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THE ARTS: BUILDING A FOUNDATION TO INCREASE SCIENCE LITERACY SKILLS FOR URBAN YOUTH

BY

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DISSERTATION

Submitted in partial fulfillment of the requirements

for the degree of Doctor of Philosophy in Education

in the Graduate School of the

University of Missouri-St. Louis, 2015

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Abstract

This study examined issues related to the development of science literacy skills for urban youth, which affected school performance and achievement in science. Examined were historical and societal educational issues, identity and perception of place in society, perceived individual cultural advantages, self-efficacy, and future career interests in science.

Strategies used to address these issues included culturally responsive approaches using hip-hop art forms, as an infusion into the urban middle school classroom. Middle school teachers and youth in large Midwest urban school districts were first surveyed to discover their attitudes about science education and to determine the students' level of science literacy. A performance arts-based approach was then established to connect science investigations to science literacy, and to build a foundation for science literacy skills.

Students and their teachers were then trained to create spoken-word science poetry, intertwined with science inquiry explorations, to develop culminating hip-hop science performances. An assessment of this performance arts approach to learning science revealed that eighty-six percent of the students thought that they had learned science better through science poetry developed into a poetry song. Seventy-one percent of the students felt that drama, or acting out science concepts, helped them to have a better understanding of concepts. In addition forty-three percent of the students gave advice to the researcher in regards to making science education approachable through the training they had received.

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"A More Perfect Union"

"Understanding this reality requires a reminder of how we arrived at this point. As William Faulkner once wrote, 'The past isn't dead and buried. In fact, it isn't past.' We do not need to recite here the history of racial injustice in this country. But we do need to remind ourselves that so many of the disparities that exist in the African-American community today can be directly traced to inequalities passed on from an earlier generation that suffered under the brutal legacy of slavery and Jim Crow.

Segregated schools were, and are, inferior schools; we still haven't fixed them, fifty years after Brown v. Board of Education, and the inferior education they provided, then and now, helps explain the pervasive achievement gap between today's black and white students."

(Barack Obama, 3/18/2008)

CHAPTER 1

INTRODUCTION

Statement of Purpose

The quote cited mirrored a reality needing more in depth exploration and serious consideration. The issue of becoming a social change agent resonated throughout, in that, educators and other stakeholders (juvenile authorities, administrators, etc,) are faced with the daunting task of making a conscious effort to change this bleak reality. The segregated schools in urban communities were, and continue to be inferior schools, and the inferior education that was and is provided now, begins to explain the pervasive achievement gap between today's Black (African American) students in urban communities and White students, specifically in science (Gibson, M. A., Ogbu, J. U., 1991).

One purpose of this study was to determine if a culturally responsive (Gay 2000) program in the form of hip-hop art forms motivates urban middle school students' interest in science in order to bridge the science achievement gap. By capitalizing on African-American everyday

cultural literacy practices and teaching in a manner that made use of their cultural knowledge, frames of reference, prior experiences and performance styles, a foundation was developed that built interest and confidence in higher achievement in science. They have developed an affinity toward a genre of music and spoken-word rap indigenous to their West African heritage brought to the United States during slavery. This practice was cultivated first as elements of hip-hop culture in the Bronx, New York City (Richardson, E., Smith, J, Beasley, K.,2012).

Another purpose of this study was to examine science literacy skills of youth in urban communities, and to determine how students arrived at such a state of low achievement in science. What should be done to harness the cultural capital that youth in urban communities currently possess? Could use of elements in their cultural background steer them toward the beauty, mysteries, and wonders of science? This study contended that developing art forms of the hip-hop culture in traditional science classrooms within a diverse group of youth creates a group of future science literate citizens of urban youth who were currently disengaged in traditional science classrooms. Developing hip-hop art forms within urban science classrooms presented themselves as culturally relevant/responsive practices that reached into and validated the daily literacy and lifestyles of urban students. Science and science-related fields help to create life choices that maximize potential toward becoming more productive urban citizens in the mainstream of society, therefore, use of culturally relevant pedagogy in science classrooms should create interest in science, increase science achievement, and interest urban students in pursuing science literate endeavors. Part of the issue was, there was little or no interest in science by urban students in middle schools, so lack of achievement in science, and significant deficits in science literacy exhibited themselves in traditional classrooms (Oakes, 2000 & Emdin, 2010). Therefore, students performed at very low levels on high stakes standardized science tests. Use

of hip-hop spoken-word poetry and music as cultural art forms showed promise toward capturing the attention of middle school African-American youth, as a means of using their cultural capital to increase achievement levels in science when used as a culturally responsive/relevant tool in a traditional classroom setting.

