crime Scene Investigation (CSI)* belongs to the genre of law applicable to a police or detective story, whereas the detective solves a crime or mystery through a keen sense of observation and cleverness. Allen suggested that *CSI* claims universality and is a detective story where science represents the law. *CSI* is a crime drama depicting forensic scientists who supposedly use cutting-edge methods and instruments to examine the evidence collected at crime scenes to solve crimes. The science, albeit forensic science, portrayed on the television program has an impact on high school students‘ understanding of science and scientists. Aikenhead (1988) studied urban high school students and discovered that television had more of an impact on students‘ beliefs about science and its social, technological context than school science. Students look at the images of science being shown and believe this is how science looks and works. The field where science represents the law is known as Forensic Science.

Forensic science is the application of science to criminal and civil laws influenced by the criminal justice system (Saferstein, 1998). It refers to the application of principles and methods of science and medicine to legal questions of a criminal or civil nature.
Forensic science involves the process of analyzing a crime scene which is a combination of criminalistics and criminology (Ramsland, 2001). Forensic science depends on the process of science to obtain the truth. The scientific process is also used in forensic science as discussed by Ramsland (2006).

In other words, when scientific testimony is presented, judges have to determine whether: (a) the theory can be tested, (b) the potential error rate is known, (c) it was reviewed by peers and has attracted widespread acceptance within a relevant scientific community, and the opinion is relevant to the issue in dispute. (pp. 62-63)

Cavender and Deutch (2007) found that CSI is one of the most popular shows among African Americans. In the show, the characters use specialized scientific equipment, use the scientific jargon, and wear lab coats and aprons to give credibility to their investigations. CSI portrays our society’s current social-ills with plots taken from current headlines and has become a television media phenomenon. Students find the CSI program intriguing and want to see the bad guys caught using the sophisticated technology depicted. Cavender and Deutch found the images depicted in the show validate scientific evidence and science itself:

CSI characters look the part of forensic investigators at the crime scene and in the crime lab. At a crime scene, they display the markers of the police such as identification badges, but they also wear clothing which visually marks their special status such as jackets and caps labeled ‘forensics’. Gloves and booties complete the crime scene ensemble. As befitting scientists, in the crime lab characters wear lab coats, smocks or lab aprons. (p. 74)

Students gain a sense of the field of science by observing those in science fields. For most students, this would include science teachers, doctors, scientists, and dentists, etc. To observe a person on television dressed in sexy, trendy clothing walking into a crime scene and talking the language of science makes the field of forensics exciting. As
argued by Anderson (2007), “The media uses spectacle to generate points of view, perceptions, anxieties, aspirations, and strategies to strengthen or undermine support for specific education policies, practices, and ideologies” (p. 103). CSI provides a glimpse of the crime laboratory that is essentially a science lab with sterile workstations that are not for experimentation (Ramsland, 2001). Unfortunately, viewers are not shown the specific protocols scientists use for evidence being analyzed in order to avoid cross contamination. Occasionally, the scientists on the show provide the name of an instrument, but rarely discuss the history or process. The show does not offer the explanation of how these analyses have been tested in the community of scientists and have been accepted as the proper way to perform the test on the physical evidence.

Considering most students rarely have or will visit a forensic laboratory, I believe that educators should be careful describing its images and provide explanations of its various functions. One image consistently shown on CSI is the forensic scientist leaving the laboratory and going to the crime scene to collect evidence dressed in trendy outfits. First, not all scientists go to the crime scene. Second, for the scientists that go to the scene, they rarely go in trendy outfits due to the nature of the scene. Unless someone is familiar with forensic science, one would assume the show’s depiction is correct.

The scientists in true crime media—CSI, for example—perform experiments that try to substantiate that forensic science can and will reveal the answer (Cavender & Deutch, 2007). Most students lack substantial knowledge about the forensic science community. CSI uses high-tech effects to explain visually the complicated forensic jargon that otherwise would not be as entertaining. The implications can be powerful for students who are visual learners. These high-tech effects can impart accurate or
inaccurate information. The high tech effects explains the urgency of why practitioners need to think and present opportunities that will enable students to critically analyze the media’s depictions of science and how it relates to science. The knowledge and skills such as how to incorporate new technology into the field is needed for students to know, to become and to remain good scientists.

Science and Science Education

Science is “knowledge or a system of knowledge covering general truths or the operation of general laws especially as obtained and tested through scientific method and such knowledge or such a system of knowledge concerned with the physical world and its phenomena: natural science.” (Webster, 2009)

What Is Science?

During slavery, Africans brought their scientific knowledge of herbal treatments for various infections to North America (The Encyclopedia of African American Heritage, 1997). After slavery, these earlier scientists continued their craft but their science was not accepted. In the 1900’s, Benjamin Banneker and George Washington Carver were two well-known African American scientists. Current examples of scientists include Dr. Benjamin Carson – a pediatric neurosurgeon, Dr. Shirley Jackson – physicist and president of Rensselaer Polytechnic Institute, and Dr. Mae Jemison – physicist and astronaut. In comparison to their Caucasian counterparts they are not as well-known nor always discussed in classrooms. Today, there are many more African American scientists but few in comparison to their Caucasian counterparts. For this study, gaining an understanding of science as defined by those in power historically and today is warranted.
Scientists, for the benefit of all people, are urged by society to explore, to understand, and to make known existing and new scientific knowledge about the laws of nature (Hodges, 2006). Gaining scientific knowledge about the natural world determines what is useful and allows science to go beyond the limits of the people that engage in it: which suggest products of science are humanly constructed and these constructs are based on the natural world (Southerland, 2000). Science is a process where truth is the goal, achieved through testing and constructing new scientific knowledge about the natural world. Toumey (1996) defined science as “the systematic study of nature” (p. 11). The procedure depends on careful and detailed observations of a phenomenon with the aid of instruments to find patterns and create theories (American Association for the Advancement of Science, 1990).

Science is also an occupation where humans conceive, develop, and create theories. Once science theories are accepted by a community of people and considered important, the science concept is defined and constructed into a conceptual framework to be examined (Kuhn, 1962; Latour, 1987). Crooks and Flockton (1996) argued science is a universal discipline and defined it as an active process derived upon a growing body of knowledge. Scientists contribute to this body of knowledge using observations, skills and imagination to tackle a problem and to investigate objects and events of the natural world. When exploring science theories, science can be defined and understood differently by other community and cultural populations. Latour (1987) suggested the narrow lens of the scientific community attempts to understand an aspect of the natural world while neglecting to consider alternative approaches to science. If the science is not a part of or put through the scrutiny of Western culture then it is not considered science.
Snively and Corsiglia (2001) discussed how many indigenous cultures use oral methods in recording systems versus Western culture. The American Indian healing culture provided many examples of science, including discovering and using quinine, Aspirin, and ipecac (stomach remedy) (Snively & Corsiglia, 2001).

Dr. Mae Jemison, the first African American female astronaut, quoted that “It is important for scientists to be aware of what our discoveries mean, socially and politically. It's a noble goal that science should be apolitical, acultural, and asocial, but it can't be, because it's done by people who are all those things” (Lewis, 2011, p. 1). Science as a discipline entails facts and information obtained by following specific rules that present and disseminate information in a certain way. In the scientific community, scientists have their own beliefs, language, values, expectations, and technologies that define the culture of science (Aikenhead, 1996). The scientific community operates within a closed system to construct their arguments for their scientific theories and facts. As the theories are accepted by the scientific community, science as a discipline is shifted by unanimous assent to a new particular paradigm (Kuhn, 1962).

Latour (1987) examined how science was done in laboratories and found scientific information was not produced but rather socially constructed. These social constructs are defined by Latour as the Actor Network Theory (ANT). Latour’s theory argued that scientific facts are constructed through a network of various actors interacting with one another. The actors are the scientists, the laboratory, the equipment, the technicians, the subjects or samples being studied, and the wider scientific community. Therefore, the actors present their perspectives in these closed scientific communities that must validate the view of Western Science. Many interpretations exist for defining
science for the last two hundred years (Toumey, 1996). The Western view of science
developed from three concepts as suggested by Toumey (1996): the Protestant model, the
philosophy of useful knowledge, and the European scientific research ethos. First, the
Protestant model gave rise to the systematic study of nature through scripture; observing
patterns in nature where God would be revealed. The second concept, philosophy of
useful knowledge, allowed the United States to use the natural world through engineering
and technology to show prowess. Third, the European scientific research ethos, also
known as the European Enlightenment model, separated from the Protestant model. This
third model detached from religious beliefs, employed a positivist attitude and required
that nature be explained as laws or processes. Science was to be looked upon as a
laudable vocation. Western science originated in the philosophy of Ancient Greece and
the Renaissance and supports an analytical and reductionist methodological approach to
the natural world. The existing research literature is torn over what comprises western
science.

Western science, through the lens of nature, attempts to discover, to articulate and
to explain regularities in nature that are universal (Siegel, 2001). Aikenhead (2001)
defined the Western view of science as being “purely objective, solely empirical,
immaculately rational, and thus, singularly truth confirming” (p. 2). Furthermore,
Mazzocchi (2006) concurred that “Western science is objective and quantitative as
opposed to traditional knowledge” and “is based on an academic and literate
transmission” (p. 464). Arguably, Western Science is taught and practiced with the
premise of finding “truth.”
In most science discussions, the word “truth” tends to be the underlying objective. As scientists begin to understand the natural world, the new knowledge brings humans closer to understanding the “truth” about the world. Science assumes the universe is a limitless system where the rules are the same everywhere, drawing and contributing towards a growing and changing body of knowledge that ultimately brings us closer to the “truth” (Singham, 2000). Siegal (2002) pointed out science is to investigate a world independent of our thoughts and beliefs. However, Jackson (2005) defined scientists as personally engaging in pursuits to reveal the truth about nature because “it speaks with no one’s voice. But the knower, like all personae, is a constructed identity” (p. 12).

Previous studies have argued that Western science is a reflection of White male science (Pomeroy, 1994) or categorized as Western modern science (Ogawa, 1995). The argument is science is from a European American or Western point of view (Ogawa, 1995; Pomeroy, 1994) that identifies with power, finance, and progress. Harding (1991) points out that science has many interlocking practices, meanings, and products that make up a cumulative tradition of scientific knowledge.

The knowledge produced from science research is meaningful and useful in all cultural communities, and it is linked to one’s culture (George, 2001; Southerland 2000). Science is located in a cultural context that relies on the merit of scientific knowledge as measured by how it meets western science epistemic requirements (Southerland, 2000). In many cultural communities, scientific beliefs are construed with Western Science. Because of the differences in scientific beliefs, there are discrepancies in defining science that affects each culture’s ways of doing science. As noted by Harding (1994), “We live
in one world, and the scientific choices made by each culture have effects on others” (p. 321).

Despite the different definitions of science, this study focused on the Western view of science. Other cultural science perspectives such as Aboriginal and Native American science are pertinent; however, for the purpose of this study the Western dominated view of science was the basis in which this study was constructed. The purpose of examining Western science was to show that science and culture are interrelated. Banks (1992) stated that

Western traditionalists hold the balance of power, financial resources, and the top positions in the mass media, in schools and universities, government, and in the publishing industry . . . the reality is that the curriculum in the nation's schools and universities is largely Western in its concepts, paradigms and content. (p. 33)

For bilingual/bicultural students to be successful in the science classroom, they need to assimilate both linguistically and culturally to a White male dominated way of thinking and learning (Barba, 1993, p. 1055). This argument is specifically relevant to students’ science learning, considering the canonical science belief has been depicted as alienating to underrepresented groups in science, given White male characteristics (Aikenhead, 1996; Fordham, 1993). Examples of White male characteristics may consist of a White male, old, wearing glasses, and wearing a white lab coat. The next section explores the impact of Western science on the education discipline that affects the future development of the scientist. Science has become more complex and imperative in our daily lives and students need the best possible education (CSMEE, 1998) to understand the world they live in.
What Does Science Education Say Science Is?

_The study of science as an intellectual and social endeavor—the application of human intelligence to figuring out how the world works._ (Benchmarks, 2010)

Education is often times viewed as the reverse of science as a tradition, which often leads to conflict in the classroom (Latour, 1987). Scientific knowledge is produced and manufactured in laboratories and is disseminated to the public. Members of the public are active in the proliferation of this science knowledge. Kuhn (1962) concluded that the scientific community works in tandem with laboratories by contributing, in unison with them, fact upon fact that paves the way toward truth.

Through the outcome of Project 2061 (the year Haley’s comet is to return), modifications in the science curriculum have been going through major revisions; but changes in the way it is taught in school have been slow (Ryan & Cooper, 2010). Members of the American Association for the Advancement of Science, which included an expert panel of scientists, mathematicians, and technologists, identified the knowledge needed for students to be scientifically literate. In 1989, the recommendations were developed into the publication _Science for All Americans_ that defines science as:

Science is a process for producing knowledge. The process depends both on making careful observations of phenomena and on inventing theories for making sense out of those observations. Change in knowledge is inevitable because new observations may challenge prevailing theories. No matter how well one theory explains a set of observations, it is possible that another theory may fit just as well or better, or may fit a still wider range of observations. In science, the testing and improving and occasional discarding of theories, whether new or old, go on all the time. Scientists assume that even if there is no way to secure complete and absolute truth, increasingly accurate approximations can be made to account for the world and how it works. (Rutherford & Ahlgren, 1990, p. 2)
After the publication of *Science for All Americans*, another book, *Benchmarks for Science Literacy* was published which provided an outline of what all students should know and be able to do in science, mathematics, and technology by the end of Grades 2, 5, 8, and 12. *Benchmarks for Science Literacy* define science as:

One is that by working together over time, people can in fact figure out how the world works. Another is that the universe is a unified system and knowledge gained from studying one part of it can often be applied to other parts. Still another is that knowledge is both stable and subject to change. (American Association for the Advancement of Science, 1993, p. 5)

The National Science Teachers Association (NSTA) is the agency that develops the bridge between the scientific community and the science education community. NSTA trickles scientific ideas down to the individual science classrooms, the epicenter of the science education community. The ideas of NSTA are the ones that influence the Ohio Department of Education (ODE) that controls individual science classrooms in the state of Ohio. Science connections are seen and supported by the science education community not only to define science in classroom but also in the curriculum formation that trickles down to the student’s understanding of science.

The NSTA (2010) defines science as:

Science is characterized by the systematic gathering of information through various forms of direct and indirect observations and the testing of this information by methods including, but not limited to, experimentation. The principal product of science is knowledge in the form of naturalistic concepts and the laws and theories related to those concepts. (p 1)

The scientific community strongly supports science as a method or process to explain a theory or natural phenomena. The Ohio Academy of Science defines science as a method that will ultimately lead to the knowledge of natural phenomena that will always be open to further investigation so that it may be accepted or refuted based on
scientific evidence (Shrake, Elfner, Hummon, Janson, & Free, 2006). Additionally, the Ohio Department of Education provides the following definition of science which is the foundation for teaching science in the classroom.

Science is a systematic method of continuing investigation, based on observation, scientific hypothesis testing, measurement, experimentation and theory building, which leads to explanations of natural phenomena, processes or objects that are open to further testing and revision based on evidence. (ODE, 2010, p. 2)

Therefore, in the classroom, the approach taken to construct scientific knowledge is known as the Scientific Method.

As students begin to learn and utilize the Scientific Method they will learn themselves the knowledge and skills needed to process the world around them. Scientists use a series of steps to obtain, acquire, investigate, and explain the natural world. Carey et al. (1989) support the steps in teaching science,

the standard curricular unit on scientific method contains many exercises to teach students about the design of controlled experiments, such as identifying independent and dependent variables in experiments, and identifying poorly designed experiments in which variables have been confounded. (p. 514)

Therefore, using the scientific method allows students to apply their knowledge in a systematic method.

Scientific method is augmented by scientific inquiry that engages students to develop the capacity to ask questions and to observe the world around them. The students are then instructed to use their observations to construct explanations for the questions or problems posed. The National Science Education Standards defined scientific inquiry this way:

Scientific inquiry refers to the ways in which scientists study the natural world and propose explanations based on evidence derived from their work.
Inquiry also refers to the activities of students in which they develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world. (p. 23)

The goal of inquiry-based science is to ensure students become more knowledgeable about science as they become scientifically literate adults. That is, citizens who understand how scientific knowledge is produced will be careful consumers of scientific claims about public scientific issues (e.g., global warming, ecology, genetically modified foods, alternative medicine) both at the ballot box and in their daily lives” (Duschl, Schweingruber, & Shouse, 2007, p. 169).

Scientific inquiry is defined as the diverse ways in which scientists study the natural world and propose explanations based on the evidence derived from their work. Scientific inquiry also refers to the activities through which students develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world. (National Research Council, 1996, p. 23)

Scientific connections are seen and supported by the science education community not only to define science in the classroom but also in the curriculum that trickles down to the student’s understanding of science.

While the current definitions of science by the science education community provide a vague picture of what takes place in the science classroom, on the following points, each is clear: Science is (a) performed systematically, (b) will discover the truth behind the phenomena, and (c) is a way of thinking about the natural world. Furthermore, two central points are reflected in the definitions that science teaching must consider: Students must know science is a process whereby scientific knowledge is (a) explained through careful observations, and (b) repeated testing over time. Once constructed, new scientific knowledge must be tested and accepted by the scientific community in order to
be viewed as the truth, which may lead to a new paradigm shift. However, to continue to discover the truth and advancing the scientific community, students must be exposed to the scientific process that is applicable to their lives.

**School Science vs. Media Science**

*Every child can learn [science]. Yet in every school, there are those who do not* (Slavin, Madden, Karweit, Livermon & Dolan, 1990, p. 256).

**Students’ View of Science**

Daily in the lives of many urban students, science knowledge is constructed from personal experiences that foster their desire to engage in science. Students’ perception of scientific learning contributes to their motivation for learning science and for the construction of a cohesive knowledge of science. As a result of the many interactions that students encounter on a daily basis, the interactions eventually conflate their understanding of science with their interaction with science; visiting the doctor, using cell phones, conversing with family and friends, watching television and attending school. Students learn science when objects of science impinge upon them through health systems, political systems, media systems, and industry systems (Weinstein, 1998). Students’ feelings toward science are affected or influenced by many variables. Existing research suggested that students’ attitudes toward science could have an effect on students’ interest in science (Rennie & Punch, 1991; Shrigley, 1990). In order to engage students in science, there needs to be a reason why they need to know science. Research by Bouillion and Gomez (2001) suggested that when you cannot connect science to students’ lives, students are not able to see the relevance of science to real
problems and issues. For many urban students, science is viewed as culture capital that is
used to help one attain their future goals (Tobin et al., 2005). Eicher (2007) stated:

Research has shown that connecting science to the real world is an effective
strategy for engaging students in science and math. Showing the relevance of
science can stoke students’ curiosity and sustain their interest in science — a
critical challenge schools face today.

As discussed by Zacharia and Barton (2004):

In short, students’ attitudes, both at the middle- and high-school level, appear
to be affected by the students’ interest levels in science, their abilities in
school science, the curriculum and the learning climate, their access to
extracurricular science experiences, their family, their teachers, their own
self-concept, and their peer groupings. (p. 199)

Finding ways to impact or modify urban students attitudes in science are needed
in the early years and should be reinforced throughout their middle and high school years
(Basu & Barton, 2007). Furthermore, Basu and Barton suggested that by tapping into
urban student interests such as sports, music, games, and food, science educators
positively affect the student’s level of interest in science. Developing a curriculum that
demonstrates how science is useful in the lives of students can become a powerful tool to
increase or bolster participation in science classrooms. O'Neill and Barton (2005)
suggested that:

First, science is a social, cultural, and political practice, and if urban youth
are to feel part of science, then all of these dimensions of science must be
explored. Second, for students to have fair access to and experiences in
science, the science must somehow be connected to their lives at the core. (p.
292)

Emdin (2011), Norman et al. (2001), and Seiler (2001) pointed out that the
method of teaching science fails to captivate urban students‘ attention. Urban students‘
views are not solely affected by one factor but rather a compilation of many issues. In
order to increase participation in science we must create a curriculum to demonstrate the relevance of science to urban student lives.

**Students’ Conceptions of School Science**

A classroom lesson seeks to make scientific sense of a scientific concept, but this becomes a cross-cultural activity when the scientific sense does not automatically fit with the student's more global view of reality. (Cobern, 1996)

Science is defined as a *de facto* gate keeping device for determining what should and should not be included in a science curriculum (Cobern & Loving, 2000). Aikenhead (2006) suggested that school science’s main purpose is to pipeline students into science degree programs by focusing on intellectual knowledge. A metaphor used to describe the K-12 educational journey for underrepresented African American students in science would be a leaky pipeline (Blickenstaff, 2005; Young, 2005). To pipeline a person into science based on their intellectual knowledge fails to demonstrate equity for all and further brings concerns over how scientific knowledge is being manipulated. Therefore, African American students need to know that they need the intellectual knowledge in order to enter into science degree programs. Unless they have a good system to provide the support (i.e., tutoring, access to mentors, and teacher and parental reinforcement), students will not succeed.

To a certain degree, school science does not appear to be applicable to everyday life. Most students have difficulty when they learn science at school even if school science has relevance to their own lives (Aikenhead, 2006). Students may have difficulty interpreting and transforming information from one context to another. They may not test ideas learned in the classroom with interactions from outside high school academia,
(Linn, Davis, & Bell 2004). For example, teaching about thin-layer chromatography (TLC), a scientific technique to separate mixtures has very little relevance within the framework of a student’s life. If thin-layer chromatography is discussed in the context of cosmetic science—where students are allowed to see how the knowledge of TLC is applicable to their lives, such knowledge may take on credence outside the classroom door. If there is any large social or cultural relevance in this science content, Aikenhead (2006) suggested students will have the motivation to learn science. But if students find school science in an ethereal realm outside of everyday living, then such science will lack meaningfulness in the lives of students.

Existing research suggests that when high school students make decisions to go into the sciences they are based on two factors. First, students need to be academically successful in science. Second, students must see themselves functioning within the discipline (Subotnik, Tai, Rickoff, & Almarode, 2010). In other words, based on students’ observational knowledge of people in the sciences (e.g., family members, friends, classmates, mentors and teachers), they decide if their observations match up with their self-image (Hannover & Kessler, 2004). Many students have a negative image of what it is to be a scientist. As noted by Ogbu (2003) and Fordham (1996), students who are considered smart and science-savvy are not popular. The need to be accepted and popular by peers is deemed more important than basking in the accomplishments of being scientific. Finding a way to modify the image students have of scientists and science in classrooms has to be achieved in order for students to consider science as a viable career option.
Barba (1995) indicated “the study of science and related technologies often requires students to adapt to a White male culture, to a Eurocentric/androcentric world view” (p. 8). As proposed by Lemke (1990), science is taught as a property belonging to a community of people who share values such as individual effort and achievement, attention to detail, the separation of reason from emotion, respect for authority and following instructions exactly” (pp.177-178). Take notice of this disjuncture between science and school science. As noted by Arrorio (2010), “The science which is taught in school is a simplification of real science and for example takes into consideration the age of the students” (p. 133). What constitutes real science is complex and school science, which many urban public school students encounter, is not real science. In school science, students are taught the scientific method or the step-by-step method of performing scientific experiments. Many science educators tell students to make observations, to make a hypothesis, to observe, to collect data, and to record results in order for students to determine if their hypothesis is wrong or right.

On the other hand in real science, scientific inquiry starts with a question at the same time as observing some natural phenomena. This is a form of scientific investigation. Suppose there is no known answer to the posed question, then one or more hypotheses or explanations can be tested by students who conduct a scientific experiment to answer the question. The process of doing science usually begins with a question, for which there is no known answer. For scientists, most experiments are repeated and re-designed to refine the existing scientific laws, theories, and models to match experimental results and predict natural phenomena. As noted by Bell (2006), science is and will continuously change through time, in terms of how it is performed, what is studied, who
researches it, and how it is used in the world. Teachers and students tend to perform scientific experiments to discuss a *known* phenomenon (by the teacher) to answer the question. The *known* raises issues about what counts as science knowledge, who is knower and who is served and benefited from the science knowledge (Bell, 2006; Harding, 1991). Barton (1998) suggested this perspective questions the interpretation of science (what science is assumed to be) and questions the characteristics of science. We come to ask what sort of person we should be engaging in scientific knowledge. Such musings determine who winds up studying science.

From childhood to adulthood, people continuously examine incoming information and determine its truth. The media and the science classroom are places where the information flows. While production companies put false images and false information on the television and make it look truthful, science teachers can discuss various science topics each day in the classroom so students can recognize the difference between truth and fiction.

**How Student Views of Science Are Shaped: Media Science**

*The world of science, judging from some media portrayals, is a world of white-coated boffins peering through microscopes, laboratory benches with bubbling flasks set above flickering Bunsen burners, and racks of test tubes and petri dishes emitting strange aromas. (Allan, 2002, p. 1)*

Many times when I was asked to speak to high school students about the field of forensic science, I was surprised to learn about students‘ naïve misconceptions about forensic chemists. The misconceptions included views on the way scientists dressed, collection of evidence, and time needed for analysis. Understanding how media science shapes students‘ conception of science is vital for improving science education.
Students learn science in and through a variety of contexts: in school, out of school, and from families, friends, and the media” (Barton, 1998, p. 382). As stated by Cavender and Fishman (1998), "the social context in which we live informs and shapes everything from what we think about the nature of our institutions and the policies that drive them” (p. 5). Sensationalism sells in the world of media and students are often one of the biggest consumers. Popular belief is influenced more by cinematic images than by actual images of scientists in the media and have an impact shaping society's image of people as scientists (Allan, 2002). Storey (2003) defined popular culture as: "popular culture is an arena of struggle and negotiation between the interests of dominant groups and the interests of subordinate groups” (p. 4). During this struggle, many definitions, understandings and knowledge of science are developed.

Dana Kollman reflected in her memoir the views from student comments obtained from media on forensic science:

Before you even ask the question, the answer is no! No, no, no, no, no! No you can't get fingerprints off of rocks! No, I don't watch CSI! No, crime scene investigators don't interview suspects! No, I wasn't interested in the O.J. case! No, I wasn't a cop (and no, I didn't decide to do Crime lab work because I couldn't get into the police academy)! No, luminol doesn't glow blue hours after it's sprayed! No, Crime Lab doesn't respond to only murders and high-profile crimes! No, I didn't wear a miniskirt and heels to work. (Kollman, 2007)

Most of these contradictions come from television, and students believe they are true.

Popular culture shapes students' conception of science. This tends to play a bigger role in the student's mind than school science. Media is a reflection of pop culture, and cultural constructors of knowledge are found in the genre of crime dramas. The hierarchical process of creating scientific knowledge in crime drama media moves from: everyday-
knowledge, scientific knowledge, true knowledge, popularization of scientific knowledge, and scientific truths, all ultimately transmitted to the public (Weingart, 1998). Weingart’s process depicts how science is developed through the science community, duly accepted and then conveyed to society.

Media Crime Drama (MCD) is a narrative genre presenting a story through a sequence of events (Arrorio, 2010) combining science and crime for entertainment. These police procedural programs are popular in the United States and yet remain controversial, due to their coverage of unrealistic investigation procedures and the science depictions (Huey, 2010). Ramsland (2006) offered the following description of the impact of media science: “Through a proliferation of forensic television programs, the mass media has offered the public an education of sorts about forensic science and investigation, with a threefold effect” (p. xiv). The threefold effect is translating scientific information to laypeople (potential jurors) and making them savvy about the scientific knowledge, demanding of evidence and chemists, and finding less than perfect expert testimony reasonably doubtful in the courtroom (Ramsland, 2006). Many television shows depicting forensic science have been viewed, such as: Criminal Scientific Investigation (CSI), Naval Criminal Investigative Service (NCIS), Investigative Reports, American Justice, Forensic Files, The Prosecutors: In Pursuit of Justice, Justice Files, The F.B.I. Files, The New Detectives, Autopsy, Six Feet Under, History's Crime's and Trials, Secrets of Forensic Science, Medical Detectives, Secrets of the Dead, Nova, Scientific American Frontiers and many more.