Theoretical Framework

The theoretical framework for this study is grounded in the use of culturally relevant pedagogy (Gay, 2000) and culturally responsive teaching, theories surrounding science literacy skill development (Taylor & Francis, 2010), and a review of NAEP (National Achievement of Educational Progress) science scores of African Americans, examining ability levels to re-direct low achievement and develop a means of motivating middle school students toward higher achievement levels. In addition, a performing arts directive toward teaching science literacy skills was developed.

Perspectives on Culturally Responsive Teaching

Culturally relevant pedagogy brought the researcher's attention to factors that affect middle school performance and achievement, because they shape self-efficacy (Florence, 2010). Underdeveloped self-efficacy decreases residual effectiveness of academic programs for students, often affecting academic skills, aspirations, and social integration. In my experiences urban students seemed not to value themselves, or trust that schools will do anything to offset negative portrayals of them. Constant negative exposure promulgated their invalidation, so students were more likely not to achieve as well at academic tasks. Gay (2001) noted that in negative learning environments, students' motivation for learning was negatively affected, and engagement in the learning process was diminished. Additionally, lack of exposure to effective

science instruction in schools of urban communities affected student motivation (Norman, Ault Jr., Bentz, & Meskimen, 2001). Culturally relevant pedagogy embodied factors that validated, affirmed, and reinforced the performance styles of African American learners, and posed a means of arming their teachers with professional development tools that co-constructed a productive learning environment. The researcher felt that teachers and students could be empowered in this way, toward progressively higher achievement levels in science and instruction (Emdin, 2011). Culturally relevant pedagogy influenced the researcher construction of an interdisciplinary program that utilized the cultural capital of African-American students that undergirded higher achievement in science learning and addressed self-efficacy needs.

Science Literacy and the Next Generation Science Standards

The researcher was influenced by the meaning of science literacy practices as expressed by Taylor & Francis, 2010. They promoted science literacy practices that reinforced real world application of science experiences and helped learners understand key concepts, theories, and principles of their natural world (Great Source Education Group, 2002), which included such habits that assisted in acquiring an understanding of the nature of basic daily scientific experiences. Emphasized by Taylor & Francis was that scientific knowledge and scientific ways of thinking should be recognized by individuals in their daily lives. Science literacy had been broadened to emphasize understanding of the interdependence of science, math, and technology through STEM (Science Technology Engineering Math) initiatives, so the researcher included this knowledge in developing science pedagogy. Nelson, 1999; Taylor & Francis, 2010 proffered science literacy skills as those which support a student science knowledge base with problem solving utilizing analysis, interpretation, and discovery of patterns in science while investigating.

The ideology embedded in STEM and NGSS (Next Generation Science Standards) shaped the researcher's perspective that science literacy preparedness for African-American students required science instruction positing experiential learning, exploration, and attention to prior knowledge that anchored instruction and provided for better understanding and relevance to the learner. NGSS addressed an interdisciplinary approach that incorporated more communication arts skills for students. Facilitated instruction that included these tenets were embedded in the study for African-American science learners.

High stakes science tests scores were reviewed to determine the progression of science skills for science learners, and to analyze why they might be performing at such low achievement levels in science. A National Assessment of Educational Progress (NAEP) report of updated progress for science achievement indicated that there was an evident gap in science test score averages among Black, White and Latino learners, requiring serious attention as to what compensatory measures had been employed for the students, and how they had been implemented. Clearly, past remedial and compensatory methods had not decreased the achievement gap, or significantly improved science literacy and science literacy skills. Further examination of the NAEP scores administered in 2011 (Fleming, 2012) measuring how students conduct and reason through real life science situations, indicated that students were challenged in grasping the necessary science concepts occurring in investigations. Lack of preparedness of African-American middle school students toward high achievement levels for science literacy skills in the 21st century, and the despairingly low science scores on high stakes testing, prompted the researcher to examine the use of cultural capital as a means of motivating student interest and achievement in science.

Complimentary Perspectives

This study was offered as a means of establishing a foundation for science learners, as best science teaching practices were explored that improved interest and achievement. Through the tenets of culturally relevant pedagogy and culturally responsive teaching, the theories revolving around the components of science literacy and other science initiatives, and examination of science NAEP scores, the researcher developed a program directed toward use of cultural art forms that increased science achievement and interest in science for African-American students. The study was offered as a forum for African-American learners to envision entering the field of science, after having achieved a level of science literacy and literacy skills, gained in a culturally responsive environment that celebrates their cultural capital. This study infused a culturally responsive/ relevant learning environment into the science curriculum that increased academic performance and motivation, and invited urban students into the science arena.

As a science educator in an urban community, I have had experiences teaching elementary and middle school students. Elementary school students exhibited enthusiasm throughout science discovery investigations, exhibiting good science process skills requiring interpretation and analysis. When tested in science through the NAEP (National Assessment of Educational Progress, 2009)) at the fourth grade level, elementary students scored higher at grade level than middle school students. Science learning for middle school students had been implemented much in the same manner as with elementary students, but middle school students were apathetic at best, citing that science was difficult for them. This led me to question why there was such a marked decrease in interest and motivation at the middle school tested eighth grade level. Not until I experimented with science poetry as a means of expressing observations

and discoveries during a science investigation did middle school students respond with better understanding of science concepts. Student interest in expressing science concepts increased, even though they seemed to struggle with relating them to everyday real-life experiences. They seemed to become more observant in order to best write their science poetry. A hip-hop musical backdrop was added to the science poetry presentation. Their observations and discoveries during the investigation opened up choreographing of movements while performing with the hip-hop music backdrop!

A Performance Arts Direction for Teaching Science Literacy Skills

While observing student teams as they developed choreography of movements to represent science concepts from created science poetry, I noticed the level of concentration and focus exhibited as the student teams prepared a representative presentation. They worked quietly in teams so that other teams, who would be observing and evaluating them through a pre-established rubric, would not hear secrets of their presentation. They were oblivious to time constraints, and even solicited time during the next day's class period to prepare further. Thus students were given ten minutes of the class period daily, to work on their presentations, thereby surfacing that creativity projection was the catalyst that motivated them. As their facilitator, I roamed between teams asking questions about science content representation, proposing suggestions.

The creativity factor in performance arts experiences mimicked process skills represented in science inquiry investigations. While participating in a performance arts drama representing science concepts, student were engaged in comprehending science from multiple perspectives, allowing them to see science as fun and exciting (Varelas et al 2010). The research of Nicholas

and Ng (2008) communicated that creativity allows students to draw on communication skills to cause higher-order thinking skills to surface. Thereby abstract science became more concrete and visual, with creative unique outcomes, helping students make better connections to science in action around them. Figure 1 compares science process skills to arts creativity skills addressed by Nicholas and Ng.

Figure 1: Comparing Creativity Skills of the Arts to Science Process Skills

Science Process Skills (Morrison, McDuffie, 2009)	**Arts Creativity Skills** (Nicholas & Ng, 2008)
Observing during exploration	Observation during exploration of new meaning-making strategies
Identifying	Creative outcomes based on what people think, believe, and know
Classifying	Making wide connections
Communicate and justify explanations	Focusing and task commitment
Hypothesizing	Selective questioning
Recognizing patterns	Lateral thinking while interpreting or representing facts and experiences
Formulating explanations (evidence)	Creative thinking: Addressing multiple dimensions of theories—that are incorporated into other theories of creativity
Connect explanation to scientific knowledge	Good general knowledge and thinking base

Working through training as part of a team of science curriculum writers, I gained skills that aided me in developing expertise as a science curriculum writer. The science curriculum for a large Midwest city was systematically re-constructed to include necessary ability levels for grades K-12. The curriculum was created to reflect cross referencing of skill mapping of science disciplines, math and technology. Through extensive professional development, teams established science objectives that reflected clusters of ability levels for grades K-12. Additionally, the mapping reflected at what grade level the science skill was progressively re-visited at another ability level. This experience framed my direction as I planned a program for higher skill level achievement in science for African-American students.