High school students prefer a science that is applicable to their life. Forensic Science is a field that attracts many people [especially high school students] from all
walks of life because it pertains to all walks of life. High schools students find it intriguing because of the gross factor, the sexiness, and the excitement of the chase. Television is dismissed as disposable in education, with a debate on what is valued versus what we should value (Byers & Johnson, 2009). Byers and Johnson (2009) further affirm that watching true-crime media can cause students to have high expectations of what science can do and greatly color their perceptions of science. Analyzing the content of the images of crime and justice, said Durham (1995), leads to –the misrepresentation of crime types, as well as of offender and victim characteristics, but this is important because large numbers of citizens [students] obtain their information about crime [science] from the mass media‖ (p. 145). Durham further suggested a concern on how the viewing of crime shows influences student understanding of science and shapes their enthusiasm for how crime solutions are achieved.

Crime Scene Investigation (CSI) with the visual effects and fast-moving story lines enables students to understand and construct knowledge about forensic science while following the plot line. There are few cultural or language borders students need to cross in order to view and observe media drama science. The performers being observed and viewed on the media drama shows serve as scientists in a world now dominated by entertainment. Students take visual examples of the media crime dramas and place them into their knowledge which demonstrates how science is constructed.

CSI, set in Las Vegas, first aired on television October, 2000. The show airs weekly for 60-minutes, focusing on the activities of the Crime Scene Investigations Bureau forensic chemists (Close & Erickson, 2011). The CSI forensic chemists use state-of-the-art forensic technology and scientific ingenuity to solve unsolvable crimes. The
program depicts the scientists in sub-teams investigating cases they have been assigned to investigate (Close & Erickson, 2011). During the program, the CSI team is depicted examining crime scenes, securing evidence, conducting lab experiments, interviewing witnesses and suspects, and, ultimately, using forensic science to solve crimes (Cavender, 2007). Ramsland (2006) suggested that the inspiration for CSI came from actual crime cases where the expertise of crime scene analysis was needed for accurate understanding for prosecution. Using the structure of other famous true-crime drama shows and high-technology, the show was an instant success. The success of the show is found in many of the comments from the first aired show of CSI:

Valentine_76 - I loved every minute of this first episode of the first season of CSI. All of the story lines felt real, as well as the people portraying them. (Valentine_76, 2011, para 4)

Gesa-J - This was one of the most original pilot episodes I have ever seen. In this episode, there are various cases to be solved by a great team (btw, "A strong Team" was the German title for this episode... sort of appropriate, I think) of CSIs, and we get to know the characters and their relationships pretty good. Keeping in mind that this was the very first CSI episode ever, I think it is amazing, how great they explained all the forensics, too! I mean, after several episodes, you know what they mean by GSR, but then we didn't. (Gesa-J, 2008, para 5)

Greenman314 - A well-rounded episode that introduces us to the crime lab through the eyes of rookie Holly Gribbs, this episode is just plain great. (Greenman314, 2007, para 11)

After the first show, two more show spin-offs aired: CSI: Miami (aired 9/23/2002), and CSI: New York (aired 9/22/2004). CSI: Las Vegas (original) provides the excitement of casinos and desert settings, CSI: Miami provides the alligators and ocean front views, and CSI: New York provides gritty high-rise and old money feel (Ramsland, 2006). Each show has a different approach of the chemists and the crimes to solve.
Constructivism: A Philosophy for Constructing Knowledge

Personal construction of [science] knowledge occurs through the interaction between the individual’s knowledge schemes and his or her experiences with the environment. (Arroio, 2010, p.133)

Construction of Knowledge

Constructivism is influential in Western science education (Matthews, 2002). Urban African American students communicate with school, family, friends, community, and media. As students interact with various groups they construct their science knowledge. Examining the history of constructivism in the construction of science knowledge advanced an understanding of this study.

At the turn of the century, John Dewey (1910) and Jean Piaget (1920) developed Progressive Education that developed into constructivism that was further developed by Jerome Bruner (1966), Maria Montessori (1948), and Lev Vygotsky (1980). Each of the aforementioned theorists believed that when young children interact with the environment and peers, learning and development occur (Bodner, 1986). As noted by Bodner (1986), “Piaget argued that knowledge is constructed as the learner strives to organize his or her experiences in terms of preexisting mental structures or schemes” (p. 873). Constructivism’s emphasis is on student construction of knowledge, not reproduction of knowledge, put together from experiences, mental structures, and cultural beliefs used elsewhere but also used to understand scientific information.

Knowledge and knowing are constructed – socially, culturally and personally. As noted by Shealey (2006), “knowledge construction is an important part of multicultural education” (p. 16). Guba and Lincoln (1994) stated constructivism’s aim,
is to understanding and reconstruction of the constructions that people (including the inquirer) initially hold, aiming toward consensus but still open to new interpretations as information and sophistication improve. The criterion for progress is that over time, everyone formulates more informed and sophisticated constructions and becomes more aware of the content and meaning of competing constructions. (pp. 110-111)

Richardson (2003) defined constructivism as a knowledge or sense-constructing theory.

Students create or construct new knowledge from what they know and the world in which they live. According to Bodner (1986), constructivism focuses on constructing knowledge in the student's mind. Each student enters the science classroom with different experiences; thus, the teacher must be cognizant that knowledge is constructed distinctly in each student's mind. In a classroom, construction of scientific knowledge is performed in groups where students work collaboratively on hands-on activities related to a problem. The teacher formulates questions that delve into student beliefs that allow them to discuss and to debate with their peers. Therefore, scientific learning through constructivism is a tool that allows students to create knowledge about the natural world.

Initially, constructivism was a theory of learning and has evolved into a theory of teaching, a theory of education, a theory of the origin of ideas, and a theory of both personal and scientific knowledge (Matthews, 2002). Matthews critically argued that constructivism has become in many ways the chosen method of teaching mathematics and science. Yet, many science teachers are not fully embracing the method of teaching constructivism as noted by Matthews (2002):

Many science educators are interested in finding out how, on constructivist principles, one teaches a body of scientific knowledge that is in large part abstract (depending on notions such as velocity, acceleration, force, gene), that is removed from experience (propositions about atomic structure, cellular processes, astro-nomic events), that has not connection with prior conceptions (ideas of viruses, antibodies, molten core, evolution,
electromagnetic radiation) and that is alien to common sense, and in conflict with everyday experience, expectations, and concepts. (p. 129)

Most science teachers provide a demonstration and allow students to construct their knowledge by asking questions and providing answers as they deem necessary.

Vosniadou and Ioannides (1998) suggested “science knowledge” as conceptual knowledge which is based on student interpretation of everyday experiences and is continuously restructured. But, how do teachers offer experiences for subjects in and beyond the realm of the classroom? Providing students opportunities to experience real science is detrimental in constructivism. Clearly, constructivism has alerted teachers to the importance of assessing a student’s prior knowledge, the need of student understanding of new knowledge, the humanistic view of science and the connection to a student’s culture and interests (Matthews, 2002). Even if constructivism’s concepts are found useful in the class, it should be noted they are also present in non-constructivist epistemology (Matthews, 2002). After reviewing the research literature Mayer (2004) found that the data did not support using the constructivist teaching technique of pure discovery and described the inappropriateness as the “constructivist teaching fallacy.”

Mayer (2004) argues that not all teaching techniques based on constructivism are efficient or effective for all learners, suggesting many educators misapply constructivism to use teaching techniques that require learners to be behaviorally active (Mayer, 2004).

Traditionally, teachers viewed students as empty vessels upon whom information was poured and then students would regurgitate the learned information. Bodner (1986) stated:

The traditional view of knowledge views the mind as a "black box"; we can accurately judge what goes in (stimulus) and what comes out (response),
but we can only guess about what is happening inside the box. The constructivist view of knowledge views the environment as a "black box"; each of us knows what is going on in our minds; what we can only guess about is the relationship between our mental structures and the real world. (p. 876)

Researchers, as noted by Bodner (1986), found students were not retaining the knowledge coming by the lecture style method. In order to motivate students to learn and investigate on their own, students must see the relevance of incoming information to their lives and have a reason to learn (Brooks & Brooks, 1993). Three constructs determine students‘ attitudes toward science: teacher, student, and learning environment (Zacharia & Barton, 2004).

Lemke (1990) asserts scientists are constructing understandings in many subjects — in science, as in all other fields, it seems we do not so much discover truths, as we construct meanings” to obtain scientific knowledge (p. 185). To facilitate students‘ construction of scientific knowledge, teachers should be cognizant of a student’s prior knowledge and use it to construct new scientific information. Many teachers do not probe student constructs before introducing new science concepts (Putnam, 1987). Brook and Brooks (1993) suggested five principles in a constructivist classroom that will motivate and encourage students to learn:

1. Teachers seek and value student points of view. By following a student‘s views about concepts, teachers can create lessons based on the student‘s interests.

2. Classroom lessons challenge student suppositions. By allowing students to challenge their current suppositions, students will confront their thinking and thus, the learning occurs.

3. Teachers create lessons that are relevant to student lives. Letting students grapple with the big ideas and determining what requires more investigation is empowering for students.
4. Lessons should be structured around primary concepts and big ideas, allowing students to determine the relevant parts of these concepts as they refine their understanding of the big ideas.

5. Teachers assess the student’s learning daily, embedding assessment in daily classroom investigations, not as separate events. (p. ix)

Student conceptions are ideas students create about the world, the scientific terminology they develop, and the strategies students use to obtain the knowledge needed to explain how things work (Confrey, 1994). Scientific conceptions of knowledge are constructed throughout a learner’s life and Etkina and Mestre (2004) acknowledged that this idea-building is a natural process wherein the learner is mentally engaged. Etkina and Mestre (2004) further proposed that students enter the classroom with prior experiences and even though these prior experiences are similar, they can be perceived differently by other students when they compare notes (Elby, 2000).

Acknowledging students’ prior knowledge and helping them to construct new or revised interpretations through “real life” applications may be a way to hook students into science without the use of the textbook. Students are exposed to many forms of media in their lives; finding ways to use the same technologies to encourage them to understand, to define, and to construct scientific knowledge will empower them to become scientifically literate adults and citizens.

When students’ conceptions are in conflict with accepted meanings in science, they are known as misconceptions (Confrey, 1994). Therefore, it is extremely important to examine and clarify a student’s prior knowledge in the classroom. Knowing how students constructed a science topic is insightful in helping them learn new information.
Confrey (1994) suggested that certain qualities of the science-classroom-experience allow students to gain clarity in acquiring science knowledge.

Three types of knowledge are gained from the science classroom experience as noted by Duckworth (1987): "Perceptual knowledge (the way things look over time), action knowledge (the way I have done things before), and conceptual knowledge (the name I give things, the way it represented, that is, an idea, word, or formula)" (p. 42). Teachers need to explore what students know and have constructed to make appropriate choices in their teaching prior to introducing new concepts (Etkina & Mestre, 2004, p. 12). Etkina and Mestre (2004) claimed that "the teacher needs to evaluate if sufficient prior knowledge is available and to evaluate whether this knowledge conflicts with the knowledge being taught." The methods to facilitate a reconstruction of knowledge include students, discussing, doing, teaching, and offering problem-solving-strategies in science (Etkina & Mestre, 2004). Additionally, students must be given opportunities to use the knowledge in settings outside of school, in their culture, to solve everyday problems in order to assure the transfer is complete.

Culture - Students (Science Construction)

"Science concepts have a socially negotiated meaning shared within a group such as a science class or peer group" (Aikenhead, 1996, p. 3). This study explored the meaning of science concepts through student culture, language, cultural adaptations and backgrounds as shared within a group or classroom. The relationships existing between culture and the construction of science knowledge have many implications. Science can
emerge not only as a form of learning about the world we live in, but the culture of urban underrepresented African American students in science (Emdin, 2011).

Hurtado, Cabrera, Lin, Arellano, and Espinosa (2009) asserted that “the culture of science encompasses a variety of dimensions. It espoused the way knowledge is constructed, as well as how scientific knowledge is produced and reproduced through normalized practices within scientific fields” (p. 205). The learning process and knowledge construction is the result of students interacting in social environments to construct a mutual knowledge that is fitting through tools and symbols (Brunsell, 2006). Brunsell further suggested that the shared meanings and understanding students develop when involved in the learning process is known as culture, which influences their understandings and perceptions of science. Once understanding and meanings emerge, they are molded and implicated in the culture. Brunsell (2006) alluded to the fact that students are involved in many cultures as they interact with friends at school, family at home, friends and family in racial groups etc., ultimately providing a lens that arbitrates the construction of [science] knowledge.

Within the science classroom African American students are exposed to a culture different from home and friends. The students learn the culture of science through language, tools, and the Scientific Method. In learning the Scientific Method, one engages in a series of steps for investigating an observation or experience in order to construct new knowledge or revise prior knowledge. For example, Brunsell (2006) suggested that as a student learns how to use scientific tools, they begin to understand how the scientific tool is used in life. If a scientific tool (perhaps a microscope) does not
reflect a student’s culture, the student must understand the scientific culture to know how to use the tool.

As students develop in their early years, they are situated in family practices which facilitate their culture and language development. Bourdieu (1997) identifies a student’s cultural background as habitus. The habitus makes students behave in specific ways. For example, Carlone and Johnson (2007) studied 15 successful African American women underrepresented in science and created a model of science identity. The model was based on a strong science identity, great competence in work and recognition from peers. The researchers found the women’s gender, race, and ethnicity also played a role in the women’s science identity and self-efficacy. In science classrooms, underrepresented students in science need to develop a strong science identity, receive recognition from teachers and classmates, and become competent in talking scientifically.

Language. Intertwined in the culture is the construction of language. So students who understand the language of scientists taught in the science classroom will have easier access to scientific knowledge than those who do not have access. Once the student obtains the scientific language needed any student will understand a particular field of science. All students face the difficult Western science vocabulary in different fields of science. But once it is mastered, the door to a particular community of scientists is opened (Seymour & Hewitt, 1997).

The Western view of scientific literacy entails the ability to conceptualize reason and phenomenon from a scientific epistemology (Brown, Revels, & Kelly, 2005). Two views of scientific literacy emerging from the research suggest that scientific literacy prepares students to engage in social events, and to engage in social activities that employ
conceptualized scientific terminology that is not in general use. As students engage in social events and activities they will adopt the scientific skills needed for the 21st century. Accurate use of scientific terminology in spoken and written discourse establishes scientific literacy. What you know is transmitted through the language you use.

The science curriculum should be evaluated by examining certain cultures and certain languages. In this process, how science pedagogy both instills science knowledge and emphasizes power is clarified. To understand how the linguistic practices of science classrooms deter the full participation of some students, the concept of pedagogy as content is raised. Delpit (2002) stated teaching and learning are developed and reliant on the shared language between student and teacher. The shared language can be found in many venues of science teaching. Scientific knowledge is derived from internal (using prior knowledge to transform new knowledge), external (constructing “new” outside knowledge) and a combination of both (a give-and-take interaction between revised prior knowledge and knowledge from the outside world) (Etkena & Mestre, 2004). If the media is able to attract student interest in science, using their culture and language, then it should be a doable task for teachers to excite students. The key point for teachers is to recognize that knowledge constructed by the students will affect how they interpret what is taught in the classroom.

Teachers need to realize that the linguistic form a student brings to the classroom is largely connected to their families, community, and identity (Perry & Delpit, 1998). Fordham (1996) mentioned that more attention and validation should be given to the language used by African American parents when rearing their children. The student’s linguistic pattern differs dramatically from that employed in the upper strata of society,
and school personnel fail to acknowledge these differences. Brown (2006) referred to language as a way to signal one’s identity. He further suggested that the science classroom is a place where a student’s identity guides and determines the student’s culture. Science knowledge construction involves science language construction. Further research is needed on how language identity and classroom learning impact student learning with the ultimate goal of making students scientifically literate members of a scientific community (Brown, Reveles, & Kelly, 2005).

Ogbru (2003) suggested educators need to recognize the language difference of diverse populations. By acknowledging student culture, language, and cultural adaptations and backgrounds, teachers begin to change the achievement gap and classroom performance of underrepresented students in science. Students need to learn how to transition themselves from their home culture to the culture of science. Somehow, students need to speak the language of science and their mother tongue. Speaking in both languages empowers students to speak with confidence in the laboratory, employing their current knowledge and yet build upon it to gain new scientific knowledge. Lemke (1990) advocated teaching the student science as a language, maintaining that:

> learning science means learning to *talk science*. Talking science means observing, describing, comparing, classifying, analyzing, discussing, hypothesizing, theorizing, questioning, challenging, arguing, designing experiments, following procedures, judging, evaluating, deciding, concluding, generalizing, reporting . . . in and through the language of science. (p. 1)

Having students talk science means to successfully perform the science processes listed above. Additionally, Barton (1998) posits to decenter science and to allow students to
construct scientific knowledge from any experience, interest, pursuit, or hobby they bring to the classroom.

Looking into the lens of identity in the science classroom, one can extrapolate that a student’s scientific identity can play a major role when a student engages in classroom conversations as well as participating in activities that lead to gaining new scientific knowledge (Brown et al., 2005). Students enter the science classroom conversation in different contexts depending on their identity, language, and culture. The students negotiate their own identity roles and teachers can and do have an influence on how those identities develop over time. In order for new scientific understanding to take place, scientific understanding should occur within a culturally specific context. Language in the science classroom is a tool for helping teachers to develop student voices, patterns of language, and cultural practices that will lead to improving the scientific literacy for all.

**Socially,** Carlone and Johnson (2007) found cultivating a student’s science identity encompasses socialization into the sciences and helping the student construct meaning of scientific experiences that allow them to not only feel like a science person, but to be seen by others as a science person. Hurtado et al., (2009) found:

\[\ldots\] fostering science identity development involves more than focusing on individual factors such as increasing one’s level of competence in science. It also involves social factors, including socialization into the sciences and making meaning of science-related experiences, such that an individual not only feels like a science person, but also acts and is seen by relevant others as a science person.

A review of students’ engagement was studied by Fredricks, Blumenfeld, and Paris (2004) and they identified three aspects: behavioral engagement, emotional engagement and cognitive engagement. Students demonstrating behavioral engagement
are extrinsically motivated by the teacher or science activity and show they are engaged. Showing apparent interest and delight in response to behavioral engagement that science is of value to their lives is truly demonstrating emotional engagement. Cognitive engagement occurs when a student demonstrates their knowledge through a teacher-created task. Based on student-engagement-research, the importance of school engagement is becoming more evident. This is a concept to be explored in the science classroom.

**Culturally Relevant Pedagogy: A Construct for Engaging African American Students in Science**

A model is needed which focuses on African American students’ psychosocial and cultural well-being, thus allowing students to negotiate educational demands while exhibiting cultural capability. Ladson-Billings (1995) defined culturally relevant pedagogy as “a theoretical model that not only addresses student achievement but also helps students to accept and affirm their cultural identity while developing critical perspectives that challenge inequities that schools (and other institutions) perpetuate” (p. 469). Brown (2004) indicated gaining students’ cooperation in urban [science] classrooms involves establishing a classroom atmosphere in which teachers are aware of and address students’ cultural and ethnic needs as well as their social, emotional, and cognitive needs”. Cultural relevant pedagogy is providing an equitable education (Ladson-Billings, 1994) to everyone. In using this model, teachers help African American students to realize, to comprehend, and to evaluate current social inequities while also helping them succeed academically and culturally in science (Ladson-Billings, 1995).
African American students’ identities are influenced by unending messages from the media, patriarchy and urban culture (Evans-Winters, 2011). Using a culturally relevant pedagogy will produce students who can achieve academically, who demonstrate cultural competence, and who can both understand and critique the existing social order” (Ladson-Billings, 1995, pg. 474).

Summary

In this chapter, I reviewed research literature concerning significant achievement gaps in science. To bridge achievement gaps, researchers inquired into African American students’ experiences in science education by examining how race, poverty, urban living, and popular culture shape African American students’ conceptions of school science and media science. Informed by the research literature, this qualitative case study offered an in-depth inquiry into selected African American students’ experiences in the learning of science at an urban school in order to explore the possibility of developing culturally responsive pedagogy in science education.
CHAPTER III

METHODOLOGY

My interest in science continued into my college years. Physics, introduced me to the concept of gravity. As we were sitting in the large lecture hall, the Physics‘ instructor began class by taking a ball and throwing it up in the air. Immediately, he took the ball and dropped it from his waist and told the class we would be learning about the speed and distance of the ball. Next, we walked into the laboratory, I was worried and scared that I would not understand nor calculate the measurements to obtain the distance and speed. I had no prior knowledge in the subject matter. The instructor immediately knew we needed help and offered his assistance. He asked the class what we knew and observed. Once obtaining our prior knowledge, he showed and asked us how to calculate the answer. From this initial encounter, I learned students‘ prior knowledge can help them construct new knowledge and help the teacher know what to provide to help the students build up their scientific knowledge.

As discussed in Chapter II, understanding African American students‘ experiences of science education is the key to bridging the achievement gap in science. Drawing on constructivism as a lens of qualitative inquiry, this study offered a critical examination of African American urban high school students‘ conceptions of school science and media science. In this chapter, I first explained how constructivism provides a framework to inquire into African American students‘ construction of scientific knowledge. Next, I explicated why I have adopted a qualitative case study to undertake an in-depth inquiry into urban African American students‘ experiences in science.
education. Finally, I described and explain the research design and the procedures of data collection, data analysis, and data validation.

**Constructivism as the Epistemological Frame**

Polkinghorne (1992) contended that knowledge is a construction built from the cognitive processes (which mainly operate out of awareness) and embodies interactions with the world of material objects, others and the self. Novak and Gowin (1984) also pointed out that students construct science knowledge through their prior experiences and observations. They consistently build their science knowledge as they gain "new" experiences and observations. By way of cognitive processes and experiences, students develop their understandings of science. Through the topic of science, the cognitive processes and experiences lead to meaningful interpretations. Utilizing a constructivist approach, this qualitative study aimed at transforming the world into a series of representations, including field notes, interviews, conversations, photographs, recordings, and memos to the self" (Creswell, 1994, p. 3). Constructivism, as the epistemological frame in this study, allowed the researcher to describe the myriad of realities constructed by African American students through school science and true-crime media science.

Through the lens of *methodological constructivism* (Noddings, 1990), I examined cognitive processes and the problem of encouraging engagement in science by the African American high school students. Methodological constructivism consists of interviews over periods of time to learn student conception of learning. This approach brings the teacher into focus which encourages the learner or student to reflect and to
relate new science knowledge into their existing knowledge. Noddings (1990) summarized the following points that depict current constructivists’ views:

1. All knowledge is constructed. Science knowledge is constructed, at least in part, through a process of reflective abstraction.

2. There exist cognitive structures that are activated in the processes of construction.

3. Cognitive structures are under continual development. Purposive activity induces transformation of existing structures.

4. Acknowledgement of constructivism as a cognitive position leads to the adoption of methodological constructivism.
   a. Methodological constructivism in research develops methods of study consonant with the assumption of cognitive constructivism.
   b. Pedagogical constructivism suggests methods of teaching consonant with cognitive constructivism. (p. 10)

Furthermore, by looking through the lens of methodological constructivism the purpose of the research was to elicit a clearer understanding of how urban African American high school students’ constructed and defined science through school science and media science. The findings of this study are intended to add to a continuous developing body of literature and theory on the achievement gap and science curricula in addition to informing teacher education programs, science teachers, curriculum developers, school administrators, and other community stakeholders interested in improving and engaging all students in science education.

More specifically, this study examined the construction of media science and school science, as cultural referents, in African American students’ construction of scientific knowledge. This research considered the ways in which selected students understood and perceived school science and true-crime media science and the
relationship between the two. Also, this research focused on how students made use of
time, resources, materials, and tools in explicit and implicit attempts through a negotiated
shared construction of forensic scientific knowledge in the media. In addition, this
research explored a deeper understanding of the melding of these two relationships as the
students construct their science knowledge in the urban science classroom.

**Qualitative Case Study**

The orientation of this study was a qualitative study. Creswell (2003) and Denzin
and Lincoln (2005) defined a qualitative study as a situated activity that locates the
observer in the students‘ world. The student‘s world consists of a set of interpretive
material practices that make the world visible. As articulated in the statement by
Rossman (2003), “Qualitative research has two unique features: (a) the researcher is the
means through which the study is conducted, and (b) the purpose is to learn about some
facet of the student social world” (p. 4). Accordingly, Merriam (1998) suggested,
“qualitative researchers are interested in understanding the meanings people have
constructed, that is, how they make sense of their world and the experiences they have in
their world” (p. 6). Furthermore, Denzin and Lincoln (1994) defined qualitative research:

Qualitative research is multimethod in focus, involving an interpretive, naturalistic approach to its subject matter. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials—case study, personal experience, introspective, life story, interview, observational, historical, interactional, and visual texts—that describe routine and problematic moments and meanings in individuals‘ lives. Accordingly, qualitative research deploys wide range of interconnected methods, hoping always to get a better fix on the subject matter at hand. (p. 2)
Qualitative research is "any kind of research that produces findings not arrived at by means of statistical procedures or other means of quantification" (Strauss & Corbin, 1990, p. 17). Patton (2002) described qualitative methods, as a "study of issues in depth and detail" by approaching the fieldwork "without being constrained by predetermined categories of analysis" (p. 14). Merriam (1998) stated, "qualitative research characteristics include the researcher being concerned with the process, the meaning, and the primary instrument for data collection analysis and the fieldwork." Furthermore, Merriam described the objective in qualitative research as being able to interpret and to understand the meaning of the experience, not the measurement.

Using a qualitative case study approach (Merriam, 1998), the research was a description of a single entity, albeit a high school classroom, relying on inductive reasoning, using multiple data sources. Employing a qualitative study provided "sufficient time and resources to spend on extensive data collection in the field and detailed data analysis of 'text' information" (Yin, 1989, p. 17). A qualitative inquiry was chosen to inquire into what students do in the settings in which they learn to use what is seen for elucidation (Eisner, 1998). Lincoln and Guba (1985) pointed out that a qualitative method is chosen because it exposes the nature of the transaction between the researcher and participants, influences the value patterns encountered and thus allows the researcher to assess the phenomenon more easily. Utilizing qualitative research allowed the researcher to interact with African American students in their language, in their classroom and on their terms (Kirk & Miller, 1986).

Based on constructivism as the epistemological frame, this qualitative study delved into urban African American high school students’ conceptions of school science
and media science, specifically, the science represented in *Crime Scene Investigation*. In seeking a wider understanding of the context of the study, I, as a participant observer, described and interpreted the natural setting, the variables under consideration, as well as the interactions of the different variables in the context in gathering rich data. As suggested by Eisner (1998), this qualitative researcher was trying to observe sources of interpretation and to understand what students do in the science classroom in which they work and learn. Characteristics that identify the particular design, implementation and data processing methods of naturalistic inquiry are as follows:

One considers the naturalistic setting, the human data collection instrument, the utilization of tacit knowledge, the qualitative methodology; the purposive sampling instead of random sampling, the inductive data analysis, the emergent design; the negotiated outcome, the case study the reporting mode, the idiographic interpretation; the tentative application (instead of generalization), the focus-determined boundaries, and the special criteria for trustworthiness. (Lincoln & Guba, 1985, pp. 39-43)

The researcher in this current study did these aforementioned characteristics, essentially participating in naturalistic inquiry.