In order to teach urban youth, it was critical to navigate beyond traditional science instruction currently observed in classrooms, towards instruction in which educators employed themes from art forms/elements of hip-hop culture. The goal was furthered by focusing explicitly on advantages of hip-hop culture that are conducive to, and empower traditional science educators in the classroom (Emdin, 2012). Since African-American youth routinely navigated every day life outside of school through the lens of how their roles related to their learning and achievement, it was critical that teachers be helped to understand how students continued to try to make better sense of their worlds (Delpit, 1998; Nasir, Roseberry, Warren & Lee, 2006; Wright, 2011). The researcher contended that they made better sense of their worlds through a culturally responsive/relevant paradigm.

This current study examined the use of hip-hop performance art forms and culture as a culturally responsive/relevant approach that addressed science learning for urban students in traditional curriculums. Elements of hip-hop culture were nurtured in the arts, as youth explored their creative potential. This study suggested that this new way of learning science promoted

student cultural capital, and was easily infused into traditional curriculums to increase science learning, and at the same time be culturally responsive. This approach sought to develop cognitive strengths by connecting away- from-school communication processes to learning in the traditional classroom

Recent research examined the use of culturally responsive/relevant instruction that engaged urban students and incitd them toward marked interest in academic achievement. This study promoted hip-hop spoken-word poetry (Petchauer, 2009, 2011; Davis, 2000; Alexander-Smith, 2004,) as a strategy that increased science literacy and science literacy skills for students in urban communities. Hip-hop spoken-word science poetry incorporated chunks of main ideas retrieved from science investigations, into science poetry of a repetitive, and often, rhyming nature for long term memory retention of learned science concepts. Youth were essentially empowered to quickly retrieve and project learned concepts into discussion, for problem-solving in real-life science and problem-based experiences.

Can science literacy skills be projected and made useful for possible solutions to real-world science issues in urban communities? This investigation suggested that science literacy and science literacy skills can be accentuated through incorporation of a hip-hop performance arts strategy that capitalized on the cultural capital of urban students, and utilized elements of hip-hop culture. It is suggested that this type of performance arts approach systematically and more expediently prepared urban middle school youth to use their cultural capital, and their acquired knowledge and skills, that addressed real-world science issues within their lifestyles, community, and globally, through inquiry science and problem-based science experiences.

Research Question/s

1. How might culturally responsive programs using hip-hop spoken-word science poetry as a cultural art form be used to connect urban middle school students' everyday literacy practices to development of science literacy skills?

2. How does engagement of urban middle school youth in written creation of hip-hop spoken-word science poetry intertwined with science inquiry investigations, build and increase science literacy skills?

3. How does hip-hop science poetry training, intermingled with science inquiry investigations, be established as a culturally responsive teaching tool for teachers of middle school urban youth, to increase science literacy skills?

Delimitations of the Study

Since this study was conducted in middle school settings in large urban school districts, availability of sample populations was broad. As the study was designed to be implemented during school hours, after school, or Saturday, as designated by administrative and teaching staff, there were several opportunities to engage with teachers and students.

This was a year-long study program with urban youth, including professional development for teachers. Through a developed training system, teachers were enabled to test the concept of establishing a foundation for science literacy skills, through the performance arts. Science poetry in a hip-hop performance format was contained as an integrated approach that reached into the world of urban student literacy practices and music away from school, developing science learning as an innate, ongoing process.

Limitations of the Study

It was expected that there might be limited access to urban students, as well as limited numbers of teachers accepting and participating in an unconventional teaching strategy in traditional urban educational institutions. A collaborative component among students is included to address critical thinking skills. However, traditional classrooms may not have accommodated this approach, because teachers may not have been comfortable with a classroom atmosphere that required highly active interaction among students. Therefore, the study was not conducted with as many subjects as intended. However, expectations were that this process of teaching science literacy skills would come to be recognized through teacher professional development and student engagement, as one that reached all learners, giving them a decided edge on increased science academic achievement.

The proposed science strategy was infused into the classroom through a science/performance arts connection, but required a teacher paradigm shift towards teaching and the learning capabilities of students. This methodology required consistent effort toward planning and implementation. It also required monitoring of a sequential process that progressed students toward development of science literacy skills.

Definition of Terms

The following are the operational definitions used in this study.

Science literacy: A foundational science knowledge base for understanding of basic science concepts in the scientific world (Great Source Education Group, 2002; Taylor & Francis, 2010)

Science literacy skills: Science skills that allow for use of a science knowledge base to explore scientific phenomena, and to reflect and interject understanding of science concepts into science problem-solving (Nelson, 1999; Taylor & Francis, 2010).

Culturally Responsive: An approach used in the context of fostering positive images of a group of people and the cultural offerings presented by that society. This approach makes use of cultural knowledge, prior experiences, frames of reference, and performance styles (Gay 2000 & Emdin, 2010).

Hip-Hop: Hip-hop comes from the culture of urban African-American and Latino youth, as an expression of thoughts, words, and behaviors/actions/mannerisms. This free-expression of urban African-American and Latino youth usually often relates to their personal lives and social problems. This expression is often in pre-written rhymes called spoken-word poetry, and demonstrated in strong, rhythmic, oral expression with spoken lyrics, emulating the rhythm/beat of music. It includes such activities as graffiti, break-dancing/"b-boying, "dee-jaying", and rapping/spoken-word, often done in conjunction with a music backdrop (Morrell & Duncan-Andrade, 2002; Baszile, 2009; Low, 2010; Richardson, Smith & Beasley 2012; Forchu, 2012)

Problem-based science learning: This type of science learning involves engagement in science experiential activities closely aligned to real-world experiences, and elicits critical thinking skills that utilize acquired scientific knowledge (Warren, 2005; Marzano, 2007; Taylor & Frances, 2010).

Cultural Capital: The acquired human knowledge serving as contribution to a society by a cultural group (Nieto, 1999; Portes, 1998; Emdin 2010; Warren, 2011).

Culture: Culture is that which is inclusive of the social behavior patterns, arts, beliefs, institutions, and the expression of human work and thoughts of a group of people (Wlodkowski; 1995; Warren & Rosebery, 2010; Emdin, 2010; Wright 2011).

Science Inquiry: Learners engage in a science investigation of scientifically oriented questions, formulate explanations from evidence experienced, connect explanations to scientific knowledge, and communicate and justify explanations (Morrison & McDuffie, 2009)..

.**Significance of the Study**

The achievement gap has widened for African-American urban youth and other marginalized groups (Latinos). The effectiveness of remedial and other compensatory programs has been questioned, because these programs have not significantly improved school performance (Ogbu & Gibson, 1991 & Blanchett, 2009). Literacy disparities and meager school performance have caused the United States to fall drastically behind several industrialized nations in science and math achievement (Sabochik, 2009). These disparities in literacy present historical and societal issues that continued to plague academic achievement levels in schools in urban communities, producing an ever-widening gap of underachievement between African-Americans, Latinos, and the ruling social group (Ogbu & Gibson, 1991).

The challenges of achieving educational parity continued to be perplexing, with persistent achievement gaps, especially apparent in science and math (Emdin, 2011; Ferguson, 2007; Haycock, 2001). Palpable efforts were needed to provide tools that promoted self efficacy for students in urban communities. Investigation of the current achievement validated the need for a holistic approach to be established. Teachers who will become educators of urban African-American youth needed tangible tools that helped them develop necessary and effective change.