In addition, a qualitative approach emphasized a holistic description of the situation (Fraenkel & Wallen, 2003). Qualitative case study is a method used by researchers to study a single unit composed of one person or as large as a school (Lichtman, 2010). In this study, I chose the students to be the single unit as defined by interest (Denzin & Lincoln, 1994). Lichtman (2010) further asserted, “A case can be limited to a characteristic, trait, or behavior” (p. 80). Richards (2005) stated that in a case study the researcher attempts to see how the themes and issues interact. —A good case study is far more intrusive and far more recognizable than your account of one participant among many” (Richards, 2005 p. 173). Therefore, the researcher explored the world of
three African American students, who are an underrepresented group in science. The case study is an in-depth study of one person or unit to gain an understanding of the research topic. Goetz and LeCompte (1984) defined case study as a research model for analyzing an observable experience (the African American student conceptualization of science). Eisner (1998) made the point that case study is an opportunity to learn:

> If we learn something about a case that we did not know at the outset of the study, not only have we achieved consciousness of that quality or feature, but also we learn to look for that quality or feature in other places. (p. 207)

Merriam (1998) suggested that a case study is a sociocultural analysis of a unit of study, a bounded system that in this instance is drawn from the African American student participants. The researcher interpreted the sociocultural history of the students through social-economic factors, attitudes of the students, and educational factors which provided the bounded system used in this study. For the purpose of this research, the researcher used concept maps, interviews, and participant observation to gain an understanding of how the students made sense of science in school and through television. The choices chosen for data collection were, as Merriam (1998) pointed out, a process of reflecting on each choice which was continuously modified as needed, until one was withdrawn from the study. This study comprised a process of collecting data that allowed interaction between the researcher and students that resulted in achieving rich, thick results (LeCompte & Schensul, 1999). Initially, the researcher collected data from journals, concept maps, focus groups, interviews, surveys, case study, participant observation and content analysis of artifacts. Once the study was completed, the researcher found that concept maps, interviews, and participant observations, provided the rich thick data needed.
Denzin and Lincoln (1994) posited that “a case study is both the process of learning about the case and the product of our learning” (p. 237). The researcher relied on emergent aspects of the study known as the inductive process. Lichtman (2010) stated that qualitative research function is to observe the whole study, obtain the thoughts and viewpoints of the participants, and use an inductive approach. The initial issue investigated by the researcher guided the study and was found to be important by the classroom teacher and school leaders which allowed for easy access to the research setting.

From the perspective of Lincoln and Guba (1985), a researcher chooses a case study to provide a “thick description” to facilitate communication and to honor the facets of naturalistic inquiry. Denzin and Lincoln (1994) identified three types of case studies including: intrinsic case study, instrumental case study, and collective case study. An intrinsic case study provides a thorough understanding of the particular unit, instrumental case study provides insight into the theory, and collective case study was used in this study by allowing a number of cases to inquire into the phenomena.

**Research Design**

The research setting was located in a Midwest state, and within the state it is one of the largest eight urban K-12 school districts, with an enrollment of over 50,000 students. Statewide, 13% of children were living in poverty while 29% lived in poverty in the city where this study was conducted (U. S. Department of the Census, 2009). The district includes 84 K-12 schools, in particular, 28 high schools that are located throughout a large metropolitan city, with high rates of crime and poverty (U. S.
Department of the Census, 2009). The high school used for this study, EuCarlene High school (fictitious name) enrolls approximately 500 students. EuCarlene is considered a high-poverty school. One hundred percent of the students are eligible for free or reduced meals and 27.5% of the students have disabilities. Demographics of the student body were 89% African American, 9% Hispanic, and 2% Unspecified. The gender of the student body was 69% female and 31% was male. Graduation rates for the 2009-2010 school year were the following: 70.6% for the school, 54.3% for the district and 83% for the state. In 2007-2008 EuCarlene High School’s average state graduation subject scores were the following; Reading 74.6%, Math 59.3%, Writing 75.4%, Science 36.3%, and Social Studies 60.5% in comparison to the district scores: Reading 68.7 %, Math 55.2%, Writing 67.3%, Science 43.7%, and Social Studies 54.8%. These scores were below the state's average scores which were the following: Reading 85.2 %, Math 79%, Writing 85.2 %, Science 72.8 % and Social Studies 78.4%.

After the high school was identified as a potential research site, letters requesting permission to interview students and collect information were sent to the classroom teacher and high school’s principal, the school district’s Internal Review Board (IRB), superintendent, and The University of Akron IRB (see Appendix A). Approval was given by the classroom teacher and high school’s principal, the school district’s researcher and assessment director (IRB). After approval was received from interested parties, then permission was granted by students’ parents or guardians who were sent approval and consent letters requesting consent to collect information and conduct interviews with the participants at the high school site (see Appendices B and C). The students were individually given assent forms to participate in the study.
The classroom research setting was located within the above described Midwest urban public high school. EuCarlene High School is divided into two small academies, housed within one large school building. The academy consists of two tracks: In track one, students major in law and municipal careers (i.e., Law Academy, Public Safety Academy, and Urban Studies Academy). Students in track two major in the health care profession (i.e., Dental Assistant, Dental Lab Technician, Medical Assistant and Nurse Assistant). Through an application process, students apply to either track during the ninth grade year. The selection process includes a completed application, a student information sheet, two teacher references, a student interest essay, and prior academic achievement and attendance records. After an initial selection, each student is interviewed orally by school faculty, the program director, and the school principal (Advisory Committee) for final admission into the career program selected by the student. The Advisory Committee determines who is admitted. Applicants are notified of acceptance by the end of May. Students who are admitted are expected to complete all high school graduation requirements and at the same time earn a state vocational certificate through the completion of a specific course sequence over a four-year period of time. All students are mandated to take the high school courses authorized by the state, which include at least three science classes.

Historically speaking, many of the students in the high school are simply not on radar, described by Fishman, DeBarr, and Gardner (2006). The urban teachers tried to think of creative ways to give students who were not on radar a chance to be visible and valued. Fishman et al. (2006) found that urban teachers work endlessly to satisfy student needs (e.g., creating law enforcement and health-focused courses to begin a
career after graduation) and to derive ultimate meaning from their work while meeting school and state standards. The EuCarlene high school teachers are challenged to find innovative ways to excite and to encourage African American students to be prepared to enter the workforce after completing high school. Eisner (1998) stated, “In classrooms, knowing the history of the situation, something about the teacher and the school, and the values that are regarded as important in the community can help us to notice and interpret what we have noticed” (p. 66).

The Researcher as a Participant Observer

The researcher directly participated in the study of urban African American students in their classroom (natural setting) by using the method of constructivism that would capture their social meanings and interactions, allowing the researcher to directly participate in the setting to collect and to observe data (Bryman, 2001). The researcher entered the research setting (a classroom), viewing the participants as a whole through the language, the economic issues, the atmosphere, and the school. As a researcher, I have been aware of the sociopolitical and historical context in which inequalities experienced. The inequalities experienced by students are due to race, ethnicity, social class, and gender reflected by funding, aptitude tracking (high-stakes tests), access to high-stakes content and resources, depictions of diversity in teaching and learning, and expectations of students (Nieto, 2003). Examples of inequalities consist of narrow or biased textbooks that fail to show or depict underrepresented individuals in science.

The researcher taught a forensic science class in the law enforcement academy. Thus, the school and the classroom participants, including the cases of this study, were
aware of the researcher as a teacher. The researcher was familiar with the students in a pull-out class context. However the researcher confided in and deferred to the classroom teacher very often concerning the students. The classroom teacher was more than willing to share knowledge of what to expect from the students and knowledge of the students as individuals. The teacher also shared pedagogical and instructional knowledge as it related to the students in the classroom.

Initially, I began three months of classroom observations after completing individual interviews and a focus group. I spent one day per week in the 11th grade high school classroom. Many times, when the school was in session, I was in the classroom making observations. At other times, I was facilitating hands-on lessons with students in groups. The teacher was receptive to sharing of her classroom and invited me to participate wherever and whenever I needed. When classes were not in session, I would talk with science teachers, guidance counselors, and other school personnel. There were times I attended and found the classroom teacher absent with either a substitute teacher or with me handling the class alone. Throughout my time in the school, I examined, graded and collected artifacts of teaching and learning – weekly assignments, tests, or projects to better understand how students were performing. Additionally, I attended field trips, sat in planning meetings, overheard conversations, and visited with teachers and administrators when “critical” moments were presented. Hence, the researcher was a participant-observer.
A Case Study Based on Purposeful Sampling

For this study, purposeful sampling (Patton, 2002) was used to identify a single classroom for study. Purposeful sampling allowed for the selections of information-rich-cases for an in-depth study versus a more generalized approach (Patton, 2002). In this study, the case was to provide a typical description of the student participant population (Patton, 2002). I selected the three participants. Final selection was made by the researcher who chose the three cases, noting, “there are no rules for sample size in a qualitative inquiry” (Patton, 2002, p. 244). “Studying information by rich cases yields insights and in-depth understanding rather than empirical generalizations” (Patton, 2002, p. 230). The case study consisted of three participants who were chosen by the researcher and classroom teacher as typical or average of the research population. The criteria for sampling included having attended EuCarlene High School from Grades 9-11, having the ability and commitment to meet with the researcher, and having taken the Spring 2009 Forensic Science course with the researcher. (The researcher taught the course in Spring 2007, Spring 2008, Spring 2009, and Spring 2010). The researcher was a consultant who taught one day a week in the school and provided hands-on science lessons on the topic of Forensic Science. Within the Forensic Science Crime Scene course, the researcher observed the participants while collecting in-depth interviews and artifacts. Student participants were typical of other students in the classroom (Lichtman, 2010) and, therefore, selection was based on the following criteria:

- Student depiction of science in their version of the initial complex concept map.
- Student rich journal entries.
• Student ability to meet with the researcher after school for interview.
• Student responses to questions.
• Student absenteeism’ records (whether the student had habitually unexcused absences from school).
• Student commitment whether the students feels a sincere obligation to participate in the study or not).

The researcher sought cases which contained rich and thick information and from which learning could occur, in order to generalize the study’s outcome to the class population from which it was drawn (Merriam, 1998).

Initially, 30 eleventh-grade students were registered for the Forensic Science Crime Scene course. Student participants ranged from 16-18 years of age and were enrolled in the 11th grade. Twenty-one students, 11 male and 10 female, participated and finished the course. Three 11th grade case study participants, Mariah, Lenise and LV (pseudonyms selected by the participants), were selected by the researcher because they fulfilled all the purposeful sampling criteria. The one male and two female participants represented a diverse cross section of the classroom. Mariah (#1) is a 17-year-old self-identified female living with unmarried caregivers and three siblings and has taken earth science, physical science, and biology. Lenise (#2) is a 17-year-old self-identified female living with unmarried caregivers and seven siblings and has taken physical science, biology, and chemistry. LV (#3) is a 17-year-old self-identified male living at home with married caregivers and six siblings and has taken earth science, biology, and chemistry.
Sources of Data

As the participant observer, the researcher collected data by engaging the students in concept maps, journals, interviews, focus groups, and reflections on observed classroom activities. Considering that research design cannot be completely specified in advance, an emergent design was incorporated as defined by Givens (2008), "Emergent design involves data collection and analysis procedures that can evolve over the course of a research project in response to what is learned in the earlier parts of the study" (p. 244). Through an emergent-design research process, understanding evolved from emergent data collection and analysis not only to answer the research questions, but also, more importantly, to elucidate the students and their learning (Merriam, 1998).

Journals

Towndrow and Ling (2008) indicated that "Reflective journal writing also allows students to identify and record their attitudes and beliefs. It provides an avenue for giving expression to doubts and frustrations about science itself and about learning science" (p. 280). Science notebook journals were given to students by the researcher. Students were instructed to put their name in the journals and to copy the concept map definition of science. In the study by Towndrow and Ling (2008), they found journals helped a seventh grade classroom of girls, who were reluctant to ask questions in class and found by retaining records of student experiences and allowing students to think about the questions regarding their laboratory experiences, the students were able to sharpen their laboratory ability. Students in my Forensic Science class were both excited and apprehensive about using the journals. The apprehension of students stemmed from no
prior experience in using journals in their education. However, the students were excited to try something new. The excitement was from receiving a “free” book to use without rules and grades attached.

Each student kept a journal to record each day’s experience and learning, thus becoming a tool for assessing the construction of new knowledge. Students used journals to write weekly about science, to note their observations, to reflect and to make connections from new science information with things they already knew (Towndrow & Ling, 2008). The science journals were given to encourage the recording of information during the course, to respond to prompts provided by the researcher and to keep a weekly log of science activities (Ruiz-Primo, Ayala, & Shavelson, 1999). Initially, students were asked about their former science experiences (e.g., prior science courses taken, what science subject was taught, grades received, what they learned in science courses, the names of scientists they learned about, and aspirations after high school) (see Appendix D). They were also asked to name programs depicting science on television and told to put this entry on the first pages of the journal. The journals were also used to write notes and reflections on lessons, videos, and field trips (e.g., County Coroner’s Office). Weekly journal writing allowed students to address the following prompts: (a) One thing I learned today is . . . , (b) One thing I am not sure about today’s lesson is . . . , and (c) I can use this knowledge when I . . . . The journal writing helped students to reflect on their knowledge, to learn how to address unfamiliar concepts, and to predict how they would use the knowledge in life (see Appendix E).
Concept Maps

William Pinar (2004) proposed that science curriculum be a union of a student’s biographic past as well as the complexity of the student’s biographic present. These topics would inform a teaching style and a teaching plan. Pinar suggested that teachers follow the student in an undetermined process of openness. As Kincheloe (2005) proposed, "Critical constructivists always keep these autopoetic notions in mind. As they build a curriculum, they are acutely aware that knowledge emerges. . . from an interactive relationship between the knower (subject) and the known (object)" (p. 109). Considering learning as a process that has little or no predetermined paths as suggested by Pinar, concept maps were used in this study.

According to Novak (1998), meaningful science learning can be supported through the construction of a concept map which pictures relationships. For this study, concept maps allowed the researcher to view students‘ awareness of forensic science to build upon their conceptual knowledge. Novak and Gowin (1984) stated that concept maps provide a road map that clarifies key ideas of what has been constructed. Furthermore, concept mapping allowed the researcher to assess the participant‘s prior learning and revealed thought processes that usually remain private.

Markow and Lonning (1998) discussed how concept maps help students learn scientific concepts:

Students are actively involved because they construct the concept maps. By using a preinstruction concept map, a teacher is asking students to record their preconceptions and eliciting from them questions about the material to be learned. When the teacher uses a postinstruction/activity concept map, he can see the progress made by individual students in assimilating and accommodating new knowledge into their existing cognitive structure. (p. 1015)
As a graphing tool, Hilbert and Renkl (2008) suggested concept mapping is composed of nodes that denote ideas and links that represent relationships between the concepts that represent scientific knowledge. Confrey (1990) found concept maps created a way for students to analyze scientific relationships and beliefs. A concept map allowed the students in this study to picture how the science concepts were hierarchically related and interrelated (Hilbert & Renkl, 2008).

The students were guided to develop a concept map focusing on their definition of science. The concept map was developed at the start of the semester-long program to clarify the ideas African American students brought to the class (see Figures 4.1, 4.2, and 4.3). Students organized and represented knowledge to help construct the meanings of science (Novak, 1998). Each student was given a sheet of paper with colored pencils (green, blue, and red) and prompted by the researcher to:

1. Write down the word “science” (in green) in the center of the paper (circle and to think about it).

2. To place other words outside the circle they felt connected or applied to science in green. If the word applied to school science, write in blue; if it applied to the television program CSI, write in red.

3. In thinking about the relation of outside items to the center item, (students were to erase, edit, and/or shorten words for key ideas and link key concepts with words to clarify their relationships.

4. Working outward continuously they were to add key words and try to be more specific, and
5. Students were told the concept map was their (personal) science learning document and to copy it into their journals.

**Interviews**

For the purpose of the study, I selected and interviewed three students. Each student interviewed fulfilled the three requirements as suggested by Rubin and Rubin (1995): Students were (a) familiar with media science and school science; (b) willing to discuss the phenomena, and (c) representing different points of view. The use of interviews and observations are commonplace in qualitative research, (Denzin & Lincoln, 2005; Merriam, 1998; Yin, 2002). The interview is the researcher’s most important data gathering technique (Fetterman, 1989, p. 47). Considering that the researcher wanted to understand how African American students constructed their knowledge of science, the interviews served as a data collection method. The interviews allowed students to reflect on school science and true-crime media science.

The primary instrument for gathering data for the research included a semi-structured interview where questions were carefully designed to provide adequate analysis for the purpose of the research. Twelve major questions were developed for probing the students (see Appendix F). In using a semi-structured format, the participants explained their ideas, events, and background knowledge on the topic (Rubin & Rubin, 1995). Using the urban African American students‘ voices from the interviews allowed the researcher to understand the classroom culture from the student’s perspective and, as suggested by Eisner (1998), recognize how students perceived the situation.
The students in the study were willing to identify or to share their feelings once they felt someone was willing to listen (Eisner, 1998). The interviews served as a conversation between the researcher who asked the questions and the students who made the responses (Denzin & Lincoln, 1994). The researcher chose to be informal to allow the interviewees to be at ease, not be rigid, and to have a sense of what they wanted to know (Eisner, 1998). The interviews were, —. . in some ways, like participating in a good conversation; listening intently, and asking questions that focus[ed] on concrete examples and feelings rather than speculations . . .” (Eisner, 1998, p. 183).

**CSI Video and Selection**

The true-crime television (media) show, *Crime Scene Investigation (CSI)*, depicts a group of trained forensic chemists/investigators whose primary job is to solve crimes by scientifically analyzing the evidence and connecting the missing pieces that will solve a mystery each week. *CSI* is an attention-grabbing show that depicts forensic scientists as “all” knowing within 60 minutes, although working in the forensic field does not necessarily mean you have “all” the answers. Television as popular culture leads one to believe that the field of forensic science is glamorous and exciting whereas, from personal experience forensic science work can be tedious, redundant, unglamorous, and produce more questions than answers.

The *CSI* Digital Video Disc (DVD) from season two was “purposefully randomly selected” by the researcher. Patton (2002) suggested the power of purposeful random sampling, which leads to information-rich samples, is appropriate for the purpose of generalization and in-depth understanding. In selecting information-rich samples, Patton
further states, purposeful sampling will illuminate the research questions under study. In season two, episode 10 was chosen for viewing. The episode selected for viewing, *No Humans Involved* (McCreary & Bailey, 2004), aired Thursday, December 9, 2004, and depicted the attitude that certain victims, for various reasons were not worth investigating. As noted in a review:

> The grim reality of the foster care system is explored without resorting to sensationalism. Lorna Tenney is argumentative and hostile, but Gwyneth is very frank when she tells Sara that she's one of the better foster parents. After being in ten different families, Gwyneth certainly must know of what she speaks. She also talks with the authority of a child who has had to grow beyond her years in order to survive. (Huntley, 2004, p. 1)

Using a process that allowed students to provide responses, case study participants observed *CSI* DVD episode 10 to code and to identify the representation of science in the program. This also framed the interview questions for the focus group. Each participant, while viewing the *CSI* DVD, wrote a response on paper where they observed science anonymously. The responses were instantly collected and stored without code by the researcher. The responses were then mined for future further analysis by the researcher.

**School Science Classroom Video and Selection**

As suggested by Annenberg Media (2010), multimedia resources help science teachers increase their expertise in education by assisting them to improve their teaching methods. —Annenberg Media uses media and telecommunications to advance excellent teaching in American schools” (Annenberg Media, 2010) through the use of best practice and is standards-based media. The researcher purposefully reviewed and selected an Annenberg DVD. The criteria used for selecting the video consisted of finding a homogeneous sample with similar characteristics to a high school classroom. Students
viewed and coded one Annenberg Media’s live science classrooms DVD. Also, this activity framed the interview questions for the focus group. Each participant, while viewing the *Chemical Reaction* DVD, wrote a response on paper when they observed science and the anonymous responses were instantly collected and stored without code. The responses were mined for future further analysis by the researcher.

The lesson *Chemical Reactions* involved learning about chemical reactions by formulating and exploring concepts required for the understanding of chemical analysis. Annenberg describes the lesson “Students in a ninth-grade Principles of Science and Technology class formulate and explore their own questions about a chemical reaction” (2009). Students were shown how substances undergo intended chemical changes, using everyday materials such as baking soda, soft drinks, over the counter drugs, and felt tip markers. The learning standards included (a) measurement of volume and mass requiring understanding of the sensitivity of measurement tools and knowledge and appropriate use of significant digits; (b) the requirement to explain and give examples of how mass is conserved in a closed system in a physical change, and (c) to differentiate between physical change and chemical change. Then, on the DVD, a ninth-grade student in Principles of Science and Technology class formulated and explored “their own” questions about chemical reactions. The grade-level-objectives included: to study about the importance of chemical design for future development and to emphasize the use of scientific investigative skills for facilitating laboratory learning.

The state standards for EuCarlene are found in the ninth grade Physical Science and Science Inquiry standards (ODE, 2007) regarding mass as shown in the Annenberg video:
Nature of Matter

1. Investigate how matter can change forms but the total amount of matter remains constant.

Nature of Energy

4. Explain how energy can change forms but the total amount of energy remains constant.
5. Trace energy transformation in a simple closed system (e.g., a flashlight).

Doing Scientific Inquiry

1. Explain that variables and controls can affect the results of an investigation and that ideally one variable should be tested at a time; however, it is not always possible to control all variables.
2. Identify simple independent and dependent variables.
3. Formulate and identify questions to guide scientific investigations that connect to science concepts and can be answered through scientific investigations.
4. Choose the appropriate tools and instruments and use relevant safety procedures to complete scientific investigations.
5. Analyze alternative scientific explanations and predictions and recognize that there may be more than one good way to interpret a given set of data.
6. Use graphs, tables and charts to study physical phenomena and infer mathematical relationships between variables (e.g., speed and density).

Focus Group Using Videotape and DVD

Digital Video Discs from CSI and Annenberg were “purposefully homogeneously selected” for review by the researcher. The videos were purposefully homogeneously selected because of some characteristics deemed necessary by the researcher. The No Humans Allowed episode of CSI and the Chemical Reaction lesson from Annenberg Media were used to gather data for the study. Additionally, the digital video recordings were used as sources for the focus group interview.

The design of the focus groups included using selected student participants composed of homogeneous strangers with a researcher involved in a highly structured
interview (Morgan, 1996). As Fowler (1993) suggested, the researcher drafted a set of questions created from the individual case study interviews on the DVDs in order to create in-depth-interview questions. A focus group was convened. To allow the participants to feel comfortable, the researcher had the student participants meet in a small meeting room away from potential distractions. A journal was used by the researcher to record key comments made during the meeting.

First, a stage was set for discussion. The students were reminded of the purpose of the study and told they were able to leave any time during the session with no ramifications. Ground rules were discussed to inform participants to express their opinion, that there were no right or wrong answers to the questions, and that everyone's opinion was valued and respected. Students were reminded that the session was being audio-recorded so the researcher could capture their comments. Second, the researcher conducted the discussion. Questions were asked and each student was allowed an opportunity to express their comments (see Appendix G). Third, comments were clarified by the students. Morgan (1996) suggested that focus groups allowed the researcher to gather data from the focus group’s interests through the interactions in the group.

Fowler (1993) stated that it is valuable to conduct a focus group with students before designing a set of interview questions. The advantages of having focus groups in this study as discussed by Morgan (1996) were the ability for the researcher to observe a large range of behaviors, enabling the researcher to interact with students, and allowed a more open discussion on topics. Focus groups provided data and insights into a student’s beliefs and behaviors that would have been unattainable without focus group interaction.
(Morgan, 1996). In gathering rich data, focus groups provided information that was not easily obtained from interviews and observations.

**Participant Observation**

Participant observation is a starting point in research as described by Schensul, Schensul, and LeCompte (1999) and was used for this study. The process of participant observation allowed the researcher to build relationships, to gain an understanding of how the students related to one another, to provide an acknowledgement of the researcher in the setting, to offer a cultural experience for the researcher with cultural experiences that were discussed in interviews, and to show the patterns of social and political etiquette (Schensul et al., 1999). Patton (2002) suggested five important purposes of observational data: to describe the setting, to experience the setting and students firsthand, to see things students in the setting may overlook, to learn things people are unwilling to share in an interview, and to draw on personal experience for the final analysis. The researcher was involved in a process of learning by engaging in the daily routine of the students in a natural setting (Schensul et al., 1999). In order to understand the nuance of student construction of science in school science and the representation of science in true-crime television, the researcher needed to observe and experience the phenomenon. The observational techniques provided further insight into the high school students’ knowledge of science thinking in school, as well as their notions of true crime television.

As a university-based researcher and instructor in the Law Enforcement Academy, I served as participant-observer in the classroom (Ladson-Billings, 1994). In
these roles the researcher functioned as teacher, aide, and mother figure. The researcher developed a relationship with the students that did not distract from the regular classroom routine or lessons.

Considering interviews occasionally represent the initial encounter with students, observations must be conducted carefully with stringent sensitivity for the research participants, (Merriam, 1998). Adler and Adler (1994) noted observation traditionally has been without intervention and the observer neither manipulates nor stimulates participants. However, the researcher not only observed but became engrossed in studying the participants. The researcher was "immersed into the students‘ culture” (Fetterman, 1989, p. 45). --Qualitative observation is essentially naturalistic in essence; it occurs in the natural context of occurrence, among the actors who would naturally be participating in the interaction, and follows the natural stream of everyday life” (Adler & Adler, 1994, p. 378). The researcher observed phenomena of interest to draw information from the students not obtainable by other methods. Observations made by the researcher were related to the classroom setting in which the forensic science course took place. The observations generated insight and better understanding of the phenomenon studied.

**In-depth Focus Group Interview**

In-depth interviewing about No Humans Allowed and Chemical Reaction digital video recordings allowed a deeper knowledge of the research topic and was used to answer the research question and provide evidence for the answer (Schensul et al., 1999).

The recorded in-depth interview is a research method that is based on direct intervention by the observer and on the evocation of evidence. In the sense that the evidence was not tangible until the interviewer recorded it,
and that the evidence is the result of the interviewer’s questioning, this is the making of evidence. (Yin, 1994, p. 3)

Therefore, the researcher does not use an unchangeable testing instrument, he or she is open to observing the informant’s choice of behaviors. In this way, the researcher learns new things not in original hypotheses – in fact, many qualitative researchers do not form hypotheses at the beginning of the research” (p. 6).

After convening as a focus group and viewing the CSI’s DVD program No Humans Allowed and Annenberg’s video program Chemical Reaction, the focus group reconvened for an in-depth interview. The structured interview consisted of setting a stage for discussion. Students were reminded of the purpose of the study and told they were able to leave any time during the session with no ramifications. Next, the researcher conducted the discussion. Questions were asked and each student was allowed an opportunity to make comments (see Appendix H). Last, student comments were clarified. Fowler (2002) suggested the purpose of a focus group is to compare the reality of answered questions of the interview to the embedded abstract concepts from students’ scientific constructs.

The interview questions were selected specifically for the study. Four recommendations suggested by McNamara (2009) were used to create valuable interview research questions: (a) wording of the questions were open-ended to allow participants to choose their voices when answering questions, (b) questions were as neutral as possible, (c) questions were asked one at a time, (d) questions were worded clearly for participants, and (e) why questions were avoided. Creswell (2007) recommends being flexible with
research questions and developing questions to keep student participants on focus with their responses to the questions.

**Artifacts**

Artifact collection provided detail evidence of corroboration in a less disturbing method than other collected data (Merriam, 1998). But as a researcher, one needed to glean information cautiously from artifacts that were designed for purposes other than research and, therefore, were used prudently (Yin, 2003). Artifacts such as a student’s journal writing, notes from observations, student work samples, and the final mock crime scene project were collected as site-based documents to investigate further the research questions and sub-questions, and, finally, to facilitate data analysis. Merriam (1998) pointed out personal artifacts are trustworthy sources of data wherein a student’s attitude and worldviews can be obtained.

Participants submitted several assignments during the Forensic Science course. One assignment encouraged students to create a mock crime scene wherein students created their own crime and provided an outline, evidence, photos, witness testimony, and a final report. The mock crime scene was an accumulation of their understanding of forensic science at the end of the course. Student outlines allowed the researcher to examine how they applied their knowledge about science to their final mock crime scene. In addition, their understanding of science was evaluated through monthly quizzes and tests.
Data Collection

Based on a case study approach, the researcher used five data generating components: concept maps, journals, student interviews, classroom observation and video coding. Data collection began at the beginning of September 2009. During this study the researcher gathered and described in the field journal, the physical setting and rough sketch of the classroom. Student names were tallied and recorded each week for attendance purposes. The data were analyzed and categorized in order to gain meaning and understanding from the data collection.

The data collection stage of the research lasted nearly three months – two weeks to collect concept maps and journal entries, two months of formal classroom observation, and, finally, a month to collect individual interviews, video observations, and the focus groups. Documents (including lesson plans, assessments, and crime scene case projects related to the study) were collected and analyzed when time permitted. Extensive field notes were recorded, analyzed, and organized throughout the data collection process.

Journals

Student journals were collected and reviewed by the researcher monthly. Originally, the intent was to collect weekly, but the researcher found the set-up of the course and the student’s access to the journals very difficult. Once the course was completed, the researcher collected the notebooks and reviewed the journals to find concepts and themes for coding (see Appendix I for example).
CSI DVD Recording

The researcher showed the CSI video *No Humans Allowed* and told students to watch and to observe when science was being portrayed. Students were given a sheet of white paper and a pencil to record their observations. Each case study participant, while viewing the *No Humans Allowed* video, recorded a response on the sheet of paper when they observed science and the responses were instantly collected and stored anonymously until coded.

Coding of School Science Video

Students viewed and coded one Annenberg Media‘s live science classrooms DVD (the coding framed the interview questions) on what they viewed as science. The researcher showed the Annenberg DVD *Chemical Reactions* and told students to watch and to observe when science was being portrayed. Students were given a sheet of white paper and a pencil to record their observations. Each participant, while viewing the Annenberg DVD, wrote a response on paper as they observed science and the responses were instantly collected and stored anonymously by the researcher until coded. The responses allowed data to be mined for further analysis by the researcher.

Participant Observation

Observations focused on a student’s behavior, conversations and interactions during class. Throughout the science course, the researcher acted as a participant observer in attending the class and collecting data by recording field notes and making digital audio recordings of classroom discussions. During the interviews, handwritten
observations were taken from personal notes and possible future questions were shaped to use in further investigation.

**Focus Group and In-depth Interview**

Once coding of the data was completed, as suggested by Fowler (1993), a focus group composed of the individual case studies, was convened. The researcher drafted a set of questions for in-depth interview questions. Focus groups with the three case study participants were conducted in person on site at the school, including two one-hour semi-structured interviews. Interviews were audio taped with a digital recorder.

To facilitate the semi-structured interviews, the researcher assembled students together in a focus group. The researcher found it beneficial in working with the group to deal with any ambiguities and other difficulties (Treagust, Duit, & Fraser, 1996). Merriam (1998) noted that highly-structured interviews do not provide the students’ true perspective. Therefore, interviews with participants for this study were semi-structured. A semi-structured interview provided for reliable investigation of topics with the students and started with basic introductory questions which allowed flexibility in engaging the student voices and unearthing deep insight (Merriam, 1998; see Appendix G).

Only the researcher conducted student semi-structured focus group interviews, which facilitated consistency in the inquiry process. As stated by Treagust et al. (1996), “The conversation with the interviewee [student] typically centers around phrases such as ‘in your own understanding’ and ‘in the way that you think about this’ and the task is exploration of ideas rather than closed definitions” (p. 44). The semi-structured interview protocols were designed with open-ended questions to provide structure for each
interview while enabling the researcher the flexibility to elicit more discussion and clarifications from student participants. Open-ended questions allowed the researcher to gather unanticipated answers from the students and allowed them to answer in their own voices (Fowler, 1993). Asking open-ended questions allowed participants to express their views and experiences without the constraints of the researcher’s perspectives (Creswell, 2005).

**Data Analysis**

Initially, after collection, the researcher transcribed the interviews, concept maps and observations into a word processing document. Once all data were collected, the researcher transcribed the data into significant segments to be coded. I thoroughly read my transcribed data and divided it into significant analytical units to be coded. The codes were developed by the researcher’s interpretation. Coding was completed until no more segments could be developed. Once coding was complete, the data were classified by the researcher into concepts according to similarity and placed into categories or themes (see Appendix I).

As suggested by Merriam (1998), analysis of data depends on the researcher theorizing, in manipulating and discovering the relationships among the categories, to explain how and why things happen. The data collected were compared, contrasted, aggregated, and ordered to classify the schema that emerged. To give focus to the students, the researcher concentrated on the detail of the data by reflecting, coding, writing, and conceptualizing the data.
Initially, the researcher listened to interview tapes and read the interview transcripts, observational notes, journals, and documents to develop ideas about the categories for emergent themes (Maxwell, 2005). Givens (2008) clarified — Themes emerge from the close analysis of any data source, including field notes, ethnographic and reflective memos, interview transcripts, and various print, visual media” (p. 248). Data analysis began during the data-collection process to uncover emergent themes and patterns. Incorporating preliminary analysis allowed the researcher to conduct member checks. Richards (2005) suggested that sharing your interpretation with students is useful and a helpful act that should be built into the study. The researcher was able to ask clarifying questions, pursue other data sources, and explore the validity of emergent themes. The case study student interviews were transcribed within three to five days after meeting with the case study students to ensure an accurate representation of participants’ perspectives in the final report of this research project. The researcher analyzed the document data by hand. Document segments were identified and coded.

**Concept Maps**

Concept mapping (Novak, 1998) is an informal process whereby a student draws a picture of all the concepts related to a general theme. The student concept maps in this study were collected and copied. Analyzing and scoring student concept maps were adopted from a method which was defined by Novak and Gowin (1984). According to this model, concept maps were made and scored using the scoring guideline: (a) *Proposition* – A relationship is shown between two concepts indicated by a connected line and linking word(s); this scores 1 point; (b) *Hierarchy* – when the map shows a
hierarchy for each valid level of the hierarchy, score of 5 points; (c) Cross links – when the map shows meaningful connections between one segment of the concept hierarchy and another segment, score 10 points for each cross link that is both valid and significant and 2 points for each cross link that is valid but does not illustrate a synthesis between sets of related concepts or propositions; (d) Examples – when the map shows specific events or objects that are valid instances of those designated by the concept label, score 1 point each; and (e) a criterion-concept-map may be constructed and scored for the material to be mapped. Student scores were divided by the criterion map score to give a percentage for comparison which is reported in Chapter IV. The researcher developed a thick description from the concept maps, concerning student constructs of science and when compared to how the participants reflected during the interviews. Observations enabled the researcher to draw inductively about student construction of science which could not be obtained solely relying on interviews (Maxwell, 2005) or concept maps.

**CSI - No Humans Allowed DVD and Annenberg – Chemical Reactions Digital Video**

Students’ responses from viewing the video were collected. Initially, the researcher read through the text and identified the student quotes that addressed repetitive and highlighted themes. Each quote was cut out with the student’s name and where it appeared in the text with individual markings placed on the back. All of the responses were laid out randomly on a table and sorted in similar piles and coded into themes to determine categories. After sorting the themes and exploring them sensitively, categories related to the phenomenon were recorded (Richards, 2005). Richards (2005) posited that
—most qualitative researchers code. Coding generates new ideas and gathers material by topic” (p. 87).

Each pile of themes was placed into a separate plastic bag and labeled. The overarching themes were separated into subthemes, hierarchically organized. Then another peer coder independently sorted the quotes from each major theme into piles to identify themes and subthemes shared across coders. The researcher and peer coder were unaware from whom the quotes came which was an unbiased way of coding.

**Coding Data**

Once the research period ended, the data were analyzed for emergent themes. Data from all sources, including student and researcher field notes were analyzed. Once the data collection began, the researcher began coding field notes and memos into appropriate themes as they emerged. Coding included five separate phases as described by Fowler (1993), data organization, designing the code for student answers, placing codes into categories, entering data into a process, and cleaning data (for accuracy) prior to analysis. The researcher modified (added or deleted) various themes that were relevant or irrelevant to research questions.

The researcher engaged in three individual case studies, one hour interviews (during the fall), one focus group consisting of three cases, and 66 hours of classroom observations to generate field notes. The development of coding categories and changes to coding categories were documented within personal descriptive field notes. The researcher developed an a priori code. This consisted of brainstorming a variety of coding possibilities and settling on the code list categories that are provided in Appendix I.
The researcher coded the data according to the developed code list. During the coding process, the researcher began to note emerging codes. Once the researcher coded the data, the data were presented to a peer researcher in order for them to code and identify the themes. Once the data were coded and themes emerged, the researcher forwarded and discussed the findings.

**Data Validation**

The findings were validated by triangulation. Richards (2005) defined triangulation as the process by which diverse sorts of data or methods of handling data are compared to the research questions. The collected data were triangulated, member checked, and peer debriefed in order to find convergence between multiple sources of information. As pointed out by Merriam (1998), cross check corroborated the accuracy of data gathered. In triangulating the data, the researcher was prevented from accepting the validity of initial impressions of the study that enhanced the scope, density, and clarity of constructs developed during the study (Merriam, 1998). Merriam suggested triangulating the data, as a structured method to play with ideas.

Various data sources were used in this study to crosscheck and validate findings. For this study in order to check for accuracy, the researcher followed the suggestions of Creswell (2004):

1. Triangulate different data sources of information by examining evidence from the sources and using it to build a coherent justification for themes.

2. Use member-checking to determine the accuracy of the qualitative findings through taking the final report or specific descriptions or themes back to participants and determining whether these participants feel that they are accurate.
3. Use rich, thick description to convey the findings. This may transport readers to the setting and give the discussion an element of shared experiences.

4. Clarify the bias the researcher brings to the study. The self-reflection creates an open and honest narrative that will resonate well with readers.

5. Peer debriefing to enhance the accuracy of the account. This process involves locating a person (a peer debriefer) who reviews and asks questions about the qualitative study so that the account will resonate with people other than the researcher. (p. 196)

Denzin (1994) identified four types of triangulation: (a) data source triangulation, when in different contexts the researcher looks for the data to remain the same; (b) investigator triangulation, while observing the same phenomenon investigators observe the same; (c) methodological triangulation, to increase trust in the analysis one approach is followed by another; and (d) theory triangulation, as investigators with dissimilar perspectives interpret the same results. Using investigator triangulation, the researcher reviewed and coded the themes. Coding is the method of classifying themes in accounts and attaching labels to catalogue them. Themes are descriptions of participant accounts containing specific observations and/or experiences that the researcher sees as pertaining to the research questions (Denzin, 1994).

Member checking was completed at the end of the study when the researcher completed the report and had it reviewed by the student participants (Richards, 2005). Glesne (2006) defined member checking as sharing interview transcripts, thoughts, and final drafts of the report with research participants to make sure the representation was correct. In this study, member checks were conducted with student participants during data transcription and the final phase of the study to allow them to inform the researcher.
of any misinterpretations or omissions. In the final stage, the researcher followed the suggestions of Fetterman (1989) who recommended that the researcher → reconfigure all notes, memoranda, interim reports, papers, tape recordings, and so on to draw an overall picture of how a system works from myriad minute details and preliminary conclusions” (p. 21).

Through the credibility (internal validity), transferability (external validity), dependability (reliability), and confirmability (objectivity), the trustworthiness of a qualitative study is established (Lincoln & Guba, 1985). In what follows, I first discussed each one of these components. Next, I addressed the issue of generalizability as it relates to case studies in general and this specific study. Finally, I inquired into the criterion of reflexivity, which points to the subjective nature of this qualitative study.

**Credibility.** To institute credibility, qualitative researchers may include prolonged engagement, triangulation, and negative case analysis as various methods of achieving credibility. In this study, there was prolonged engagement by collecting data from January through June of 2007. This length of observation resulted in over 22 classroom session observations and six interviews. Further, I incorporated triangulation by utilizing multiple data sources and multiple researchers. The multiple data sources consisted of concept maps and journal entries, formal classroom observation, interviews, video observations, the focus group, and artifacts. As has been discussed previously, there were three students involved in this study.

**Transferability.** Consists of thick description. According to Heppner, Kivlghan, and Wampold (1999), “thick description is an unadulterated and thorough presentation of the data” (p. 263). Presenting detailed information from interviews, observation field
notes, and various supporting documents provides a thick description. As I collected data, I recorded detailed information within my field notes that were typed into descriptive, personal, and analytic field notes utilizing the thick description to develop the code list and to provide examples of the themes.

**Dependability and confirmability.** In order for the researcher to establish reliability. A case study protocol is one way to establish the reliability of the data (Yin, 1994). Protocols were established to assure that I followed a set procedure for data collection in order to minimize differences in data collection due to researcher error. Moreover, I established an audit trail in order to enable others to understand how I arrived at my conclusions. The data management system consisted of the code book (Appendix I). My codebook consisted of categories and subcategories of themes that emerged from the data as I collected and analyzed the data. Each category and subcategory was operationalized through a detailed definition along with an example of the category or subcategory from the actual data.

**Generalizability.** Is related to whether the research findings can be applied to or generalized in other populations. According to Yin (1994), the purpose of case study is more often advantageous to generating theory rather than generalizing its applicability to other populations. Patton (2002) suggested generalizability is one of the criteria for qualitative research depending on the cases selected. In this study triangulation was used, typically a method for improving the validity and reliability of research

**Reflexivity.** Provides a way to position the researcher within the research study. The findings from the data of qualitative research are impacted by the subjective experience of the researcher conducting the research. In order to address the subjectivity
of the researcher and control for bias, the researcher was expected to compile personal notes that detailed personal views related to observations, interviews, and any other aspects related to the research.

**Trustworthiness.** The trustworthiness or validity of the data collection and analysis methods were strengthened by reaching theoretical saturation before leaving the field. Transcribing was conducted by the researcher rather than external transcribers. Using of state-of-the-art audio-visual equipment and computer software strengthened the validity of records. A personal journal for memos was used to take account of the researcher’s influence on the data. Memos, collected simultaneously during the study, allowed the researcher to reflect on methods, theory, and purposes, which permitted one to analytically think about the data and gain insight (Maxwell, 2005).

In this study, trustworthiness was established through triangulation of data from interviews, concept maps, video coding, journals, classroom observations as well as member checks and my reflections and field notes. In this study, each focus group and interview was audio-taped and transcribed by the researcher for member checking and review.

**Summary**

Drawing on constructivism, this chapter offered an explication of the design and validation of this qualitative case study, which aimed to offer rich and in-depth descriptions and interpretation of the data collected from participant observation, interviews, journals, concept maps, and artifacts in order to inquire into African American students’ conceptions of school science and media science in the context of an
urban high school. Chapter IV focuses on the analysis of data collected. In Chapter V, I examine the critical lessons learned from the study and present recommendations for reforming science education in urban schools.
CHAPTER IV

FINDINGS

I was asked to teach electricity to a group of Jewish Orthodox middle school girls. The teaching method for the school involved lecture with very few hands-on lessons. In my position, it was the job description to teach the students the lesson and the classroom teacher the pedagogy of that lesson. Students were asked to stand in a circle to show how electrons work in a battery, passing pieces of paper around the circle. After the visual demonstration, students made series circuits with light bulb, battery, and wire which allowed students to light the bulbs. Ironically, the students kept trying different combinations to discover how to light the bulb, and the regular classroom teacher begged me to give the answer. I told the teacher to be patient. After 15 minutes, there was a scream in the back of the classroom from a student who figured out how to make the light appear. The teacher found it amazing that the students learned on their own how to operate a circuit. The teacher also learned not only how to light a bulb but also how to help students in their construction of scientific knowledge.

Introduction

In this chapter, I first provided a descriptive account of the field setting and participants' backgrounds. Second, I presented data collected from the interviews, journals and reflections that illustrated the participants' voices. I further analyzed the stories and the re-voicing of common events told by case study participants as well as the collected artifacts. Third, I examined and analyzed the themes emerged from the data. Finally, I discussed how the findings address the research questions.
Context of the Study

EuCarlene is located in a large metropolitan city. Upon visiting EuCarlene and its surrounding area, I found many dilapidated homes and buildings with a few ‘newer’ homes that were built through redevelopment grants. Directly across the street from the school is a neighborhood store with large black security bars on the windows and doors.

Description of Field Site Setting

The high school was built in 1972; its landscape has very little grass and no flowers. I found EuCarlene depressing and saddening, nothing surrounding the school provided a desire to learn about science. I was simply saddened by what I see upon entrance on the school grounds – beer cans, newspapers, empty food containers, and flyers. As I stood in front of the school and looked, I found no new buildings, homes, or restaurants. The neighborhood has no laundromat, hardware store, grocery store, library, or bowling alley. Many of the amenities taken for granted in my neighborhood are not found in EuCarlene’s neighborhood. Poverty has adverse effects on students. Examples include: concentration and memory from stress and being a part of the cycle of poverty making it difficult to break the cycle.

Initial Observation

I was surprised to find that only three blocks from EuCarlene High School is one of the largest renowned hospitals in the world. The hospital is a leader in research, education, and health information. Also, I found one of the nation's top universities is located a block from the hospital. Many informal science organizations are located only a few blocks from the high school. There is one shopping center with a few stores and
many fast food restaurants located nearby. EuCarlene is near many science institutions of learning and research. Yet when I visited the school, I did not find any indication of collaborations between EuCarlene and the aforementioned medical and science institutions. Surprisingly, the renowned hospital has an existing relationship with one of the schools in EuCarlene’s district. The high school is a specialized school, medicine focused, whereas students accepted are in the top percentage of the school district. The hospital provides materials, instructors, board members, and funding. Considering there is a relationship between the district and the hospital it would be nice to see some of the same resources provided to EuCarlene. The impact of the partnership between the hospital and EuCarlene would have a lasting effect on both the staff and the students.

A visitor management program exists in many schools which account for and screen visitors, volunteers, and faculty passing through school doors. Upon entering EuCarlene, everyone and their belongings are searched. Visitors must sign-in at the front desk; however, visitors do not receive or carry a pass to identify themselves. Implicitly, having visitors only sign-in without wearing identification implies the school is only protecting themselves. I found the protection weaken after only two weeks of attendance which surprised me. The guard subtly told me to go through without signing-in or being scanned, but I decided to sign-in to document my presence and protect myself. This viewpoint is discussed in my personal notes:

The school building is locked and I must go through the metal detectors to see if I have a gun or knife or some other contraband. The security guard had me enter and sign a notebook with the day and time of my arrival. After signing in the guard has me place my purse on the scanner/x-ray to check for contraband and then has me walk through the metal detector. After a couple of weeks, I no longer go through the metal detector or x-ray. I continue to sign-in weekly to document my presence. (Researcher’s personal notes, January 16, 2009)
EuCarlene has a large entry and high vaulted ceilings that created a sterile atmosphere. After passing through metal detectors, the hallways are decorated with very few pieces of students’ artwork; posters of President Barack Obama and Martin Luther King, Jr. are present. In the area where the Forensic Science course met there were two large classrooms: one with round tables and the other with no desks or tables. I found this area more representative of science due to the large open window allowing the view of the outside school grounds. There were a few trees and plants in the school yard. The classroom with the round tables was for lecture and hands-on activities, while the other adjacent classroom was intended mainly for physical instruction (i.e., self-defense, exercise maintenance, and physical agility).

Technology is limited in the room. Two non-working large computers are located on the table in the right corner area of the room. There is one computer on the teacher’s desk but only works as described by the classroom teacher — when it wants to work” (Researcher’s personal notes, January 11, 2009). My personal computer is needed to access the Internet or view videos. Access to the Internet is very limited due to the schools’ rules regarding students’ ability to view and download unacceptable material. Many schools have blocked Internet websites into the school’s system in fear of hacking, destroying files, and viewing unacceptable material. The difference I found is many more sites are permitted and the suburban schools have found a way to omit unacceptable websites.

Prior to formally beginning the collection of data, I met with the African American classroom teacher in order to explain my thoughts on the importance of the research, the invaluable insight gained through students’ participation, and the impact of
the results on the educational community. There was a bit of a hesitation from the teacher regarding the necessity of parental consent forms for student participation. The concern of the teacher was the parents’ distrust of students to be test subjects. As noted by the teacher, the parents’ reluctance was mainly due to their distrust of scientific studies. This distrust stems from historically negative research studies performed in the African American community. Researchers in the Tuskegee syphilis study knowingly and purposefully failed to treat poor African American men infected with syphilis even though a cure existed. Many African Americans distrust anyone alluding to or performing research in the community. The teacher consented and felt it would be an honor to participate in the research because it would be one of the few times these students would be exposed to an African American researcher they can relate to. For many of the students, I was the first African American female completing a PhD. The teacher acknowledged she knew of no one with a PhD but wanted her students to work with and observe a real researcher.

During the months of January through June 2009, classroom observations took place at EuCarlene High School. The weekly schedule created by the classroom teacher for facilitating the course was revised as needed for schedule changes. I met and observed the class from 9:15 through 11:30a.m. The daily schedule ensued as follows:

9:10 a.m. Students would meet with classroom teacher in an outside the classroom area to discuss homework, rules, upcoming assignments/trips and current events.

9:15 a.m. Researcher would discuss the topic for the day, ask questions about prior knowledge, or give quizzes in the classroom.
9:30 a.m. Students would participate in hands-on activities in groups or look at videos to introduce concepts. (Teacher would hand-out morning snack provided by researcher to aid in learning.)

10:30 a.m. A group discussion on how to apply the new knowledge to the “real world”

11:15 a.m. Classroom teacher would discuss homework assignments and the students would clean classroom

Each morning I arrived before the designated time which allowed me to set-up my materials for teaching and to have my notebook ready to collect on-going observations. Additionally, this allowed time for informal discussions with the classroom teacher on assignments, trips, topics and issues of classroom climate.

Friday, January 12, 2009 was my first day with the entire class. At the onset of the course, 32 students were registered. However, six students were expelled prior to my visit for fighting. The reason for the students being expelled was not revealed to me. Having students expelled on the first day is detrimental in their learning. Not attending school or receiving the material via the Internet suggests the information is not important.

I was nervous meeting the students for the first time and asking for their participation in my research. The nervousness quickly dissipated during an unexpected tour visit by potential eighth grade students for whom I was asked to lead a discussion on the topic of Forensic Science. This unexpected tour would be the first of many interruptions during my time at EuCarlene. After the visiting students left, I introduced myself and my research to the class and allowed students to ask questions (about the research) in order to build rapport. Once the research study was explained, all of the students wanted to participate and were interested in reading the results.
Case Study Participants’ Backgrounds

Three 11th grade African American students were selected by the researcher because they fulfilled all the purposeful sampling criteria. The criteria for sampling included having attended EuCarlene High School from Grades 9-11, having the ability and commitment to meet with the researcher, and having taken the Spring 2009 Forensic Science course with the researcher. (The researcher taught the course in Spring 2007, Spring 2008, Spring 2009, and Spring 2010). Within the Forensic Science Crime Scene course, specific participants were selected by the researcher and recommended by the classroom teacher. The researcher observed the participants while collecting in-depth interviews and artifacts. Student participants were typical of other students in the classroom (Lichtman, 2010) and, therefore, selection was based on the following criteria:

- Student depiction of science in their version of the initial complex concept map.
- Student rich journal entries.
- Student ability to meet with the researcher after school for interview.
- Student responses to questions.
- Student absenteeism’ records (whether the student had habitually unexcused absences from school).
- Student commitment whether the students feels a sincere obligation to participate in the study or not).

The participants, Mariah, Lenise, and LV, self-selected pseudonyms, consisted of one male and two female participants representing a diverse cross section of the classroom. Mariah (#1) is a 17-year-old self-identified female living with unmarried caregivers and
three siblings. Lenise (#2) is a 17-year-old self-identified female living with unmarried caregivers and seven siblings. LV (#3) is a 17-year-old self-identified male living at home with married caregivers and six siblings.

Mariah has taken earth science, physical science, and biology. The Individual Education Plan (IEP) for Mariah, a plan for a student with delayed skills or disabilities, allowed for extra help in classes. Mariah found science useless in life but has an interest in cooking. “I would like to be an expert in cooking because I love to cook. I love to put things together and add different flavors to my meals” (Mariah Initial Journal Prompt, 2/20/09). The classroom teacher assigned Mariah in groups that provided the least restricted environment needed for Mariah to excel. On one particular occasion the teacher switched group members and told various students to behave and help Mariah. “Please switch groups and help Mariah with the crime scene presentation. You know how to help her. I am not playing with you either!” (Mrs. Alexandra [fictitious name] Researcher notes, 5/28/09).

Lenise has taken physical science, biology, and chemistry. Although Lenise felt underprepared in science, she has developed a strong personal interest in science, especially in the field of forensics as a homicide detective. In describing an interest in forensics, Lenise stated, “I want to be a homicide detective and you need a science and chemistry background to do that. I was thinking of minoring in forensics in college” (Lenise Initial Journal Prompt, 2/20/09). Lenise described science as being useful and helpful to animals and plants. “Science is the theory of knowing about different objects or animals. Science to me means that you can help out animals or people that are not feeling well. They [scientists] can come up with different cures” (Lenise Initial Journal
Prompt, 2/20/09). Lenise met often with the researcher before and after the class to ask additional in-depth questions about the field of forensic science. Lenise’s questions included: “If I am a homicide detective, will I get to analyze evidence? Mrs. Whitt, Did you enjoy being a forensic chemist? Do fingerprint examiners need to have a background in science? How did you get into the field…were you smart? I really want to do what you do”. (Lenise Researcher notes, 2/20/09).

LV has taken earth science, biology, and chemistry. Science was defined by LV as “the beginning to a whole new world…. and it’s like a flask everywhere bubbling. Science by definition to me is the study of things and how they work” (LV Initial Journal Prompt, 2/20/09). LV is strongly interested in nerolinguistics, the study of people who lie. The interest in science was demonstrated in LV’s comments, “I would like to become an expert on those who lie. I would like to know why people lie and when people lie” (LV Initial Journal Prompt, 2/20/09). Overall, LV strongly disliked the field of science but found the field of forensic science really interesting, from a law enforcement (police officer) perspective.

**Method of Inquiry – Going Beneath the Surface**

The methodology of my study incorporated the principles of case study as described by Merriam (1998) by merging the day-to-day experiences of three African American students and utilizing their voices. My objective was to obtain a narrative of urban high school students’ experiences and identify the meanings of school and media science. In working within a classroom of African American high school students, three student participants served as the primary source of information. The participants were
able to describe the educational issues and inequities that affected their accruement of science as a field of knowledge through school and media. I found the participants’ point of view provides teachers, administrators, and teacher educators with informative clues to understanding why urban African American youth are disinterested. During the final weeks of the forensic science course, students were disappointed that the course was ending. The students appreciated the snacks, the instructor, the hands-on activities, and the field trip to the Coroner’s office. Most importantly, they appreciated the new knowledge they had obtained in understanding their favorite true-crime media shows in the field of science.

Data were obtained from students’ journals, concept maps, focus group interviews, observations, and artifacts. For the study, three students from the Forensic Science course were selected as case study participants. The students selected represented a cross-section of learners and aptitude levels thus providing me with a homogeneous portrayal of students’ feelings, understandings and attitudes about their science education. I audiotaped and transcribed each interview. After collection, I clustered and identified the themes gleamed from the data. In analyzing the data, I found mutual agreement between the participants on the reasons for their disinterest in science, inequities they find in school, the science depicted in school and media, and how the science in school and media impacts their lives.

**Analysis of Inquiry – Going Beneath the Surface**

Two themes emerged from the participants: (1) the access to the scientific world and (2) the accruement of science as a field of knowledge of school and media science.
**Theme 1: Access to the scientific world.** Access to science that affected African American students’ conceptualization of science in the world included: (a) inequalities and (b) applicability to life.

1a. Inequalities. In this study, the students felt there were inequalities in the way they were taught and treated by their science teachers. The discrepancy in the distribution of funding for science field trips, materials, and resources is another problem brought on by inequalities in education for EuCarlene. The students felt they lacked resources to engage in the study of science and were denied the opportunity due to previous class behavior. As noted by the following interview discussion:

Remember um when (she looks at LV) we had done the experiment and Maya and Brandon stuff popped off? (Lenise Final interview, June 7, 2009)

Yeah, because they put extra solution in there and shook it up and it just started to build up bubbling and stuff. (LV Final interview, June 7, 2009)

Yeah (Lenise Final interview, June 7, 2009)

It flew off. The cart flew off and mine flew off because it was suppose[d] to fly off. (LV Final interview, June 7, 2009)

And Mrs. Alexander was mad when it happened too because she didn’t want us to do anymore labs. (Lenise Final interview, June 7, 2009)

1b Applicable to life. As noted previously in Chapter I, many African American urban students are disengaged in the study of science. Prior to taking the forensic course the case study participants did not consider science applicable to their lives. During the forensic science course, the case study students found some school and media science applicable to their lives. In teaching about fingerprints the EuCarlene students found the topic interesting and usable in their lives. Interestingly, the EuCarlene students applied
the new knowledge about fingerprinting to prior knowledge they learned about genetic fingerprinting.

**Theme 2: Accruelement of science as a field of knowledge.** Issues of acquisition of school and media science that affected African American students’ conceptualization of science included: (a) the classroom, (b) the scientist, and (c) the attitude towards science. I found the lack of students‘ accruelement of science as a field of knowledge was attributed to several learning factors from 2a. *the classroom* (few science materials and the lack of laboratory resources) perceptions of 2b. *the scientist* (home conditions and peer group performance) and 2c. *the attitude towards science* (the school conditions, the teachers’ style of teaching, and the emotional predisposition of students) (Agboghoroma, 2009). Also, as suggested by Agboghoroma (2009), the method chosen for delivery of science information impacts students‘ engagement.

**Themes and Categories Within Data Sources**

Student journals were collected and reviewed by the researcher monthly. The students drew maps of all the concepts related to a general theme. These concept maps were collected, copied and analyzed.

**Journals**

**Theme 1b - Access to the scientific world (applicability to life).** All three of the participant students took science courses. All participants took and enjoyed science at the early levels. However, two developed a strong dislike for science classes in their high school career as noted by LV and Lenise,
What I dislike about science [in high school] is lectures. (LV Initial journal prompt, 2/20/09)

Students remembered and stated various topics that were of interest to them. For example, Lenise recalled learning about DNA,

What I remember the most is that if you know the DNA structure of the child and parents you can separate them then you can put them back together. (Lenise, Initial journal prompt, January 7, 2009)

In learning about DNA, Lenise felt it was applicable to her life and found the subject interesting and important. The importance of DNA was not enough to gain Lenise’s interest in science. Lenise disliked science and stated,

I don’t like science because I don’t get it [the concept] the first time. (Lenise Initial journal prompt, 2/20/09)

Theme 2c - Accrualment of science as a field of knowledge (the attitude towards science). Journals were provided to students in the Forensic Science course to inquire into their definition of science through a concept map. Additionally, the journals were used as a method to record their daily learning experience, thus becoming a tool for assessing the construction of new knowledge. Initially, students were asked about their former science experiences and asked to name programs depicting science on television and told to put this entry on the first pages of the journal. Most students found science boring as demonstrated in students’ comments:

What I don't like about science is that most of the time it is boring and I don’t like math and science. (Student #1 Initial Journal Prompt, 2/20/09)

[Science is] a boring subject that I have to pass to graduate next year. I don’t like science because it is boring. ” (Student #2 Initial Journal Prompt, 2/20/09)

[Science is] a boring subject. And it [science] means nothing to me. (Student #3 Initial Journal Prompt, 2/20/09)
Science to me is a subject based on a bunch of theories. I dislike science because it is slow and boring. (Student #10 Initial Journal Prompt, 2/20/09)

Mariah strongly attributed the boredom in the study of science to the science teacher:

I don’t like science because it’s boring. It’s not the subject, but it’s the teacher I have. He is boring and some of his work is stupid. (Mariah Initial journal prompt, February 20, 2009)

Initially, one of the first journal prompts was for EuCarlene students to define science in their own words. Most of EuCarlene students' definitions of science were negative with 14 out of 23 students explicitly disliking science and finding the subject boring and inapplicable to their lives. Many students find science boring, unrelated to, and unconnected to their lives. As noted by the interviews conducted by Basu and Barton (2007), students found science cold and unattainable. School science is often represented by talking scientifically, memorizing facts and formulas versus scientific inquiry. I found students disinterested in completing the journal prompts when asked about the subject of science. Students asked me why and how this would apply to what they would learn in my course. Once I explained the prompts were to help me in my research they continued and completed the information.

On January 16, 2009, I posed questions to inquire about students' prior knowledge of forensic science (see Appendix D). Students were asked what their favorite science show was and the following responses were provided:

I would want to become an expert in lying. My reason for this is I watched a new show Lie To Me. (LV Initial journal prompt, 2/20/09)

My favorite T.V. show is Cold Case CSI Files. It is one of my favorite T.V. shows because it tells me and shows me old murder and rapes cases and they help other people solve cases. (Lenise, Initial journal prompt, 2/20/09)
My favorite show is *106 and Park*...I watch it every day at 6:00pm. (Mariah, Initial journal prompt, 2/20/09)

The *Lie To Me* television show depicts a deception expert in operation who analyzes facial expressions and involuntary body language to read feelings ranging from hidden resentment to sexual attraction to jealousy (Fox, n. d.). *Cold Case* is a police program that revolves around a police department specializing in investigating unsolved cases (TV.com, 2011). The *106 and Park* program shows the live countdown of the 10 most requested rap, hip/hop, and Rock & Roll music videos. Interviews of actors, singers, and athletes are included alongside the videos (Tvrage, n. d.). The students’ body language, voice level, and discussions were engaging, lively, and informative. Students’ provided ample examples of media television programs depicting forensic science. Most inquired if I would be showing the Forensic programs in class. Also, students suggested if I did not have copies of the programs, they would allow me to borrow their copies. EuCarlene students wanted to know if the shows depicted real science because it seemed very real to them. The initial conversations were great in obtaining students’ prior knowledge and providing the hook about the subject of forensic science.

**Concept Maps**

**Theme 2b - Accrueement of science as a field of knowledge (the scientist).**

Concept maps, in this study allowed me to view students’ awareness of forensic science to build upon their conceptual knowledge. Consequently, the concept maps allowed me to assess the participants’ prior understanding and revealed thought processes that usually remain private. The students were guided to develop a concept map focusing on their definition of science. The concept map was developed at the start of the semester-long
program to clarify the ideas African American students brought to the class (see Appendices H, I, and J). Students organized and represented knowledge to help construct the meanings of science (Novak, 1998).

In order to understand why some students construct a deep understanding of science whereas other only develop a superficial grasp of the material the researcher chose to use concept maps (Novak, 1998). The concept maps were used on Day 1 to help the learners begin the process of meaningful learning to facilitate integration of new concepts and ideas with the learners’ existing relevant knowledge (Novak, 1998). Each case study student was given a sheet of paper with colored pencils (green, blue, and red) and prompted by the researcher to:

1. Write down the word “science” (in green) in the center of the paper (circle and to think about it).

2. To place other words outside the circle they felt connected or applied to science write in green. If the word applied to school science, write in blue; if it applied to the television program CSI, write in red.

3. Erase, edit, and/or shorten words for key ideas and link key concepts with words to clarify their relationships in relation of outside items to the center item.

4. As you work outward continuously add key words and try to be more specific, and

5. The concept map was their (personal) science learning document and students were told to copy it into their journals. (Artifact January 16, 2009)

The concept maps of Mariah, Lenise and LV are depicted below.
This concept map illustrated the key features of Mariah’s concept of science. Mariah, when defining science on the concept map, wrote on the outside of the circle, *earth space science* which she connected and applied to science. Words chosen that applied to school science were *planets and neutrons, electrons and protons*.

Mariah’s concept of science is rooted and derived from classroom experiences. In Figure 4.1, Mariah showed the concept of science from high school science courses and built on the topics learned. “To build a truly scientifically literate society, quality science instruction for all students, including those with a special education need, is critical” (Melber, 2004, p. 9). Mariah finds science boring and inapplicable to life. “My science teacher is boring” (Mariah Final interview, June 7, 2009). Mariah was unable to describe a favorite science lesson as noted in the following dialogue:

Researcher – “Can you describe your favorite science lesson? . . .

LV – “smiles and laughs” . . .”
Mariah – “Not applicable”…

All are now laughing…

LV – “I don’t know. I can’t think of one right now” (Researcher, Mariah and LV Final interview, June 7, 2009).

Mariah felt the crime scene group presentation went well.

My group presentation went good… It could have been better…We could have put more into the project as far as evidence and pictures…But it went okay. (Mariah, Journal entry June 9, 2009).

Figure 4.2. Concept map of science – LV.

A concept map shows the key features of LV’s concept of science. LV defined science in the concept map by writing on the outside of the circle, *Theory and Forensic*, two areas connected and applied to science. LV chose words that applied to school science. The two areas were *Dalton’s Theory* and *Isaac Newton*. LV chose words that
applied to media science as seen in Forensic Science. Those three words were clues, police officer, and victims.

LV’s background experiences in science have been difficult. In Figure 4.2, LV depicts a concept of science that branches into Theory and Forensic as words to be connected and applied to science. The words selected to describe school science were Dalton’s Theory and Isaac Newton. The words chosen to apply to media science under the term forensic were clues, police officer, and victims. Interestingly, LV found theory and forensic as words connected to science in the concept map; however, in the interview LV did not mention theory, Dalton’s theory, or Isaac Newton in describing previous science courses. LV chose words affiliated with forensic science due to taking the forensic course and knowledge of forensic television shows.

Figure 4.3. Concept map of science – Lenise.

This concept map shows the key features of Lenise’s concept of science. Lenise defined science on the concept map and wrote on the outside of the circle, evidence and
forensic, both of which connected and applied to science. Words chosen that applied to school science under evidence were hair and DNA. The words chosen that applied to media science under forensic were blood and body fluids.

Compared to the other case study participants, Lenise has a comprehensive understanding of what science is. "I think like in science you got to try and figure out stuff, like when we made the fingerprints we tried to figure out exactly whose fingerprints they were and stuff" (Lenise Final interview, June 7, 2009). Lenise found the Forensic Science course applicable to her career goal. After graduating from high school, Lenise plans to become a homicide detective. The information and skills gained from the course were useful to Lenise.

Interviews

Theme 2c - Accruement of science as a field of knowledge (the attitude towards science). Two of the three participants told of science-based programs they found interesting and watched on a weekly basis. Conversely Mariah named a program not specifically science-oriented, but she felt it applied to scientific concepts. When prodded by the researcher, Mariah suggested the instruments used by the musicians were depicting sound.

Mrs. Whitt, the drums make sound that doesn't apply to science? (Researcher notes, 2/20/09).

Having the opportunity to work with people who have an interest in science was important for Lenise, as brought out in her interview:

Researcher – What did you or do you dislike in your science class?…

All the students chuckle…

Lenise – Yeah, cause I like just getting together with people that really
want to do (the science experiments/projects) on a step by step. I didn’t like people like throwing stuff or not going or following directions and stuff. (Lenise, LV, Mariah and the researcher Final interview, June 7, 2009)

Lenise had difficulty remembering scientific concepts, especially those in a lesson on cohesion. This became clear in the following discussion:

Researcher – Can you describe a science lesson you dislike?…

Lenise – The last one that we did. I can’t remember what we did. That’s when we had done some chemistry. I think it was with the pennies. I didn’t like that. …

Researcher – What did she do with the pennies?…

Lenise – I think we had to um (unfinished thought).

Researcher – Was it density or was it?…

Lenise – I’m trying to figure out what we had to do. …Oh we had to see how many drops that could go on top of the pennies…

LV – Volume!…
Researcher – That was boring?… Why did you feel it was boring?…

Lenise – Because it wasn’t exciting, like…

LV – That’s something I don’t think we have often…

Researcher – You didn’t think it was interesting? You don’t think that is applicable to life?

Lenise – No. (shakes head no and repeats) No. (Researcher, LV, and Lenise, Final interview June 7, 2009)

Conceivably, this lesson was to perform a simple experiment for students to design their own experiment with variables to answer the question of how many drops of water can be put on a penny. Students were to understand the variables involved and the nature of water. Based on the students’ explanations of the experiment they were unable recall the meaning or scientific explanation of the experiment. Additionally, the students were
unable to see the connection to their lives. The lesson demonstrated how water by cohesion is transported through plants and is applicable to our need to have plants to eat and enjoy. The students did not see the connection to plants and found the lesson boring. In order for the students to remember and understand the concept of cohesion they need an awareness of how it applies to their lives. Cohesion is an important topic to know in learning about the property of water from surface tension to adhesion. As EuCarlene students discussed the experiment, they vaguely remembered the scientific principles. When the students discussed the previous genetic experiment, they quickly discerned the connection to their lives.

Students (a) were familiar with media science and school science; (b) were willing to discuss the phenomena; and (c) embodied different points of view. The interviews allowed students to reflect on school science and true-crime media science. The primary instrument for gathering data for the research included a semi-structured interview where questions were carefully designed to provide adequate analysis for the purpose of the research. Twelve major questions were developed for probing the students (see Appendix F). In using a semi-structured format, the participants explained their ideas, events, and background knowledge on the topic (Rubin & Rubin, 1995). Using the urban African American students’ voices from the interviews allowed the researcher to understand the classroom culture from the students’ perspective and, as suggested by Eisner (1998), recognize how students perceived the situation. Each student interviewed fulfilled the three requirements as recommended by Rubin and Rubin (1995).
Crime Scene Investigation

I selected CSI Digital Video Disc (DVD) from season two that was —purposedly randomly selected” for review. The episode selected for viewing, No Humans Involved (McCreary & Bailey, 2004), aired Thursday, December 9, 2004, and depicted the attitude that certain victims, for various reasons were not worth investigating. Using a process that allowed students to provide responses, case study participants observed CSI DVD episode 10 to code and to identify the representation of science in the program. This also framed the interview questions for the focus group. Each participant, while viewing the CSI DVD, anonymously wrote a response on paper where they observed science. The responses were instantly collected and stored without code by the researcher. The responses were then mined for future further analysis by the researcher.

CSI dispelled the societal stereotypes of scientists being nerdy and uncool. Science media frequently portrays fancy equipment, trendily dressed scientists, and quick analysis to answer each week’s issues that reinforces the image that science is outside of our everyday experiences (Deutsch, 2006). The participants' reactions to the image of science in the CSI video lend insight into their beliefs of how science operates in the media.

[The video demonstrated the forensic scientists] took observations, safety precautions, analyzed fingerprints, and also checked [for] footprints. (Mariah wrote - Video #2 written comments, June 7, 2009)

Forensic chemists did a fingerprint match, taking pictures at the crime scene. They were wearing gloves, and they examined the body to see how the corpse died. Blood splatters are on the walls of the jail. She [the forensic chemist] measured the victim’s wounds. They [forensic chemists] are lifting [lifting] fibers off the body. The coroner did x-rays on the body. They [forensic chemists] examined the body to see how he died. They [forensic chemists] did a fingerprint match. (LV wrote - Video #2 written comments, June 7, 2009)
[Forensic scientists are] taking pictures of the crime scene, putting on gloves to pick up evidence. There was blood splatter on the walls. [Forensic scientists] found hair at the crime scene. The child's ribs was poking out of his body. They [forensic chemists] looked at the body to see what killed him. He [the forensic chemist] took an x-ray of the body. (Lenise wrote - Video #2 written comments, June 7, 2009)

Case study participants found the science depicted in CSI through chemists’ observations, examinations, collection of evidence, and instruments. EuCarlene students found science depicted through the forensic chemists examining the crime scene and examining the clothing of the victims. When the chemists collected evidence from the crime scene, the students found science illustrated. In the forensic laboratory, the students found the instruments represented science by the chemists using them in their analyses. The participants in the study did not discern the differences between scientists and police officers as they found some scientific skills (for example, taking pictures, collection of evidence, and fingerprinting) as depicting science when they are mainly used by police officers. Considering high school students, as found in this study, are making career decisions it is important for them to make a distinction between the job descriptions of a police officer and forensic chemist. The science in media provides the scientific knowledge whereas the science classroom is providing scientific steps or a process.

Annenberg DVD: Depicting High School Science

The purpose of showing the Annenberg video was to gain an understanding of students’ views of science as depicted in a science classroom. As suggested by Annenberg Media (2010), multimedia resources help science teachers increase their expertise in education by assisting them to improve their teaching methods. —Annenberg Media uses media and telecommunications to advance excellent teaching in American
schools” (Annenberg Media, 2010) through the use of best practice and its standards based media. I purposefully reviewed and selected an Annenberg DVD. The criteria used for selecting the video consisted of finding a homogeneous sample with similar characteristics to a high school classroom. Students viewed and coded one Annenberg Media’s live science classrooms DVD. Also, this activity framed the interview questions for the focus group. Each participant, while viewing the Chemical Reaction DVD, wrote a response on paper when they observed science and the anonymous responses were instantly collected and stored without code, which made them anonymous to the researcher. The responses were mined for future further analysis by the researcher.

Due to absences and scheduling conflicts only 11 of 21 students viewed the videos. After examining the Annenberg DVD depicting high school science, students’ descriptions of the high school DVD provided insight into their beliefs about science in school. The purpose of showing the Annenberg video was to gain an understanding of students’ views of science as depicted in a science classroom. All of the participants mentioned chemical reactions as part of the science they viewed in the video described in the following statements:

[Students] had different substances to see the reacts [reactions]. They [students] used test tubes. (Mariah wrote -Video #1 written comments, June 7, 2009)

[Students] testing chemical reactions…going over safety rules…going over procedure for the experiment…utilizing test tubes, safety goggles, and spoons. The students are putting the baking soda inside the tube. The bag is expanding because of chemical reaction of the two mixed chemicals. The heat inside of the bag is giving of a bad scent. The cold and hot air is separating from one another. Liquid is evaporating and creating a form like substance [substance]. (LV wrote – Video #1 written comments, June 7, 2009)
They [the students] looked at copper and sulfur reactions. They [the students] is [are] doing a lab or calcium chorite/chlororate [test]. [There is a] spoonful of baking soda and calcium chlorite in a bag. When they [students] mixed the chemicals together it started to bubble inside the bag. It [the chemicals] started to stick to the bag. The bag started to expand and they [students] said that it started to get hot then warm. One side was not and the other side was cool. There is no more liquid in the bag. Why did the bag expand and get bigger? What made the bag hot and what made it cold [?]. (Lenise wrote – Video #1 written comments, June 7, 2009)

The students described chemicals, chemical reactions, temperature, test tubes, and goggles as depicting science. Students did not mention the science teacher or the students as scientists. In observing the video, students found the high school lab depicted science through the chemicals the teacher used in the experiment. EuCarlene students found science performed as the Annenberg students observed the chemical reactions. Science was found by using instruments such as test tubes for mixing the chemicals and goggles to protect one’s eyes during the experiment. Finally, students mentioned temperature as portraying science; the students measured the temperature of the chemical reaction. Science, in other words, are things found in a laboratory.

**Case Study Participants’ Conceptualization of Media Science and School Science**

Digital Video Discs from CSI and Annenberg were “purposefully homogeneously selected” for review by the researcher. The videos were purposefully homogeneously selected because of some characteristics deemed necessary by the researcher. The No Humans Allowed episode of CSI and the Chemical Reaction lesson from Annenberg Media were used to gather data for the study. Additionally, the digital video recordings were used as sources for the focus group interview.
First, a stage was set for discussion. The students were reminded of the purpose of the study and told they were able to leave any time during the session with no ramifications. Ground rules were discussed to inform participants to express their opinion, that there were no right or wrong answers to the questions, and that everyone's opinion was valued and respected. Students were reminded that the session was being audio-recorded so the researcher could capture their comments. Second, the researcher conducted the discussion. Questions were asked and each student was allowed an opportunity to express their comments (see Appendix H).

Participants were interviewed before and after viewing two videos of a high school science lesson and CSI episode in order to gauge their beliefs about science in the classroom and media. The case study participants were not formally exposed to the field of Forensic Science prior to this researcher presenting the course. Most of the student knowledge of forensics was obtained from watching true-crime media shows; however, they would not have used the term forensic before their exposure to the researcher. The students’ exposure to the forensic science was very limited prior to this course. Due to the classroom teacher’s insistence to combine forensic science into her criminal justice course, these selected students were exposed to forensic science. The majority of students at EuCarlene did not have the opportunity to learn about forensic science because it is not a requirement. When the participants were asked why they felt CSI depicted real science, the students shared the following views:

Lenise stated, …they [the forensic scientists] were doing everything right. They had their gloves on and stuff…When I watched CSI, I use to watch it a lot. It was long journey. I wouldn’t know what to expect. (Focus group interview, June 7, 2009)
LV stated, I really thought that it [CSI] was real and what they were supposed to do! (Focus group interview, June 7, 2009)

Mariah stated, Because I really thought CSI was real! (Focus group interview, June 7, 2009)

The participants’ description of real science depicted on television demonstrated how they constructed their new knowledge about the subject in the following dialogue:

Researcher‘s Group Interview Question: “How do you see science in the media?”

LV stated, On CSI it’s, well since we took this forensic class to me, it (CSI) doesn’t seem like it’s realistic.

Mariah stated, You kind of get a clue of what goes on [in the field of forensic science] but not the whole thing.

Lenise stated, Yeah.

LV stated, I remember watching a movie. I can’t think of the name of it…it’s name is Bait. And the guy, like it was a big stain on his shirt and he had just came into the apartment, I didn’t know what it was, it was a stain, it was coffee but the guy did not put a glove on to see what it was, he just licked his finger.

Lenise and Mariah in chorus exclaimed, Ughhh!

LV continued, And licked it [coffee stain] and he was like oh that’s coffee.

Lenise and Mariah bobbed their heads in agreement, yes.

LV observed, You’re not supposed to do that [referring to sapid analysis of stains on clothing].

Mariah said, Their [the suspect’s] coffee could have poison in it.

LV exclaimed, Right! (Lenise, LV, Mariah and Researcher, Focus group interview, June 7, 2009)

Lenise’s viewpoint summarizes the group’s feelings toward CSI:
Because I love CSI. And it seems like it’s real but most people say that it’s not, but I think some of it is real. (Lenise, Focus group interview, June 7, 2009)
In-depth Focus Group Interview

In-depth interviewing about *No Humans Allowed* and *Chemical Reaction* digital video recordings allowed a deeper knowledge of the research topic and was used to answer the research question and provide evidence for the answer (Schensul, Schensul, & LeCompte 1999). After convening as a focus group and viewing the CSI’s DVD program, *No Humans Allowed*, and Annenberg’s video program, *Chemical Reaction*, the focus group reconvened for an in-depth interview. The structured interview consisted of setting a stage for discussion. Students were reminded of the purpose of the study and told they were able to leave any time during the session with no ramifications. Next, the researcher conducted the discussion. Questions were asked and each student was allowed an opportunity to make comments (see Appendix M). Last, student comments were clarified.

The interview questions were selected specifically for the study. Four recommendations suggested by McNamara (2009) were used to create valuable interview research questions: (a) wording of the questions were open-ended to allow participants to choose their voices when answering questions, (b) questions were as neutral as possible, (c) questions were asked one at a time, (d) questions were worded clearly for participants, and (e) why certain questions were avoided. Creswell (2007) recommends being flexible with research questions and developing questions to keep student participants on focus with their responses to the questions.

**Theme 1a - Access to the scientific world (inequalities).** LV stated that teachers would limit the materials and labs because of the behavior of prior classes. The issue is described by Lenise and LV:
LV – Yeah, because they put extra solution in there and hooked it up and it just started to build up bubbling and stuff.

Lenise - Yeah.

LV – It flew off. The cart flew off and mine flew off because it was supposed to fly off.

Lenise – And Mrs. Davida (fictitious name) was mad when it happened too because she didn’t want us to do anymore labs. (Lenise and LV Final interview, June 12, 2009)

Additionally, LV stated he had limited access to comprehensibility in science due to teachers misadvising and failing him in science courses.

Mrs. How (pseudonym) was my ninth grade science teacher. She actually failed me in physical science, everybody failed in science that year (laughing). So she screwed me up. I’m glad she’s not here now. (LV Final interview, June 12, 2009)

Two of the three case study participants perceived that science teachers in the school did not trust them in the classroom that ultimately led to little or no hands-on activities.

Our teachers don’t let us do anything because they don’t trust us. (LV Final interview, June 12, 2009)

Yeah, like our teachers tell us, because of the class before you all did this we’re not going to do that [science experiment]. So that’s been cutting back on a lot of stuff we could do. (LV Final interview, June 12, 2009)

LV felt suburban students had better teaching materials and teachers as suggested by the following comment:

Yeah, like in suburban cities and on TV shows, you see suburban city kids dissecting a frog and doing this or that. (LV Final interview, June 12, 2009)

And we don’t do that [dissecting a frog]. (Mariah Final interview, June 12, 2009)
We do nothing like that we just mix chemicals from time to time, if the attitudes are good. (LV Final interview, June 12, 2009)

Educators have a substantial effect on the success and disappointment of students in their classrooms. If educators want successful African American students, educators must first want to help create successful students. Teachers need to have high expectations for their students and also provide the environment to create a productive learning. In short, students' attitudes, both at the middle and high-school level, appear to be affected by the students' interest levels in science, their abilities in school science, the curriculum and the learning climate, their access to extracurricular science experiences, their family, their teachers, their own self-concept, and their peer groupings (Zacharia & Barton, 2004, p. 199). Mariah felt the science teacher modeled some aspects of a science teacher but not all:

But he [the science teacher] kind of [gives the] idea of what a scientist is. (Mariah Final interview, June 12, 2009)

I mean I feel there could be more things to what I learn in my science class, it's not like I'm learning anything like them (referring to LV and Lenise) doing chemicals and stuff. I'm not doing that and I feel I am missing out on stuff I could be learning. (Mariah Final interview, June 12, 2009)

Consistently, students indicated that education was important but felt no one cared for them so why fight against the inevitable. Mickelson (1990) found Black students had an attitude-achievement paradox, a belief that an education will not lead to a better life, though the students believed in the value of an education. The students believed teachers and society had lost trust in them.

I do think they [teachers] try to help you, but if you don't want to do it, they won't keep trying. If they feel science isn't your subject, they won't keep trying. (Mariah Final interview, June 12, 2009)
[The science teacher] he said, like EuCarlene school district are falling behind just about every year. They are behind in technology, the computers, lots of stuff. (LV Final interview, June 12, 2009)

**Theme 1b - Access to the scientific world (applicability to life).** Lindahl (2003) found students that were initially interested in science careers lost interest when engaged in the boring science courses therefore, they had given it up. Mariah stated, *in a high pitch tone*: 

cause we don't really do nothing like science…we just break out of a book and sometimes we don't even do that. So, it's like we don't really have that science experience. (Focus group interview, June 7, 2009)

Case study participant Lenise disliked her current science course and summed it up by stating:

Uhm, basically what it [science courses] did to me, like the science that I'm learning it's not [interesting]. I feel it [the science course] could be more to what he's teaching, so basically I feel the same [disinterest] now as I did in previous years. (Lenise Final interview, June 12, 2009)

LV found science unappealing as suggested by the comment, 

Oh, it [science] wasn't appealing to me. I just never had the interest. (LV Final interview, June 12, 2009)

The scientific discipline is unappealing and produces feelings of boredom and disinterest for many urban underrepresented students that feel a disconnection between science and their lives (Basu & Barton, 2007).

My science teacher is boring. (Mariah Final interview, June 12, 2009).

Many of the participants' disengagement in science were echoed in the description of a biology class experience provided by Emdin (2011):

I felt that in this particular class, it did not matter to the teacher or the rest of the class whether I was there or not. There was nothing that made me feel like

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who I was, the intelligence I had, or the specific things that made me feel gifted outside of the classroom mattered in the science classroom. (p. 66)

In teaching forensic science, I found allowing students to share stories with which they are familiar, allowed them to connect the subject of science to their lives. The EuCarlene students had a wealth of knowledge about fingerprinting. Students discussed being fingerprinted for various summer jobs, as I discussed the types of fingerprint patterns. When discussing hair morphology, students quickly gave me examples of the various hair types that could be found at a crime scene. Students were most engaged when I tied the subject matter to the familiar – their lives. LV found science applicable to life in the following statements:

I never knew fingerprints was [sic] that important. I just thought is [it] was regular lines and you could not distinguish who is who but I didn’t know that everybody’s fingerprints were different to some degree…[in fingerprinting] index finger and our middle finger, so it applies to life…You can’t apply this [forensic science] to life…. [participant reflects] the more I think about it, you Can. (LV Final interview, June 12, 2009)

Uhm, it’s like um, this science [forensic science] is like helping humans, [and] it’s like using technology to help humans do whatever they need to do. So, Forensic Science, uhm, like you scan the fingerprints and you discover! (LV Final interview, June 12, 2009)

So, like uhm I remember her [science teacher] telling us about the DNA and I was like WOW!, this is really important. I didn’t know it was so significant, and she was telling us that DNA is distinct and can tell you eye color the way your skin will turn out, all types of things. And I was like um, that’s kind of cool (chuckles). I found that applicable to my life because I think about my physical traits that people see. I think about the ones people can’t see. The way our personality is and who I get it [DNA] from whether it be my mother or father. (LV Final interview, June 12, 2009)

Additionally, Mariah felt fingerprinting applied to the real world as stated:

I think in science you got to try and figure out stuff, like when we made fingerprints, we tried to figure out exactly whose fingerprint they were and stuff. (Mariah Final interview, June 12, 2009)
Mariah felt the need for science for a future career as a homicide detective and stated the following:

Yeah [very serious]. I was thinking of minoring in that [forensic science] in college. (Mariah Final interview, June 12, 2009)

I want to become a homicide detective and you need science and chemistry background to do that. You need to know a lot of chemistry and you would probably need a degree to become a homicide detective. (Mariah Initial journal prompt, February 20, 2009)

In the final journal entry Mariah wrote:

This semester I learned a lot of things about fingerprints. And I also learned how to gather evidence in the safest [safest way] possible. I really want to learn how to become a forensic science [scientist]. (Mariah Final Journal Prompt, June 12, 2009)

In the forensic course, the students performed exercises in a fingerprinting lab. Students learned about types fingerprints, analyzed the various fingerprint patterns of the entire class, and calculated the percentages of each pattern in the class compared to society. The students learned how to collect fingerprints and make fingerprints from various objects they had handled in the classroom. Student engagement triggered the following questions:

- Do identical twins have the same fingerprints?
- How long do fingerprints remain on evidence?
- Are our fingerprints in the Automated Fingerprint System?
- What type of background do you need to be a fingerprint examiner?
- Where do you buy fingerprint powder?
- Why can’t we inhale the fingerprint powder? (Researcher Field notes Day 3).
Based on the student questions, I found students were engaged and interested in the subject. Many of the science lessons were demonstrations or lectured-based, excluding student participation. LV found science interesting in the 10th grade when the science teacher allowed the students to participate in a Moon buggy race, but LV did not find it compelling enough to engage in further study of science. LV stated:

Some of teachers help you develop an interest and try to get you interested in science. Science teachers have you go to extracurricular activities and other stuff. My tenth grade science teacher had us to this moon buggy race and it was fun, like I enjoyed it but it didn’t make me want to be in the science field. The moon buggy race was a nice try [laughing]. (LV Final interview, June 12, 2009)

In order to attract low income urban students in science, adopting a hands-on approach is more beneficial than a lecture format. As noted above, the case study participants acknowledge their disdain for reading about science versus them performing the activity. Trying to incorporate a love for science in the high-school years after students have lost an interest is challenging unless you find a way to connect to them directly. The students shared how they were penalized for the actions of previous misbehavior in science classes and felt they should not have to suffer for the mistakes of others.

I feel we shouldn’t have to suffer for what they [previous science classes] did. (Mariah Final interview June 12, 2009)

We’re a new class but they [science teachers] don’t feel that way. (LV Final interview, June 12, 2009)

Burgaz and Ekinci (2007) describe the effects of misbehaviors. Misbehaviors include the behaviors that disrupt learning-teaching activities, disrupting the learning process of the student exhibiting misbehaviors and that of all other students, creating physical and psychological discomfort and doing harm to properties at school or in the
classroom. The misbehaviors exhibited at EuCarlene in science classes ranged from students acting out, mixing chemicals incorrectly to blowing up bottle caps. LV described personal misbehaviors in science classrooms:

I kinda got that [teacher acting negatively] because of the way I acted in class. I would do my work real fast and he didn’t like that. So, I would finish my work and then start picking on other kids and he didn’t like that… Ugh in class in chemistry class, me and my friend were mixing chemicals together and stuff and it had a reaction so, um, the cork flew off. (LV Focus group interview, June 7, 2009)

The case study participants recalled classroom science content.

Oh, like when we do different kinds of formulas, like log formulas, finding pH and finding H plus finding OH stuff and we fill out the property of, I mean the periodic table of elements. (LV Focus group interview, June 7, 2009)

We study like rocks and minerals and stuff like that like and um, how the earth and all that stuff, so that’s pretty much it. (Mariah, Focus group interview, June 7, 2009)

Students must be engaged to become interested in science. Engagement for students in science classrooms begins with hands-on activities. However, the rigor of the activities will determine the type of questions for students' inquiry. Despite increased engagement and questioning, EuCarlene students still did not want to pursue a science career. In discussing what science content the students recalled, all three students recalled: chemistry, earth science, and biology. Paradoxically, the topics were of content presented in the high school courses students were currently taking at EuCarlene not of subjects previously taken prior to high school. Also, the students did not provide connections of the topics to their lives or the importance of knowing the information in learning new science concepts.
Theme 2a - Accrualment of science as a field of knowledge (the classroom).

Student participants expressed their concerns in the science classroom. These concerns included the boredom with the subject matter, the issues with the high school science teacher, the issues of classroom management, and the difficulty with science content. Many urban students describe science as a discipline that generates sentiments such as boredom, anxiety, confusions, and frustration” (Basu & Barton, 2007, p. 466). Research reports that underrepresented students in science have extremely negative feelings toward school science and has found a decrease in the student’s attitude for science during their middle or high school years (Atwater, Wiggins, & Gardner, 1995). This is demonstrated by Lenise’s and LV’s comments regarding their science teachers who cared about them learning:

When I was in seventh grade I had a teacher who would keep piling work on me. (Lenise Final interview, June 12, 2009)

Ok, I have had someone like that. It wasn’t in high school it was in elementary. (LV Final interview, June 12, 2009)

The students took an active role in the learning. Compared to the other case study participants, Lenise has a comprehensive understanding of what science is. Lenise clearly reflects her understanding when she states,

I think like in science you got to try and figure out stuff, like when we made the fingerprints we tried to figure out exactly whose fingerprints they were and stuff. (Lenise Final interview, June 7, 2009)

In the fingerprinting lesson, students did not sit and take notes; they took an active role in learning by following my model of taking and obtaining fingerprints. I modeled how to take fingerprints and each student in turn fingerprinted another student. Additionally, I demonstrated how to obtain fingerprints and allowed students to create and collect
fingerprints. Students acquired the information and then performed the tasks on their own. All students were involved and engrossed in the fingerprinting activity. Most of the students did not want to end the class and requested for me to leave the materials for them to investigate further. The classroom teacher suggested the activity was one of the few times the entire class was on task and interested in a lesson.

**Theme 2b - Accrueament of science as a field of knowledge (the scientist).**

Students' perceptions of a scientist influence their decision to enter the science field. Many students have preconceived notions of what a scientist is and often times cannot relate to society’s quintessential vision of scientist (Finson, 2002). The first study on high school students' perceptions of what a scientist is was conducted by Mead and Metraux (1957), who found that the students believed scientists were lab coat-wearing men of tall-and-thin stature or of smaller stature who worked in a laboratory surrounded by glassware. Similarity, Thomas and Hairston (2003) found student images of a scientist still included a lab coat, eyeglasses, and facial hair. Students interviewed in this study described a similar image of a scientist.

LV stated, The television or books, for when you read a book, you start picking up images they scientists are in a white trench coat. And there are old pictures from the 1920s and other pictures like that. It is usually a guy in a white coat [all begin laughing]. It’s the first image that most scientists give up, and when you think of a scientist it’s the first image that comes to mind. (LV Focus group interview, June 7, 2009)

Mariah stated – The scientists have an imagination to put things together. Usually it’s a guy in a white coat with some big goggles. (Mariah Focus group interview, June 7, 2009)

Lenise stated – I think of people who invent different types of gadgets that humans use to better themselves. (Lenise Focus group interview, June 7, 2009)
The three case study students found their image of a scientist in the following famous people:

Mariah stated – Bill Nye, the Science Guy. I used to watch that show when I was little. He did different experiments with different chemicals, rocks, and stuff like that. So I just thought of him as a scientist. (Mariah Focus group interview, June 7, 2009)

LV – Yeah, him [Bill Nye the Science Guy] too. (LV Focus group interview, June 7, 2009)

Lenise stated - Also, Einstein. Yep. Cause he was the first man that did anything. Like when I was in the seventh grade that’s all I learned about was Einstein. We had all these pictures on our wall with different pictures of Einstein. The pictures depicted different chemicals he mixed together and stuff. (Lenise, Focus group interview, June 7, 2009)

Student participants’ views of scientists in this study were mainly linked to equipment, white lab coats, chemicals, and goggles. The connection of scientists with specific equipment rather than as a scientific process is paramount in understanding and helping urban students. These connections are needed in order to create scientifically literate students that are able to understand scientific information encountered through both school science and media science. On many levels, students need to understand the basic tenets of science. Teachers need to understand the perceptions of what scientists do help students learn and construct their knowledge of the scientific method.

Underrepresentation of African American students in high stakes science classes prevents them from entering the pipeline thus entering college. Having an incorrect image can dissuade African American students from entering the field of science. African American students will have no knowledge about the process of science behind the technology or medicine impacting their lives.
The scientists selected by the students in the study were: Bill Nye the Science Guy, Einstein and the Nickelodeon cartoon character Dexter. Finson (2002) states: “One implication that consistently arises from the studies on students' perceptions of scientists is that the extent to which an individual's perceptions are stereotypical has direct consequences on that individual's likelihood of selecting science coursework and entering a science-related career” (p. 343). As argued by Finson (2002), students’ images of scientists are directly related to their decision to enter the field of science. Teachers need to better incorporate ways to show the process of science and allow students to participate.

**Theme 2c - Accruegment of science as a field of knowledge (the attitude towards science).** Utilizing the case study students’ depictions of science in school and in media the researcher examined the similarities and differences between their descriptions of science. The students’ reactions to viewing both a video of a teacher teaching science and a video of a crime media based science show, CSI, are highlighted.

**High School Science**

Students in the study were interested in science when presented in a fun and entertaining way. A discrepant event is a way to hook students’ interest because it surprises, startles, puzzles, or astonishes the observer.

LV stated, I really don’t have a very high interest of science. The only thing I think of is blowing stuff up and in our chemistry classes we didn't do that too much, we had a few little minor explosions but wasn't [anything] nothing too huge. (LV final interview, June 12, 2009)

Lenise stated, So, it’s [science class] not like I’d like it to be. I want it [science class] to be fun and stuff…that’s [not doing labs] why I was mad because I really like doing labs. (Lenise final interview, June 12, 2009)
Mariah stated, Uhm, basically, were not learning much but we could have more experiments and stuff like that we could feel like its [science class] but its [science class is] not…I mean I feel there could be more things than to what I learn in my science class we could do more, but I like it, but it's not like I’m learning anything like them [refers to LV and Lenise] doing chemicals and stuff. I’m not doing that and I feel I am missing out on stuff I could be learning. (Mariah, final interview, June 12, 2009).

Singham (2000) asserted all knowledge is constructed in response to outside stimuli within students‘ minds. Students‘ prior knowledge works well until the student observes or experiences something that make them question their existing beliefs. This mental disruption dissipates when the student revises their belief and develops a deeper understanding of the phenomenon. –Because learners‘ ideas are constructed from a wide variety of prior experiences, it is important that the means of exploring them is capable of revealing this rich variety” (Treagust, Duit, & Fraser, 1996, p. 45).

**Participant Observation**

Participant observation is a starting point in research as described by Schensul et al. (1999) and was used for this study. The process of participant observation allowed the researcher to build relationships, to gain an understanding of how the students related to one another, to provide an acknowledgement of the researcher in the setting, to offer a cultural experience for the researcher with cultural experiences that were discussed in interviews, and to show the patterns of social and political etiquette (Schensul et al., 1999). The researcher was involved in a process of learning by engaging in the daily routine of the students in a natural setting (Schensul et al., 1999). In order to understand the nuance of student construction of science in school science and the representation of science in true-crime television, the researcher needed to observe and to experience the
phenomenon. The observational techniques provided further insight into the high school students’ knowledge of science thinking in school, as well as their notions of true crime television.

As a university-based researcher and an instructor in the Law Enforcement Academy, I served as participant-observer in the classroom (Ladson-Billings, 1994). In these roles the researcher functioned as teacher, aide, and mother figure. The researcher developed a relationship with the students that did not distract from the regular classroom routine or lessons.

**Theme 2a: Accruement of science as a field of knowledge (the classroom).**

The classroom environment of school science is oftentimes disrupted by many factors. Factors include violent (weapons, bomb threat, fights, unidentified persons) and non-violent disruptions that include viruses, assemblies, fire-drills, and personnel. Both types of disruptions have a negative impact on teaching science. During many of the days I taught science at EuCarlene, there were many non-violent disruptions including external and internal interruptions. Leonard (2001) defined interruptions as occurrences that disrupt the intended flow or continuity in a science lesson and are a major concern for the classroom environment. Interruptions interfere with the development of the relationship between students, teachers, course materials, and content. The interruptions I encountered during the lessons hindered students’ opportunity to develop an understanding of the science concepts being taught.

After meeting with the classroom teacher, the researcher observed the students were sluggish, inattentive, unengaged, and non-responsive. I attempted to remedy this internal disruption by providing snacks for the students. Even though the snack provided
the impetus for learning, it became an interruption. After consuming the snacks the students participated and became engaged in the course; however, classroom interruptions remained an issue. For example, on week four, the researcher found the classroom door locked and was informed only half of the class would be arriving that day. Additionally, the classroom teacher would not be in attendance which forced the researcher to modify the lesson. The absence of the classroom teacher had further implications to the teaching of the lesson as the materials needed were not accessible without the teacher's key. As a result, this combination of external interruptions halted the lesson with no teacher, no materials, and no technology. Interruptions plague many classrooms; but in urban classrooms, the impact of these interruptions has a more significant impact on teaching and learning (Leonard, 2001).

In working in the EuCarlene classroom, the interruptions that plagued the teaching and learning included:

- **Tardiness** – *Sometimes students arrived late to class sometimes because another teacher kept them over after the passing bell rang. They had a good reason, but it was disruptive. Students always gave me an excuse note* (Researcher Field notes week 4).

- **Inconsistency of classroom teacher presence** – *The teacher tended to leave the researcher alone in the classroom, sometimes for good reasons, but the demeanor of the students changed. I’m not engaging the students and they are out of hand* (Researcher Field notes week 4).

- **Student’s lack of basic needs and resources** – *The researcher used personal funds to purchase teaching materials, breakfast, and field trips Mrs. Whitt you did bring some food for us today? . . . I’m hungry* (Researcher Field notes week 4).

- **Inconsistent attendance of students** – *Mandatory school programs and personal issues took students out of the classroom, never all of them at once, but always a few were gone! School counselor asked me if it was ok to take students out of class today* (Researcher Field notes week 8).
- **Technology availability** – *No computer or videotape player were available and were difficult to obtain.* I forgot my laptop computer and the classroom teacher left her computer at home. So, what will I do to show the DVD? (Researcher Field notes week 6).

- **Substitute teacher** – *Ineffective and unknowledgeable about the program or the students.* Today there is an emergency drill and the substitute teacher left me alone in the classroom. The school is on lock down. What am I supposed to do? Luckily the students help me through the school drill…What a day! (Researcher Field notes, week 2).

- **Classroom space** – *The classroom was not conducive to hands-on activities or technology.* Trying to set-up scientific experiments are difficult in a classroom setting without table space, nor a place to set-up my lessons (Researcher Field notes, week 1).

- **School intercom** – *Contained a loud speaker which broadcast daily school programs and announcements.* Good morning ladies and gentlemen please excuse this interruption, but we need to remind you of …. (Researcher Field notes week 6).

The loss of focus on learning and teaching science is a major concern when an educator encounters unexpected interruptions. Delpit (2002) stated teaching and learning are developed and reliant on shared language between the students and the teacher. The shared language can be found in many venues of scientific teaching. Leonard (2001) suggested interruptions that fracture the attention of science teaching and learning show the absence of significance in the labors of instructors and learners. Due to the aforementioned interruptions, the students in the forensic course were not capable of connecting the scientific concepts in the course to their everyday lives. The students’ inability to relate scientific concepts contributed to their motivation to learn science.

Leonard (2001) discussed the possibility of limiting the number of interruptions that interfere in the classroom to protect the learning environment from potentially negative effects. In order to mitigate the effects of internal and external interruptions in
urban classrooms, it is essential to incorporate three basic concepts from elementary to high school: one, be sensitive to students; two, establish classroom setting, and three, teach effectively (Kopetz et al., 2006). In the forensics course, the researcher was sensitive to the students’ needs but the interruptions created a learning environment that did not cultivate the students’ scientific learning. Leonard (2001) stated an effort should be taken to create the kind of learning environment that will cultivate the students’ scientific learning.

The constant interruptions both by students and school personnel communicated that the learning process was not the central focus of the classroom environment. Furthermore, the interruptions were an obstacle to the learning process because the students were unable to connect constructs to the scientific knowledge. The interruptions caused both the students and the researcher to become unfocused and unengaged in the learning process. The African American high school students’ construction of science from their experiences with school science was affected by the interruptions that plague their classroom environment, which at some points were initiated by the students.

Artifacts

Artifacts such as a student’s journal writing, notes from observations, student work samples, and the final mock crime scene project were collected as site-based documents to investigate further the research questions and sub-questions, and finally, to facilitate data analysis. Merriam (1998) pointed out personal artifacts are trustworthy sources of data wherein a student’s attitude and worldviews can be obtained. Participants submitted several assignments during the Forensic Science course. One assignment
encouraged students to create a mock crime scene wherein students created their own
crime and provided an outline, evidence, photos, witness testimony, and a final report.
The mock crime scene was an accumulation of their understanding of forensic science at
the end of the course. Student outlines allowed the researcher to examine how they
applied their knowledge about science to their final mock crime scene. In addition their
understanding of science was evaluated through monthly quizzes and tests.

The students were intrigued, engaged, and interested in science-related programs.
To gain an assessment of students’ knowledge on crime scene collection, I showed a
scene from the movie, Bone Collector (1999). The movie, Bone Collector, is about a
quadriplegic homicide detective who tracks down a serial killer. The movie was used to
demonstrate and discuss the proper procedure for collecting evidence. Students watched
the movie in trepidation yet fully engaged as noted in my notes:

    The room was quiet with all eyes on the television, everyone is
    engaged. (Researcher’s Field notes, January 23, 2009)

The students wrote down their views of how the officer collected the evidence at the
crime scene. In groups, students discussed what the officer did right and wrong. After
completing the discussion students requested to view the remainder of the movie to see
how it ends. Due to time constraints, I stopped the film and suggested they borrow and
watch with their family.

   As a culminating project for the course which was to demonstrate forensic
knowledge, students were placed in groups and given the task to prepare a crime scene.
The day the project was discussed, the classroom teacher was preparing a barbecue for
the graduating seniors. Students and teachers continually interrupted the class as the
researcher provided the directions for the crime scene. Additionally, the smell of the food
added more distraction to the lesson. Each group received materials needed for the crime
scene that included evidence bags, rulers, cameras, evidence tape, fingerprint tape, fake
gun, and pencils. A sheet was given to each group providing the items needed for each
crime scene project.

CRIME SCENE PRESENTATIONS

Each group will need the following:

Crime scene sketch
Rough draft (1st drawing you made)
Final draft (your perfect copy)
Photographs
  * close up (Evidence)
  * mid-range
  * an overall picture of the whole crime scene area
    A crime scene report (each group received examples of homicide papers)
Evidence
  * number each piece and have corresponding to final report
  * have a chain of custody
  * put date/time/initials/for each piece of evidence
  * If blood put Biohazard (in red)
  * Each crime needs
    - Blood
    - Fingerprints
    - Weapon
    - Optional (hair, fibers, or glass)
Poster board
  * Group member names
  * Synopsis of crime
  * Photographs
  * Crime scene sketch
  * List of evidence (each group received an evidence form) (Artifact, May 15, 2009)

The classroom teacher divided the groups based on students’ personalities and
based it on whether a person was taking the SAT/ACT. Personalities were based on (1) a
strong personality, (2) a weaker personality, and (3) a slacker. Initially the students were
quiet and disinterested in the project. Once in the groups, the conversations were loud, but students became engaged. Many relied on the knowledge from lessons and also from the CSI program.

Different groups discussed information they learned from previously watched CSI programs with Lenise strongly describing the proper way to collect and package evidence. (Researcher Field notes week 9)

On week 10, only half of the students were in attendance where some groups had one or two students working on the crime scenes. On week 11, only a few students attended, and the ones who attended were less engaged. Those students who attended lost evidence and one particular group lost the entire crime report because of a computer malfunction. The classroom teacher was livid with the students’ apathy towards the class

Why did you give her all of the evidence? . . . What were you thinking? . . . What are you going to do now? . . . Why would you give the evidence to the person who has missed so much school (39 days)? (Researcher field notes, June 11, 2009)

The last week of the class, groups consisted of only one or two members to present their crime scenes. Parents of the presenting students and EuCarlene’s 10th grade students attended the crime scene presentations. Only a few parents were able to attend the presentation. The classroom teacher knew only a few parents would be attending and felt having the 10th grade students would provide an engaging audience.

**Theme 2a: (the classroom).** Lecturing to students daily with no opportunities for hands-on, inquiry-based learning is challenging for most students. There are times when lecturing is the best method of providing information to students. In our technological world where students are using and being exposed to web media, television media, and
gaming programs teachers should find ways using the same technology to engage students.

Two participants had a deep desire to learn science during early elementary to middle school; however, in high school the teacher’s language was a barrier. The Indonesian science teacher’s dialect became a barrier for these students to understand the information being presented.

Mrs. Davida (fictitious name) taught us about thin-layer chromatography which was hard to understand because of her language. (Researcher Field notes, May 22, 2009)

The language of science is challenging for many African American urban students (Aikenhead, 1996). In order to speak the language of science, students need to understand the language rules, hear the language, and practice the language. “Students from all language backgrounds need to acquire the discourse of science as well as the discourse of their homes and communities, to understand the culture of science as well as their own cultures” (Lee, 2005). Students need to understand why learning and speaking the language of science is important to understanding themselves and their communities.

On the field trip to the Coroner’s office, organized by the researcher, the students found the lecture portion of the presentation mundane.

Students were found sleeping, talking, and texting during the initial presentation until they were reprimanded by the classroom teacher. (Researcher Field notes, May 22, 2009)

The Coroner’s office provides field trips for various ages and disciplines. Topics usually include the various disciplines of the office, cases, departments, and analysis. In the presentation, unknown to me, the staff talked about organ donation. The students seemed surprised and somewhat squeamish at the prospect of donating an organ. After 15
minutes, the presentation focused on the departments, cases, and analysis using the language of science. For most of the students the language was confusing and difficult to comprehend. Students “zoned” out of the presentation and found other people and things to occupy their attention.

The fingerprint examiner discussed the process of fingerprinting and allowed the students to observe and participate in the superglue method of finding fingerprints; the students became fully engaged and asked many questions.

- How much glue do you need?
- Why do you work here and not the police department?
- Do you enjoy your job?
- Do you go to the crime scene? (Researcher Field notes May 22, 2009).

**Theme 2c - Accrualment of science as a field of knowledge (the attitude towards science).** The researcher provided an opportunity for the students to visit the County Coroner’s Office. The field trip offered the students a chance to see the concepts presented in the course in a real life setting. Surprisingly, students had mixed feelings about visiting the Coroner’s Office. Most were excited about the chance to see the morgue. However, others were frightened of the thought they might see dead bodies. On the day of the field trip, the school bus arrived late to the Coroner’s office, due to school personnel not submitting paperwork in a timely manner which delayed the bus. The students were agitated waiting for the bus, which demonstrated to them that their education was insignificant.

The coroner office staff asked if I had the correct time. (Researcher Field notes week 10)
I phoned the classroom teacher who informed me they were on their way. The students were uniformly dressed and were thrilled to be out of the classroom.

Wow, this is a real lab!… Is this the morgue? (Researcher Field notes, May 22, 2009)

Lenise and LV asked the most questions of the group. After the presentation the facilitator offered to take the students on a tour of the Coroner’s Office; it was 12:45 p.m. and students were excited and ready to take the tour. Unfortunately, the tour was cancelled because the bus driver told the classroom teacher he would only stop at McDonalds if the tour ended by 1 p.m. Upon hearing the bus would not go to McDonalds, the students loudly stated they wanted to go to McDonalds and forgo the tour. Food triumphed over the opportunity to walk and to observe science. For many of EuCarlene students going to McDonalds is a special treat. In my view, going to exclusive restaurant with exquisite food would be special but not special enough for me to not see the behind the scenes look of the Coroner’s Office. The students seemed perplexed at the looks from both me and their classroom teacher when making their decision. In most suburban classrooms the decision of whether to go or not go on the Coroner’s Office tour would not have been discussed. First, students would have brought a lunch from home or ate lunch at school. The students would not have been excited about going to McDonalds because for most, the restaurant is not considered a special treat. EuCarlene students felt the Coroner’s Office visit was nice and too many scientific words they did not fully understand and McDonald’s would be the treat of the day. Unfortunately, the students did not know the value or uniqueness of visiting the lab, especially considering the Coroner’s Office no longer offers tours.
During the final weeks of the forensic science course, students were disappointed that the course was ending. The students appreciated the snacks, the instructor, the hands-on activities, and the field trip to the Coroner’s office. Most importantly, they appreciated the new knowledge they had obtained in understanding their favorite true-crime media shows.

**Conclusion**

Identifying common components shared by students in this study deepened the understanding of just how students construct science in school science and media science. All three students believed science is a boring subject in school and that their teachers made science uninteresting to them. The belief that science is boring contributed to the students’ disinterest in science that deterred them from learning science in school and pursuing a future in science. After attending the forensic course, Lenise, LV, and Mariah now believe science is applicable to their lives and have changed their feelings somewhat towards science. The students now realize the glamour on television is not how *real* scientists behave in the laboratory.

Many factors impede the interest of urban African American students to want to learn science in school. The four factors prevalent in this study included: (1) Interruptions in science classroom – the researcher found many interruptions throughout the school day that hindered the ability to effectively teach science. From public address announcements, fire drills, to students being pulled out of class, all were factors that played a role in how students viewed the importance of science. (2) Science is a boring subject -- the students found the majority of science classes unengaged. Surprisingly, the
students found science enjoyable in their early grades but felt the lecture and demonstration method of teaching uninteresting in the high school career. (3)

Applicability of science to students’ lives – students did not see the connection of science to their personal lives. (4) Access to science materials and field trips – resources, materials, and field trips were limited at EuCarlene. The students stated they did not have the same resources as their peers in the surrounding affluent high school districts.

Considering the limitation of funding for the urban district, EuCarlene school field trips, resources and materials were in short supply.

On January 16, 2009, the researcher asked students if they knew the science of forensics or if they knew the television show *CSI*. Many of the students did not know what forensics meant but were knowledgeable about the television show *CSI*. The students were excited about the possibility of performing some of the science and technology depicted on the show but unaware of the procedures to conduct forensic science. Media science is an important component of students’ scientific knowledge. In this setting, students felt everything on the *CSI* television program to be true and were surprised by the misconceptions portrayed in media science.

How can teachers tap into the knowledge from this study and use it to modify the existing method of teaching urban African American students? The next chapter discusses in detail the researcher’s conclusions and implications for further research on the relationships between and among these elements.
CHAPTER V

CONCLUSION

Once completing my undergraduate degree, I needed to find a full-time job. I did not make the grades for attending medical school. I had no one to confide in or anyone who I could ask to help guide me in the right direction. There were no job prospects. So I accepted a position as a tutor in a nearby community college. I needed to find full-time employment and called my previous high school counselor requesting guidance and help. The guidance counselor called me a month later and suggested I apply for a position with the area police department as a Scientific Examiner. I asked friends, What is a Scientific Examiner? No one had heard of the title. The job description was vague but suggested the applicant needed a natural science background and a Bachelor of Science degree. I applied for the position immediately and received an interview. As I held the phone to my ear I could not believe the words being spoken to me, “Miss Johnson you have the job. Please arrive on Monday morning ready to be fingerprinted”. As a Scientific Examiner, I analyzed raw drug samples, provided expert testimony in Juvenile, City, County and Federal Court, and trained new employees on drug analysis and courtroom demeanor. I was the second African American scientific examiner to be hired by the city. I was the first drug chemist and, for me… I had the first and best job in the world. In other words, I was a forensic chemist before it was popularized by CSI.

This study was based on an assumption that school science and media science can complement each other, and the integration of school and media science can empower African American urban students to study science. How do African American high school students in urban schools conceptualize school science? How do African American high school students in urban schools conceptualize science represented by Crime Scene Investigation (CSI)? The researcher also wanted to know what students
believe about science in school and media and how these perceptions impact on their learning in the scientific field.

Because of the small number of participants, I was able to undertake an in-depth inquiry into the participants’ learning experience. As I determined the themes that kept reasserting themselves in the data, an interconnected system began to emerge. By looking at the interlocked themes that emerged from these students, the researcher was able to identify beliefs, context factors, and practices that led to the construction of science knowledge in classrooms and with the assistance of media. Drawing from the data, I gathered: (1) information on how scientific knowledge is constructed by urban African American students today, and (2) information which gives other educators an understanding of what beliefs and context factors influence African American students who wish to enter the field of science.

**Results**

In qualitative analyses Bogdan and Biklen (1982) suggest "working with data, organizing it, breaking it into manageable units, synthesizing it, searching for patterns, discovering what is important and what is to be learned, and deciding what you will tell others" (p. 145). I analyzed the data and examined the critical themes that emerged from the data (Patton, 2002). Emerging from the journals, the interviews, the artifacts, and the classroom observations were two significant and important major themes: (1) access to the scientific world and (2) accruement of science as a field of knowledge. Theme 1 focused on two categories (a) inequalities and (b) applicability to life. Theme 2 focused on three categories (a) the classroom, (b) the scientist, and (c) attitudes toward science. The case
study participants identified science in school as a compilation of observed chemical reactions, utilizing specific laboratory apparatus (i.e., test tubes), and performing laboratory experiments. Participants found science in media as an accumulation of evidence collection, observation, photography, analyzing evidence on and off site, and taking safety precautions. Both in school and media science the understanding of the significance of the scientist and scientific examiner as a key person are identified in the students’ interviews and observations. The process of problem-solving is an essential part of the analysis in school and media science. Additionally, the use of specialized instruments is integral to scientific examination and analysis in either school science or media science.

EuCarlene students in the study did not associate science with their culture or race. The students did not see science as a system of meaning in their daily lives. Culture is “a system of meaning available to actors situated in shared space, time, history, and possibility” (Grumet, 1989, p. 7). Science as system of meaning was not applicable to the students’ lives or available to them to construct meaning. In the classroom, Western science, a science that is void of a fictive kinship system of meaning (Fordham, 1995, 2010) of African Americans, is the lens through which science is taught in the classroom. In a fictive kinship system, individuals are not related by birth or have a deep relationship with each other. As school science fails to include African American students’ culture, school science is neither applicable nor meaningful in their daily lives. Science teaching that seeks to create a science discourse focusing on science as a system of meaning is one process that might encourage African American students to participate in science. One way
for teachers to create science as a system of meaning is to allow students to engage in classroom discourse about language, procedures, concepts, and rules that comprise science.

Science education is a civil right (Brown, 1990; Tate, 2001). I believe in our democratic society that each individual regardless of ethnicity has the right to a decent [science] education. Culture, especially as social justice, should be a construct found in school science. However, EuCarlene did not exhibit ontologically and epistemologically culture principally as content. An example of culture as a basic civil right would be to include culture in the state’s science standards. However, the science standards created by those in power are devoid of the culture of students underrepresented in science, as those found at EuCarlene. The state’s science standards do not include a representation of the culture of underrepresented students in science. EuCarlene's students did not associate their culture in the science lessons nor did they see themselves. From the data, the school science mentioned by the students failed to discuss the connection to their lives. The data provided an opportunity for a deeper understanding of African American students’ disengagement in science. Furthermore, a deeper insight was gained into the circumstances surrounding how and why teachers should enact methodologies that support urban students in science.

Initially, I introduced concept maps to EuCarlene students and was unable to gain their conception of science. The struggle was seen in my data collection of the concept maps. I carried a cultural experience from my graduate studies which was derived from the culture of power and thought it would be applicable for EuCarlene students. The students had no prior experience with using concept maps and did not feel it would help them learn the concept of forensic science.
In reflection, I may look like the EuCarlene students but my socio-economic status differed from theirs. Examples included: students' priority of caring for loved ones versus attending school, students preferring to go to McDonalds than touring the Coroner’s Office, and students' eagerness for the Friday morning snack due to the lack of regularly planned meals. Many times throughout the semester students would not attend school due to caring for their siblings. During the field trip to the Coroner’s office the students preferred going to eat at McDonalds which was a treat versus taking a behind the scenes tour of the Coroner's office. I found the students were sluggish and inattentive during my visits and found it was due to their not eating breakfast, so I provided morning snacks.

My socioeconomic status as a youth in high school was similar to the students at EuCarlene. Therefore, I felt I could relate to EuCarlene students. Surprisingly my outlook on life was grounded in my current middle class economic value system which in no way resembled the lives of EuCarlene students. I would not consider having my child miss school to carry for their sibling. I have financial resources to place the child in a day care or family members available to help care for the child. If given the choice of going to McDonalds or having a behind the scenes look of the Coroner's Office, I would immediately choose the tour. Going to McDonalds is not a treat but talking, observing, and hearing about the many areas of the Coroner’s would be fascinating to me. Breakfast is served daily in my home and not having it is not an option due to the importance in our mental capabilities.
How Do African American High School Students in Urban Schools Conceptualize School Science?

In today’s society, science plays a critical role in addressing challenging issues such as global warming, the possibility of robots caring for aging adults, cleaning nuclear plants, stem cell research, constructing genetically modified foods, and obesity. In our technological advanced society, we have computers collecting and storing large amounts of data. As we collect and decipher the information, we need adults who are able to read and interpret scientific information to make informed decisions. The issues are a part of society’s concerns, and we need scientifically literate adults to help solve the problems and understand the remedies. All students need to have some knowledge of different areas of science for our technologically advanced society. Students need to reflect and perform science. Rascoe and Atwater (2005) found “Black students’ academic achievement is essential because the resounding expectations for persons in our society who do not possess science knowledge and science skills essential to this new era will be disenfranchisement” (p. 892).

Research reports African American engagement in science is characterized by two conditions: (a) lack of parity (statistical representation) and (b) lack of equity (NCES, 2009). African Americans are 23% of the population (U.S. Census, 2011), 12% of the U.S. workforce (Department of Labor, 2011), but represent only 3% of the STEM workforce (United States Department of Commerce, 2011). Moreover, underrepresentation in science is greater for African Americans the higher their level of scientific knowledge. The underrepresentation of minority groups (African American, American Indians, and Latino Americans) in science is a national issue. Based on the aforementioned information the
reasons for providing access in science to underrepresented groups include social equity, national needs, and group needs. The students at EuCarlene felt access to science was limited due to the inequalities they experienced and the non-applicability of science to their lives.

EuCarlene students sensed the school district and teachers were not concerned about their learning, especially their learning of science. In this study, the students felt the teachers had no desire to help them learn science. Students felt if they were not able to grasp the subject immediately, teachers would not help or support students to learn the science. Potentially, the most disturbing issue revealed was the teachers’ negative discussions regarding the students and the school district. On one occasion, a science teacher told the students the school district did not care about them and refused to provide the material and resources needed to teach science appropriately. Students were subtly reminded that society had written them off and no one cared about them.

In the case study, students knew their suburban counterparts received better science resources and materials which allowed them to have better scientific experiences. As noted in the following discussion:

Yeah, like in suburban cities and on TV shows, you see suburban city kids dissecting a frog and doing this or that, (LV Final interview, June 12, 2009)

And we don’t do that [dissecting a frog], (Mariah Final interview, June 12, 2009)

We do nothing like that we just mix chemicals from time to time, if the attitudes are good, (LV Final interview, June 12, 2009)

Many urban schools value middle and upper class knowledge and culture. The EuCarlene students valued the image that middle and upper class individuals had about them. The students felt as if the teachers, administrators, and society had lost interest in
them and did not care. By participating in the Law Enforcement Academy, the EuCarlene students knew they were special people and as such had access to materials, resources, and experiences, but they felt it was too little and too late as high school students.

Initially, students felt science was not applicable to their lives.

Mariah stated, Uhm, basically what it did to me [science teaching], like the science that I’m learning it’s not [interesting to me]. I feel it [science lessons] could be more to what he’s teaching, so basically I feel the same now as I did in previous years. (Mariah, Final interview June 12, 2009)

After participating in the forensic course the students found the information applicable to their lives.

You can’t apply this [forensic science] to life…. [participant reflects] the more I think about it, you can. (LV Final interview, June 12, 2009)

Teachers need to take an interest in students’ lives when they enter the classroom and build a rapport to gain student respect and trust. Each and every student wants and needs someone to genuinely care for them. Taking an extra step to speak to students about their lives unconnected to school allows teachers to gain a view of the students’ world.

If most citizens enact science as practices in the everyday aspects of their lives (as distinct from engaging as scientists or in science-related professions), then the primary goal in the core courses of urban high schools must be to focus on active participation, enjoyment, and success in learning science. Students whose identities connect to science and who enjoy doing science need to see and learn how to make choices about goals most appropriate to their lives. The National Research Council (NRC) in How People Learn suggests seven principles to enhance student scientific learning.

(1) Learning with understanding is facilitated when new and existing knowledge is structured around the major concepts and principles of the discipline. Concepts and facts need to be organized into “big ideas.”
(2) Learners use what they already know to construct new understandings. African American students need to construct new knowledge through their existing knowledge, even if it is incorrect. Therefore, teachers need to pre-assess students' prior knowledge as they help students construct new knowledge. (3) Learning is facilitated through the use of metacognitive strategies that can be taught to African American students that will allow them to be responsible for their learning. (4) Learners have different strategies, approaches, patterns of abilities, and learning styles that are a function of the interaction between their heredity and their prior experiences. Teachers must be sensitive to each student's learning style. (5) Learners' motivation to learn and sense of self affects what is learned, how much is learned, and how much effort will be put into the learning process. African American students must see the applicability of science to their lives. (6) The practices and activities in which people engage while learning shape what is learned. Students need to have hands-on activities to stimulate their senses. (7) Learning is enhanced through socially supported interactions. Also, they need to work in groups to model the skills needed in the 21st century. (NRC, 2003, pp. 20-22)

The seven principles, as suggested by the NRC, are not for certain groups, subjects, or ages but for all learners.

In constructing scientific knowledge both in school and media science, students' prior knowledge is used in constructing new knowledge. Prior knowledge is instrumental in addressing students' knowledge and misconceptions. Students acquire knowledge from family, friends, school, television, and various cultural outlets. EuCarlene case participants shared how through (a) the classroom, (b) the scientist, and (c) attitudes toward science, they constructed their acquisition of scientific knowledge.

Teachers are increasingly being exposed to misbehaviors and are more bothered than students as found in the Burgaz and Ekinci (2007) study. "Student behaviors disrupt the learning order by disturbing the teaching-oriented acts and activities of teachers in the classroom setting and decrease educational quality particularly in public schools located in city centers" (Burgaz & Ekinci, 2007). Burgaz and Ekinci (2007) surveyed 378 high school
teachers and 909 high school students’ perceptions concerning the frequency of misbehaviors and the disturbance levels of the misbehaviors. The study found teachers were more provoked and more annoyed by misbehaviors than the students.

As noted by the case study participants, the previous science classes at EuCarlene had left strong influences on the science teachers’ feelings toward teaching. Lenise provides an example of misbehavior in the science classroom:

Remember um when (looks at LV) we had done the experiment and Maya and Brandon stuff popped off? (Lenise Final interview, June 12, 2009)

EuCarlene teachers found the students’ behaviors disruptive with some materials and resources destroyed which made teaching challenging. Due to teachers’ feelings of distrust, many of the students in EuCarlene’s science classes received no hands-on lessons, were not allowed to handle science materials, and took no science field trips. The case study participants wanted to have the “real” laboratory experiences as expressed by Mariah,

More labs…working with more chemicals, actually dissecting a frog. (Mariah Final interview, June 12, 2009)

Most of the science lessons at EuCarlene were taught by lecture or demonstration where teachers gave directions and information, created assignments, reviewed assignments and tests, settled disputes, and marked and graded papers. Haberman (1991) described the core functions of [science] urban teaching:

- giving information,
- asking questions,
- giving directions,
- making assignments,
- monitoring seatwork,
- reviewing assignments,
- giving tests,
- reviewing tests,
- assigning homework,
• reviewing homework,
• settling disputes,
• punishing noncompliance,
• marking papers, and
• giving grades. (p. 291)

As noted by Haberman (1991), there are times when one or all of the above activities are warranted but when systematically performed on a daily basis, they become the pedagogical coin” for teaching in urban classrooms. The tasks teachers perform constitute what parents and students expect teachers to do in the classroom. Haberman (1991) describes pedagogical coin”… constitute the pedagogy of poverty – not merely what teachers do and what youngsters expect but, for different reasons, what parents, the community, and the general public assume teaching to be” (p. 291). An example in the study is discussed by Lenise:

He [science teacher] updates like if there is something on the news, he gives us information on current events and tells us about it. (Lenise Final interview, June 12, 2009)

(in a high pitch tone) cause we don‘t really do nothing like science…we just break out of a book and sometimes we don‘t even do that. So, it’s like we don’t really have that science experience. (Mariah Final interview, June 12, 2009)

In order to provide experiences that will impact, encourage, and empower an African American student to learn science, the pedagogical coin” approach must not be used in teaching science to urban students. The study clearly shows that students are eager to have hands-on experiences that are applicable to their lives. To facilitate students‘ studying science, it is critical to explore viable alternatives. In my undergraduate courses, teacher candidates consistently complain about their mentor teachers‘ approaches in teaching in the urban schools. Many teacher candidates discuss the use of worksheets, lecture, and very little hands-on activities for teaching science in
the field –urban classrooms. Teacher candidates observe urban students who are learning science are singled-out daily and placed in separate areas of the classroom. Other observations include an urban student being told to place their nose in the corner of the classroom. Many times the individuals being separated and not participating in the classroom activities are African American males. The pedagogical coin approaches executed on a daily basis in urban schools provide little if any encouragement for students to enter the field of science.

One of the greatest challenges in teaching in the urban environment is the increasing number of interruptions as compared to suburban or rural environment settings. Leonard (2001) states one remedy may be to formulate policies at both the district level and the school level with clearly planned corrective actions. I recommend that the school consider changing the site of the class to another building or location in the school would reduce the number of interruptions but would present challenges since space in the school building is at a premium. Making curricula changes would be another option, perhaps reducing the time frame for each topic into smaller parts. EuCarlene's classroom experience reminds me that interruptions are a constant challenge in urban teaching, and I have the responsibility to interrupt the status quo of the cultural norm and voice my criticisms as well as modify my actions to see what or if any action change will occur. The challenge remains to decrease the number of interruptions by creating, on my own or working with the teaching and administrative staff, a structured and nurturing learning environment in a way that is both beneficial for the science classroom and the students.
Reflecting on my personal experiences in school, as a child, teachers took an interest in me as a student. Science teachers expected me to succeed and thus I tried to live up to their expectations. However, at times, I found the information to be quite boring and not applicable to my life. How can teachers make science applicable and be interesting to students at the same time? Hyun (2006) suggested teachers need to take a step back and ask two questions. What is science curriculum and what does it do for the learner? Reflecting on one’s teaching praxis is not always practiced in the field of education. Considering teachers’ schedules, there is little time for reflection. Teachers have little time to “get to know” each student and gain family background to help them to build or to construct a culturally relevant science curriculum. However, taking the time to reflect and becoming familiar with each student’s background would empower both the teacher and student in science classrooms. Teachers need to know content, know how to teach, and know the learner.

Curriculum, derived from the Latin word currere (to run), as defined by Hyun (2006), is allowing the learner to govern the learning experience or set their own pace. Pinar and Grumet (1976) suggested the learner should direct the curriculum. If teachers take into account students’ needs and modify the teaching to address these needs, teachers will begin to communicate with the learner (Hyun, 2006). As teachers become the learner and students become the teachers, this meaningful dance empowers both. Rascoe and Atwater (2005) suggested science teachers of Black students should serve as a frame of reference for students in three different ways: (1) validation – tell students they are capable of doing the work, (2) validation – if you do the work you will receive an A, and (3) more validation – provide a classroom where science is explicitly
explained. At EuCarlene, students needed affirmation in knowing they could do scientific analysis, affirmation they were capable of learning forensic science, and affirmation that the classroom was a safe place to ask and a way to answer questions. I found many of the EuCarlene students constructing new science knowledge by applying their prior knowledge and surprisingly surpassing my initial expectations.

To gain an understanding of the learner and to help the learner gain an understanding of science, I suggest teachers incorporate a method used in the music industry; tanning. “So tanning is a phenomenon that went beyond musical boundaries and it went deep into the psyche of young America, blurring demographic lines and causing a transformation so that there was a generation of kids that did not identify each other through color any longer. They identified each other through shared values” (Cox & Stoute, 2011). Using the example of tanning, as noted by Stoute, former record executive, current advertising strategist and the author of the book, *The Tanning of America: How Hip-Hop Created a Culture that Rewrote the Rules of the New Economy*, teachers need to go beyond the science boundaries and into the psyche of young urban African Americans (Cox & Stoute, 2011). Tanning is a trend that delves into the consciousness of American youth going and beyond musical borders. This paradigm shift distorts the lens of American youth whereas they do not identify one another through color but through shared values. Using the model of tanning, we can distort the current view of science and show African American youth through science includes the values they share.

At EuCarlene, the case study participants felt they were successful in elementary school science and teachers supported the belief that all students were successful. During middle and primarily in high school, the students felt they were unsuccessful in science,
the learning environments were not conducive to being successful, and teachers did not believe students were successful. Ultimately, participating in the Law Enforcement Academy students felt validated and found teachers and instructors who believed they could be successful. The program supported the African American students' needs and allowed them to become successful in their future career goals as described by Rascoe and Atwater (2005).

How Do African American High School Students in Urban Schools Conceptualize Science Represented by Crime Scene Investigation (CSI)?

Interestingly, the students in my study mentioned only European American scientists, such as Einstein, Bill Nye the Science Guy, and the cartoon character Dexter. The students did not mention one person underrepresented in science. In the Turkmen (2008) study, researchers found students — generally showed that scientists are male, Caucasians, elderly-aged, working indoors with chemistry.” Surprisingly, the students did not consider themselves or other members of the school as scientists. Lenise and Mariah mentioned one of the good-looking (African American) characters who depict a forensic chemist on CSI. They felt the actor who “played” being a forensic chemist was a good actor. Listening to and exploring the African American students’ conception of scientists provides an insight on their view of science.

The students’ perceptions of science in the Annenberg video and CSI video provided insight to their construction of science. Students, after viewing the Annenberg school science video, found science depicted through chemical reactions, goggles, and chemical, as noted in the following comments:
They [students] used test tubes. (Mariah wrote - Video #1 written comments, June 7, 2009)

[Students] testing chemical reactions…going over safety rules…going over procedure for the experiment…utilizing test tubes, safety goggles, and spoons. (LV wrote – Video #1 written comments, June 7, 2009)

They [the students] looked at copper and sulfur reactions. When they [students] mixed the chemicals together it started to bubble inside the bag. It [the chemicals] started to stick to the bag. The bag started to expand and they [students] said that it started to get hot then warm. (Lenise wrote – Video #1 written comments, June 7, 2009)

In CSI’s media science, students found science depicted through the scientists‘ observations, collection and analysis of evidence, taking photographs, and using instruments. Students‘ descriptions include:

took observations, safety precautions, analyzed fingerprints, and also checked [for] footprints. (Mariah wrote - Video #2 written comments, June 7, 2009)

Forensic chemists did a fingerprint match, taking pictures at the crime Scene. They were wearing gloves, and they examined the body to see how the corpse died. They [forensic chemists] did a fingerprint match. (LV wrote - Video #2 written comments, June 7, 2009)

[Forensic scientists are] taking pictures of the crime scene, putting on gloves to pick up evidence. [Forensic scientists] found hair at the crime scene. (Lenise wrote - Video #2 written comments, June 7, 2009)

EuCarlene case study students did not see using gloves in the classroom as depicting science in the Annenberg’s classroom video but in the media science (CSI) video found the use of gloves did depict science. Test tubes, goggles, and chemical reactions were indicated as depicting science in the classroom but in the CSI video were not mentioned when the chemists used chemical reactions in analyzing the evidence. Therefore, little conflation exists between of the symbols of science across school science and media science.
During the course of this study, I learned the case study participants’ conception of science in both the classroom and media strongly reflected their interest in science, but also that these perceptions are deeply embedded and manifested in their daily lives as members of society. Examples included the students’ perceptions of the school district, teachers, and resources. The case study participants perceived themselves as members of an underprivileged school district. Each of the case participants shared with the researcher their belief that they have had negative science learning experiences in high school. It was clear in the students’ words that science was a boring subject, and they felt it was due to ineffective teachers. The experiences students shared about EuCarlene’s science teachers were mostly negative. All of the students focused on the teachers’ lack of hands-on activities, their negativity towards them and the school, and boredom built into the lessons.

To a certain degree, media has played a role in teaching science. This belief is supported by the fact that students have negative attitudes towards science even before they are introduced to physics or chemistry (Hoffmann, Haussler, & Lehrke, 1998). According to Haynes (1994),

Studying the evolution of representations of scientists in Western literature, and more recently in film, allows us to see how clusters of these fictional images have coalesced to produce archetypes that subsequently have acquired a cumulative even mythical, importance. These images are depicted through six stereotypes. The alchemist, the stupid virtuoso, the romantic depiction of the unfeeling scientist, the heroic adventurer, the helpless scientist and the scientist as idealist.

(p. 3)

CSI is mass media’s —enticed-to-know” science which means its images of science, positive or negative, is dishonest sensationalism, for the media’s quest is to entice the viewer to pay close attention (Aikenhead, 2006). In providing these intriguing and
attention-grabbing media visualizations in society, how do we make all students see or more importantly understand real science? More importantly, do we care? Views entertained by students toward science are shaped by their interactions in the world and their interpretations of what they see on television. If we want to have articulate, scientifically literate students, we must let them know why becoming scientifically literate is crucial, and show them how to embrace it, using the media as one of our tools.

Student perceptions of scientists have begun to shift away from the "mad scientist" image to one that is more sensationalistic, yet more realistic. The actors portraying scientists on the CSI television program depict everyday people, and students can see themselves in action. Students are engaged in the drama and take in the glitzy images and feel consequently connected to the CSI scientists. CSI has greatly influenced how students perceive scientists at work. Multimedia genres are representational practices that are used in and are passed on as science (Pauwels, 2006). Students believe the science that is depicted on television is the standard for the profession. The students have no knowledge that science is a self-regulating system.

I found many of EuCarlene students had incorrect images of forensic science. Many felt forensic chemists were extremely smart. The students thought forensic chemists dressed in designer clothes to collect evidence. I informed the students most of the chemists wear jeans daily so they do not destroy their clothing with chemicals. When I mentioned that DNA analysis can take up to six weeks to complete, the students were completely shocked. The students felt most of the analyses were done in a day or less. Surprisingly, the students believed each forensic chemist could analyze chemical,
biological, and technological evidence. Students did not know each chemist has their own specialty and work with other chemists to complete an investigation.

The case study participants believed the science depicted on television was real. All three participants believed all forensic chemists collected evidence from the crime scene, photographed the evidence, analyzed the evidence in the laboratory, and met with the suspects to discuss the cases. The students felt most analyses were done in minutes and believed laboratories had most if not all of the fancy instruments described on television. The media is one of the major sources of dissemination for scientific information to most students. Researchers studied Hong Kong nursing students and found almost one-third stated television as their primary information source for the nursing profession, while only 3% of the nurses cited the science information provided to them in school (Law & Arthur, 2003). Society buys into the televised notions of science and science media continues to provide the stories and illustrations. There needs to be ways to have students use their own knowledge to examine the media –stuff” being portrayed on television and know how to filter the real from the fiction. Teachers should pre-assess students’ prior knowledge and allow students to explain their preconceived views. Once obtaining students‘ prior knowledge, teachers can use science media representations to allow students to compare and contrast real from fiction, thus allowing for authentic learning to be addressed in the classroom and impacting learning outside of the classroom.

Conclusions

Emdin (2011) defined oppression as ―any act or process that either limits or extracts one from a position of power or acceptance‖ (p. 68). The students in my study were not supported to engage in STEM-related disciplines. In not supporting these
students to participate in STEM disciplines they are not entering positions of power and acceptance. Students in the study were limited in learning science by (1) inadequate resources and materials, (2) teachers’ beliefs in students and school, (3) a lack of role models, (4) interruptions, and (5) a lack of hands-on activities. In order to know why—African Americans, Native Americans, Hispanics, and other ethnic groups have been historically underrepresented in the sciences, it is important to learn more about the nature of the science education available to them” (Tolley, 2003, p. 224). These students have been hindered from fully learning and constructing their knowledge of science. A depletion of science resources, materials, hands-on activities, group-collaboration opportunities, and speakers who know how to make science applicable to students’ lives in the real world are all factors contributing to the promotion of urban African American student disinterest in science.

Students are taught the strict step-by-step method of setting up scientific experiments which is labeled as the scientific method-in-action. Educators tell them to make observations, to make a hypothesis, to observe, and to record data to see if their hypothesis is wrong or right. The prior knowledge of many students contradicts the viewpoint of school science, especially the Western view of science. By acknowledging the students’ naive theories, teachers will gain an understanding of what and how to introduce new scientific concepts to students. Understanding students’ prior knowledge and obtaining their misconceptions will allow teachers, using their pedagogical content knowledge, to develop lessons to help students learn. The science teacher might have the most significant influence and power to make transformations occur in the science classroom (Counts, 1932). Krajcik (2000) also highlighted the influence of involved and
committed teachers on classroom outcomes that influence students to develop positive attitudes toward learning science. In order for students to become literate citizens, educators must take notice of how students see themselves as scientists. African American students must see how science is the key to understanding our world and themselves.

In science classrooms, a framework is warranted using social constructivism as suggested by Atwater (1996), where the teachers and the students negotiate contextualized scientific concepts. These concepts allow both to assess constructed scientific knowledge and actions. Science teachers must see their work as providing access for underrepresented students in viewing multiple layers that encourage role-playing and border-crossing in the political, historical, and social areas of science (Barton, 1998). Constructivism allows students to individually focus on constructing the meaning and the social world of science. Using a scientific inquiry methodological approach into teaching supports the framework of this constructivism.

Lenise, who preferred working in a group, said her preferences were to work with peers, but only if they were serious and willing to learn. The EuCarlene case study students had negative feelings regarding their peers' presence in science classes as noted below:

Like having the students there is sometimes it's a good thing, sometimes it's a bad thing, because some students don't care. (LV, final interview June 2009)

And there are people in class that still act out or crazy act immature. (Lenise, final interview, June 2009)
How and for what reasons students valued social relationships within science class or in their community had a strong impact on whether a science learning environment sustained their interest (Basu & Barton, 2007). Undoubtedly, students wanted to work in groups but had limited opportunities and had peers who challenged the necessity to collaborate on science projects. Science classrooms constructed around relationships and science activities that expand a student’s social relationships effects students’ sustained interest in science (Basu & Barton, 2007). Allowing students to work collaboratively in groups provides opportunities for discussion, growth, and acceptance. Students begin to construct scientific knowledge among peers.

Science teaching promotes a Western normative view of science by primarily concentrating on the facts specific to a particular science discipline. Teachers design assessments that employ the use of single-answer and pencil-paper tests which measure the coverage of a topic (Parsons, 1997). To portray science as an enterprise amenable to African American culture, science instruction must emphasize the processes underlying the construction of scientific knowledge. Urban students need to understand the history and process of science through a cultural lens connecting to their lives. Science instruction should include discussions and simulations of science as an enterprise connected to urban students’ culture. If science teaching is to make an impact in urban African American students’ lives, there needs to be a way to show that science can connect to their lives (Barton, 2001; Delpit, 1988, 1995).

EuCarlene students had many ideas and theories on what forensic science in the media depicted. The students also had the knowledge and experiences of how forensic science is enacted in the community. In allowing the EuCarlene students to share their
pre-conceived knowledge from their lives, I empowered students to learn and make decisions as they constructed new scientific knowledge. By my accepting students‘ thoughts, opinions and beliefs without judgment, I created a safe environment to allow them to learn and succeed.

In this study, the EuCarlene students were elated to be learning about Forensic Science, a subject they felt they knew. Considering the students were familiar with the topic, they were anxious to participate. Each student in the Forensic Course was engaged as I discussed famous cases such as the O. J. Simpson trial, the Sam Shepherd case, and Al Capone. Students wanted to know if the suspects were guilty or framed. After debating the cases, I allowed students to use scientific tools. Tools included lenses, chemicals, test tubes, fingerprint powder and brushes, and pipettes. Students were immersed in taking fingerprints, performing thin-layer chromatography, making footprints, and creating crime scenes.

Science inquiry came naturally for the forensic lessons as students were able to formulate questions and to further investigate topics. On one occasion, students learned about the morphology of insects and wanted to know if scientists could tell how someone died. As we discussed the subject of entomology, students wanted to understand how the process worked. I asked them to research the topic and bring to class. The students performed and emulated real scientists which allowed them to participate in inquiry-based learning.

A class activity that stressed the need for discussing the applicability of science concepts to students‘ lives was taught the second week of the course. In the second week, I provided an activity to teach about the nature of scientific observation. Students were
given an unshelled peanut from a bag of peanuts and told to carefully observe and record information about it, using their senses. After the students had completed their observations, the peanuts were placed in a bag and mixed. Students were told to locate their peanut based on their observations. The students were frustrated in this operation as I noted in my notes:

Only a few students were able to retrieve their original peanut and they felt frustrated in the process. (Researcher Field Notes, January, 16, 2009)

One exasperated male student complained and asked me,

What the activity had to do with science? I don’t see what this [the peanut lesson] has to do with forensic science. (Researcher Field Notes, January 16, 2009)

The students did not have many opportunities to work in groups, perform hands-on activities, and make observations. As noted by the male described above, the peanut activity was neither seen as science nor applicable to one’s life. After performing the activity, I informed students of the connection to forensic science.

To see, hear, and know that African American students often fail to recognize the effect of science in their day-to-day lives is disheartening. Furthermore, students in my study found science as something one can choose as a profession but overlooked how important it is in sustaining their existence in our world. Science teachers need to become aware of how their teaching portrays science as an enterprise and do their best to teach science in a way that transmits values other than the ones dominating our culture in the United States (Parsons, 1997). A valuable resource that can be empowering to teachers is self-reflection. Having teachers observe their classroom, students, materials, resources, discussions, and interactions is an invaluable resource. The media is a tool to use to help African American students connect science to their lives. —Popular belief and behavior
are influenced more by [media] images than by demonstrable facts” (Haynes, 1994, p. 1). Using media as a tool in teaching science is one way to make science meaningful and applicable to African American students’ lives. Media allows teachers (a) to hold students' interest (b) to present a diverse group of speakers from all walks of life (c) to allow students to observe and view unavailable locations (d) to know financial support is doable—many entities exist to support science teaching.

Mariah talked about watching a new television show depicting forensic science themes.

I’m starting to get interested in that show Crime 360. (Mariah, Final interview, June 2009)

LV discussed how the show Dexter impacted his understanding of science.

Yeah, [I was interested in science] especially in the laboratory did like when he had that big laboratory and was inventing things. (LV, Final interview, June 2009)

Having a science teacher that would have knowledge about the television shows, content knowledge about the science employed in these shows, and cultural knowledge about the students would bring alive to students the possibility of seeing how “real” science in the shows had applicability to their lives. Comments from LV after taking the forensic science course demonstrated the construction of scientific knowledge achieved in the final interview:

On CSI its, well since we took this forensic class to me, it doesn’t seem like its [CSI] realistic… I think Forensic Science is basically what they’re saying, like use evidence you find to piece the puzzle together to see what happened, to see what happened, um at the crime scene. (LV, Final interview, June 7, 2009)

After taking the forensic science course students further conceptualized their knowledge of the science depicted on television. Students discerned the difference between real
science and science in the media. The students found forensic science to be a puzzle, in
which you gather puzzle pieces to figure out what happened at the crime scene. As noted
above, students felt they knew about forensic science and I provided the pieces to the
puzzle which allowed them to construct their own interpretation of real versus the
misrepresentation of science depicted on television.

Science has been integrated in every facet of our daily lives to such an extent that
it isolates anyone who does not possess some understanding of scientific knowledge
(Hogben, 1960). All those who achieve this understanding will have a deeper insight into
the circumstances that shape them. Educators need to learn the ethos of the community of
scientists and modify for the urban science classroom. Educators must recognize that
finding ways to help students recognize science in their community and lives is crucial to
their understanding of science in the world. Barack Obama, President of the United
States, suggested the following steps through the Educate to Innovate program to help
students become interested in science:

• Increase STEM literacy so that all students can learn deeply and think
critically in science, math, engineering, and technology.

• Move American students from the middle of the pack to top in the next
decade.

• Expand STEM education and career opportunities for underrepresented
groups, including women and girls.
The ways to implement these suggested ideas are through the following programs:

- Time-Warner Cable, Discovery Communications, Sesame Street, and other partners that will get the message to students about the wonder of invention and discovery.
- National Lab Day to help build communities of support around teachers across the country.
- National STEM design competitions that will develop game options to engage kids in scientific inquiry and challenging designs.
- Change the Equation, a non-profit organization to mobilize the business community to improve the quality of STEM education in the United States.
- White House Science Fair, that will allow students‘ projects represent the most cutting edge science, technology and engineering (Obama, 2011).

The EuCarlene students voiced their need to have hands-on opportunities. Students want to feel, touch, hear, and smell to gain an understanding of the world. Urban students are no different. EuCarlene students needed to see how science connected to their lives. Having an African American female who worked in the forensic laboratory allowed the students to see someone who looked like them. Sharing my experiences and allowing the students to see a real forensic laboratory provided the impetus for them to learn and connect to science. Using media science through CSI provided the hook to engage the students in the field of forensic science.

A recent development described in The Cleveland Plain Dealer newspaper stated that if any EuCarlene student graduates with a high school diploma that student is automatically offered four years of free tuition at a prestigious private college in the area.
worth at a minimum, over $121,000 (Cleveland Plain Dealer, 2011). One solution in persuading students to enter the field of science in courses offered to students at EuCarlene is to consider seriously the opportunity to attend one of two private colleges free of charge. Unfortunately, few students have taken advantage of these new programs because of a myriad of issues. If anything can induce these EuCarlene students to improve their work in math and science classes, four years of free tuition is one example. What an inducement to graduate and go into the field of science! Although this program may make a difference, there may be other ways to persuade African American students to attend college and pursue the field of science.

Science media has an influence on society’s viewpoints. Therefore, it would be helpful to conduct further research on the representation of science in the media, a neglected area of research. I agree with Allgaier (2011) to give students an understanding, not only about scientific content and processes, but also about the constructed nature of media representations. The media representations of science and technology, those writers who produce the media representations, and where they appear, are of supreme importance.

If we continue to have underrepresented groups in science, science for all remains for only a select few students. Examining media science and school science through the lens of African American students empowers us and our students to understand how and why students choose to enter or avoid the field of science. It is suggested that African American students must be shown how science is applicable to their lives if they are to construct new scientific knowledge. This study adds to the literature by investigating the relationship between school science and media science. Also, this qualitative research
project may have only begun to look at the ways to aid urban African American students to enter the field of science. It does seem clear that the approach must go further than simply offering the subject of science in school or the opportunity to attend college free. Relevance to one’s life must be provided.

Allowing African American students to use their funds of knowledge from prior experiences, family, community and popular culture and merge it with their canonical (school-based) science provides an impetus for students to pursue a scientific career. Once African American students participate in activities connected to their lives by valuing their relationships and honoring their definitions of science, they will develop an interest and commitment to engage in science (Basu & Barton, 2007). The overarching goal of this study was to validate the voices of African American students underrepresented in science who have been marginalized in the science field. The results of this study suggest pushing for more research on the ways to encourage underrepresented students in science to gain an understanding of how science is applicable to their lives.

**Lessons Learned: Students’ Voices at EuCarlene**

Examining science classrooms and the developing learning experiences, one can observe the dynamic dance exhibited by both teachers and students in conflicts, social rules, sociocultural values, and knowledge (Hyun, 2006). The dynamic dance can affect students’ school performance directly and indirectly. In the Rascoe and Atwater (2004) study, Black males who obtained affirmation from teachers on their academic abilities expressed self-efficacy and inspiration to do well in science. The three points suggested
by Rascoe and Atwater to support students’ learning are needed for all students, especially for urban African American students to succeed. Students need to know they can succeed, someone believes they can succeed and are in a successful learning environment. Teachers need to believe all students can succeed, provide a learning atmosphere that allows all students to be successful and be successful in teaching. EuCarlene students received the affirmation they needed to succeed in the Law Enforcement Academy and lived up to the expectations. A concerted effort is needed in science to allow urban African American students to live up to their potential and exceed expectations.

To help students connect, construct, question, and validate science information, Etkina and Mestra (2004) provide nine suggested instructional principles, from the review of research papers on learning which teachers of underrepresented students should bear in mind:

1. Construction and sense-making of science knowledge should be encouraged.
2. Hypothetic-deductive reasoning should be encouraged.
3. Ample opportunities should be available for learning “the process of doing science”
4. Ample opportunities should be provided for students to apply knowledge flexibly across multiple contexts.
5. Qualitative reasoning based on concepts should be encouraged.
6. Helping students organize content knowledge according to some hierarchy should be a priority.
7. Metacognitive strategies should be taught so that students learn how to learn.
8. Formative assessment should be used frequently to monitor students’ understanding and to help tailor instruction to meet students’ needs.
9. Motivation is an important factor. (pp. 12-17)

Lemke (1990) reminds us to see science as language. He maintains that “learning science means learning to talk science” (p. 1). Talking science means observing, describing, comparing, classifying, analyzing, discussing, hypothesizing, theorizing, questioning,
challenging, arguing, designing experiments, following procedures, judging, evaluating, deciding, concluding, generalizing, reporting . . . in and through the language of science” (p. 1). Having students talk science means to perform successfully the science processes listed above. For example, to be able to describe a flower, one would need to discuss the morphology of the plant, the color of the flower and its leaves, and whether it does or does not bear fruit. Students then must understand concepts related to plants and possess the vocabulary to express the physical properties of plants such as type, size, shape, color, and type of fruit the plant bears. Additionally, one should allow students to construct science knowledge from any experience, interest, pursuit, or hobby they bring to the classroom.

Underrepresented students are facing multifaceted issues in science education. If science educators are to make “science for all”, then we need to develop a strategy to help science teachers teach underrepresented students in diversified ways. How can teachers develop an African American science created by and for African American students? One way is to develop a science curriculum with the learner at the center. Examining how students construct their identity, their language, and knowledge will enable teachers to develop a learning curriculum to support African American students into the field of science.

In order to be successful in equipping the next generation of scientifically literate adults, science educators must remember as posited by Ball (2000) that knowing science education and being able to use science education is at the center of teaching science. It is critical for educators to examine their own views of science and extrapolate the biases they have for underrepresented and underserved students.
Teachers need to believe and strive for "all" students to be competently scientifically literate as well as equip students with the background to understand and cope with life's issues into the 21st century. By examining ourselves and learning about the history of people underrepresented in science we can begin to create a science curriculum for African American students. In what follows, I discuss recommendations for future research on the relationships between and among these elements. These elements include high school students' construction of science knowledge and how educators can empower students' construction and interest of science knowledge using media science.

**Recommendations for Future Research**

Recommendations for science professional development coordinators, teachers, pre-service teachers, college and universities of teacher education programs, and K-12 school administrators have transpired from my study. Following and implementing these recommendations may help increase the number of underrepresented students in the field of science. Recommendations include: (1) providing access to science for all K-12 students, (2) making science applicable to students' lives by using culturally relevant pedagogy, and (3) using the media as a tool to engage students in the field of science.

**Providing Access to Science for All K-12 Students**

Each and every child should have access to science opportunities. Teachers need to consider each student's background and knowledge in providing a constructivist approach in learning science. Most of the EuCarlene students and all three case study participants found science boring. Findings from my study indicate that hands-on activities matter to students. The findings show that using constructivist methods may
impact the level of African American student engagement in the science classroom. As found in my study, students want hands-on activities they can participate in to gain an understanding of the phenomena. The students, as noted by the case study participants, want the science experiences they found in elementary school, where everyone was allowed to participate in science by using their five senses.

**Making Science Applicable to Students’ Lives by Using Culturally Relevant Pedagogy**

Culturally relevant pedagogy allows students to see how science is applicable to their lives. Allowing urban students to share their culture, knowledge, and experiences in the science classroom gives them voice and responsibility for what they learn. The students gain a sense of self and connect science to their lives. Supporting equity and excellence in the achievement of all students will require a culturally responsive pedagogy. "Culturally responsive classrooms specifically acknowledge the presence of culturally diverse students and the need for these students to find relevant connections among themselves and with the subject matter and the tasks teachers ask them to perform" (Montgomery, 2001, p. 4). According to Klingner, Artilés, Kozleski, Harry, Zion, and Tate (2005), a cultural responsive educational system believes all students no matter their language or culture will academically succeed when their experiences are appreciated and integrated in their learning. In culturally responsive classrooms, effective teaching and learning occur, whereby the strengths students bring to school are identified, nurtured, and utilized to promote student achievement.
Three dimensions are identified for a culturally responsive pedagogy: (a) institutional (administration policies and values), (b) personal (teachers‘ cognitive and emotional processes), and (c) instructional materials, strategies, and activities (Richards, Brown, & Forde, 2004). Implementing culturally responsive teaching empowers the learner socially, emotionally, and intellectually (Shealey, 2006). Teachers need to invest and believe all students can achieve in science to change the current paradigm. As teachers interact with underrepresented students of science, they need to understand their personal beliefs affect students‘ performance in science (Campbell et al., 2000).

Bensimon (2005) urges teachers to . . . learn cognitive processes that enable them to think about the situation of underrepresented students and their outcomes through the lens of equity” (p. 100). In order to eliminate the achievement gap, the teacher and administration need to make changes and think from an equity point of view.

Gaining the students‘ trust and understanding their interests provided me with a plethora of topics to engage the EuCarlene students. Using the participants‘ interests, a teacher might have a chef, linguist, and homicide detective visit the classroom to offer the students an opportunity to ask questions. Allowing students to investigate problems associated with their interests such as: (1) everyday language versus scientific language, (2) evidence from the crime scene to the lab and (3) the science of cooking.

Using the Media as a Tool to Engage Students in the Field of Science

CSI has become a cultural phenomenon in pop culture. Many other science-focused shows have the same effect in society, especially in students‘ lives. Using the media as a tool in teaching provides a tangible way to allow students to see the real
versus the fake. Through science media, students will gain an understanding of the topic and develop an interest in science. Based on my findings, I concluded the case study participants gained a better understanding of forensic science and how it is applicable to their lives. Additionally, the students discerned real science from the science depicted on television.

To have African American students observe popular culture through science media will provide a world larger than their local community that could have an integral impact on how they will take up the dream of doing science as a career (Genzuk, 1999). Using science media as a tool to excite and empower African American students to learn science is a way to build student—funds of knowledge.” Funds of knowledge occur in “every household’s educational setting in which the major function is to transmit knowledge from the elders that enhances the survival of its dependents” (Genzuk, 1999, p. 9). Implementing urban students’ funds of knowledge in the science curriculum will engage students into the content and subject, and perhaps encourage students to pursue careers in science, technology, engineering, and math (Basu & Barton, 2007). Honoring and valuing African American students’ knowledge empowers the student and engages them in the topic. Funds of knowledge allow the science teacher to assess what the student knows and allow them to address misconceptions. Using CSI as a tool in teaching forensic science, I was able to use students’ funds of knowledge to gain an understanding of what they knew about the subject and what misconceptions I needed to address.

Moje et al. (2004) suggested the genres of news media, television, and movies relate to science and students see and connect to these venues daily. Having students observe the representations of science in various forms of popular culture (media science
and how the representations are accurate or inaccurate) could be useful in constructing new scientific knowledge in a “third space” (Moje et al., 2004). The third space refers to an area containing students’ funds of knowledge with canonical science and somehow merging the two. Thus, using CSI, which the case study students have all viewed, could have useful implications for allowing students to analyze the representations of science in their lives. Teachers could support the students’ funds of knowledge and validate not only the student but the parents, community, and popular culture all worthy of pedagogical notice (Gonzalez, 2005). My study calls for a new way of knowing and helping urban students construct their scientific knowledge and heightening the awareness (Shealy, 2006).

Additionally, questions concerning how science teachers’ pedagogical content knowledge infused with a student’s culture will impact students’ interest in science, primarily focusing on students underrepresented in science. The data from this study revealed that using pedagogical content knowledge and integrating the knowledge with the students’ culture increased the case study participants’ engagement in the topic and interest in science. Teachers need to increase their self-efficacy in science content knowledge thereby allowing for them to develop strategies to create lessons adaptable for each student’s learning style.

Future research needs to focus on various science topics depicted in the media that could be researched and investigated in the high school classroom. The question warranted to be studied is: “What impact does media science have on African American students’ interest in science?” Future studies could track African American students
viewing a media science program to determine the relationship between students’ engagement and interest in science.
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APPENDIX A

THE UNIVERSITY OF AKRON INTERNAL REVIEW BOARD (IRB)

March 14, 2011

Lugan Johnson-White
Chair, League of Exceptional Studies
The University of Akron
Akron, OH 44325-1505

First IRB Protocol: China Student-Medication Study: Infants Exposed Postnatal to Highly Medicated Chinese Herbs (IRB050226-01)

Ms. Johnson-White,

You did not submit an application for Continuing Research. IRB approval for your protocol expired on March 12, 2011.

The IRB regards this as a closed project.

So that the IRB file will be complete, please complete the Final Report form for this project. Submit the Final Report to the Office of Research Services, 313 S. Main, (330) 972-2493, ext. 1102.

Please call if you have questions. Thank you.

Sincerely,

Mary Samuels
IRB Secretary
You are invited to participate in a study being conducted by Eugenia Johnson-Whitt, doctoral student in the Department of Curricular and Instructional Studies at The University of Akron.

This research project focuses on your (child's) attitude towards science in the classroom and in the media (television). The target population is John Hay High school students who participate in the Law Enforcement Career Program. The researcher is particularly interested in how your child defines science.

If you decide to participate, your child will be asked to complete a survey and to take part in an interview that will take place at school and will take 20-30 minutes of your time. Interviews will be audio-recorded and responses will be transcribed. Interview questions concern student’s experience in the school science classrooms and watching true crime media science on television.

Participation in the project is completely voluntary. You may feel free not to return the completed survey. If you agree to participate, students may refuse to answer any survey or interview questions. During the interview, students may refuse to continue without penalty.

There is no need for identification information, and no real names will be used whenever the study is mentioned. All data obtained from you through the interview will remain private and not viewed by anyone but the researcher. Any information that could identify you will be kept in a locked cabinet secured in the office of Dr. Francis Broadway. Hence, personal confidentiality will be maintained. Should you have any questions about the research or the survey you may contact Dr. Francis Broadway at 330-972-6983.

Thank you very much for helping me. Again, if you do not plan to complete the survey please throw the form away. Thank you.

Sincerely,

Eugenia Johnson-Whitt, Doctoral Student

I have read this form and agree to be interviewed. I understand that I may skip or stop the interview without penalty

_________________________________  ________________________________
Name (printed)                                                           Signature/ Date
APPENDIX C
CONSENT FORM

PART A TO BE COMPLETED BY THE YOUNG PERSON (STUDENT)

I agree to take part in the study on Lessons Learned from the Voices of African American High School Student’s Conceptualization of Science from School Science and the Representation of Science in Crime Scene Investigation (CSI) and would like to take part in (please check off one or more of the following boxes)

- □ A group discussion
- □ An individual interview
- □ A survey

I have read and understood the accompanying letter. I know what the study is about and the part of the project I will participate. I know that I do not have to answer all of the questions and that I can decide to withdraw at any time.

Name__________________________________   Signature________________________
Age_________________                    Date___________________________________

PART B TO BE COMPLETED BY THE PARENT/GUARDIAN

I have read and understood the accompanying letter and give permission for the child (named above) to participate

Name__________________________________   Signature________________________
Date______                   Relationship to student ____________________________________
Prompt for the student journals included:

First Day:

1. If you could become an expert in any subject or activity, what would you choose and why? Write at least two sentences.
2. What is science? What does it mean to you?
4. If you are taking or have taken a science course in school, what is your favorite science lesson? Why?
5. What do you remember most from your favorite science lesson, project, or experiment?
6. What do you like or dislike about science and science class?

Subsequent days (after the lesson was complete):

1. One thing I learned today is. . .
2. One thing I am not sure about today's lesson is. . .
3. I can use this knowledge when I. . .
APPENDIX E

DAILY STUDENT JOURNAL PROMPTS

- What science did you learn in your science class? (Example: I learned about a process whereby plants, some bacteria, and some protistas use energy from the sun to produce sugar, which cellular respiration converts into ATP, the fuel used by all living things)

- What did you like or dislike in your science class? (Example: I liked observing the plants grow and knowing how humans could not live without them)

- Describe the science you observed in your science class. (Example: I observed the teacher demonstrating photosynthesis on a PowerPoint)
APPENDIX F

STUDENT INTERVIEW QUESTIONS

1. What is Science?
2. Give me an example of someone doing science?
3. Describe the difference between science and art.
4. Describe the difference between science and religion.
5. Describe the difference between science and technology.
6. Why do they call Forensics of Forensic Science…science?
7. What do Forensic Scientists do?
8. Are you capable to be a Forensic Scientist? Why or why not?
9. Give me an example when you have been a forensic scientist.
10. Is there research in Forensic Science? If so, what?
11. Name something or someone that reminds you of Forensic Science in your home life.
12. In addition to my questions, what do you want me to know about forensic science as a science?
APPENDIX G

FOCUS GROUP INTERVIEW QUESTIONS

- Define the term Forensic Science
- What is your idea of a scientist?
- What is your experience with science?
- How do you see science in the media (on television)?
- What science classes have you taken?
- What science do you see in the science classroom?
- Can you describe your favorite science lesson?
- I want you to think about your science class(es) and tell me what you learned
- What did you like or dislike in your science class?
- Describe the science you observed in your science class
APPENDIX H

CASE STUDY STUDENTS’ INTERVIEW QUESTIONS

1. What is your idea of a scientist, specifically explain what you meant by a person you think of as a scientist?
2. If you could think of someone who is a scientist, who would you think of?
3. Describe your interest in science this year and compare it to how you felt in past years. Are there reasons for this?
4. Has a science teacher helped you develop an interest in science? Explain
5. How interested are you in pursuing a career in science? Why or Why not?
6. How would you describe your favorite science teacher?
7. Have you had a science teacher from the “dark side”? Explain. Did this have an effect on your performance in science?
8. When you think of science depicted on TV what show made you interested in science? What made it “cool” or interesting?
9. What do your parents think of science as a career choice for you?
10. Is science boring in your classroom/TV? What makes science interesting?
APPENDIX I

CODE LIST

1. Perceptions of science in the world (CHANGED TO)
   Access to the scientific world – Student’s access to science that affected African
   American students’ conceptualization of science in the world
   a. Inequalities – Inequity the students felt from teachers in science
   b. Life – The students found school and media science applicable to one’s life
      through:
      i. Career
      ii. Parents
      iii. Connection to life -

2. Acquisition of school and media science - Issues of acquisition of school and media
   science that affected African American students’ conceptualization of science
   included:
   a. Classroom
      i. High school science teacher
      ii. High school science
      iii. Classroom management
      iv. Recalled content I learned
   b. Scientist
   c. Attitude toward science
      i. Television
      ii. Thinking science
      iii. Feelings toward science