Re-describing the achievement gap validated the need for a coherent systemic approach to be established that described necessary change, and provided tangible tools that created, promoted, and supported effectiveness of teachers who would be educators of urban African-American youth. Addressing the achievement gap required addressing cultural identity-forming aspects of the lives of students in urban centers. Addressing the achievement gap insisted that stakeholders embarked on a venture that would develop self-efficacy in urban students. The need to create an atmosphere that offset resistance that changed students' perspectives was crucial. This became a venture that could prove to allay distrust that urban youth have of educational strategies of the dominant group in society. The felt need to perform in school by "acting White" (Fordham & Ogbu, 1986; Emdin & Lee, 2012) in order to be accepted into the mainstream, could be alleviated, for those who perceived that their intellectual capital was being devalued.

The United States lagged far behind foreign countries in (STEM) subjects. According to a recent White House comprehensive study (Sabochik, 2010), American teens ranked 21st in science, and 25th in math compared to foreign industrialized nations. The president deemed it crucial that American students from all walks of life be provided with a foundation in these subject areas that should lay the groundwork for aspiring future student scientists, who will be enabled to compete in a global economy. According to the White House blog, the president indicated that a movement in this direction could stimulate our nation's success and strengthen its role as a world leader in new discoveries and innovations (Sabochik, 2010; Maeda, 2012).

To meet the challenge of preparing students from urban communities, this study was designed to undergird the self-efficacy of urban students and increase science literacy skills. Throughout this study, STEM (Science Technology Engineering Math) disciplines were approached within a hip-hop performance arts/ science investigation environment. A culturally

responsive approach that addressed self-efficacy and identity- building aspects of the urban youth psyche, was considered crucial toward successfully increasing science literacy in groups of students in urban communities, and was inculcated. A culturally responsive environment, using elements and art forms of hip-hop culture, was expected to become the nurturing environment that empowered urban youth to become interested in science and succeed as future career scientists.

Chapter Summary

If the academic needs of a multi-ethnic society are to be addressed and met, dominant institutions and programs required a consistent redress to effect a change on the achievement gap for large numbers of people in urban communities. Without major reform they will not reap necessary benefits--perpetuating an ever widening achievement gap, by design (Lewis et al, 2002; Howard, 2003; Brown-Jeffy & Cooper, 2011). Reformed academic success through use of culturally responsive programs using hip-hop art forms could jumpstart incentive to receive and accept empowerment measures. It was expected that this could be done without raising suspicion from African-American and Latino students who saw acquiescence to the dominant value system as that which historically kept them oppressed. As a result of this suspicion students often relinquished credential-building that allowed access to flourishing careers

CHAPTER 2

LITERATURE REVIEW

Basis for Research

Incorporating Cornerstone Foundations of Human Learning

This study was examined through the lens of cornerstone theorists, in order to build an argument for addressing human learning patterns of evolving diverse student populations. Several of the theorists posited experiential learning, exploration, and attention to prior knowledge that anchor instruction, to allow for better understanding and relevance to the learner. This proposal suggested that existing ways of learning by infusing elements of the hip-hop culture art form could easily be transformed to be used as tools of learning in traditional curriculums, to address learning for diverse student populations.

Cornerstone foundations of human learning were introduced for exploration of past foundations of learning that were established by researchers, psychologists, anthropologists, and the like. These foundations, usually built upon ideas of previous theorists, had been inculcated into school curriculums around the world, and presented a global perspective of educational trends. The noted goal of the investigating researcher was that human learning theory in this proposal had been examined through the lens of cornerstone theorists, to build an argument for addressing human learning patterns of diverse student populations. This proposal suggested that new ways of learning, indeed, addressed old ways of learning posed by past theorists, and could easily be infused into traditional curriculums to address learning for an evolving diverse student population, and at the same time be culturally responsive. Culturally responsive programs could foster “social cohesion” among those of different cultures, as one group learned from and celebrated the culture of another group.

The approach to development of science literacy skills was undergirded by precepts of renowned psychologists, philosophers, and researchers. These explorers of the way people learn, inspired others to explore the merits of approaching learning in a natural way. They were forerunners to recent and continuing studies on how learning takes place in the brain. The proposed intervention outlined was influenced by tenets of learning studied and proposed by past proponents of learning and development, as cornerstones, especially Commenius (1623), Bransford (1984), Gardner (1984) and Gagne (1984).

Commenius (1623) proposed experiential learning in an interdisciplinary approach. Science literacy skills require exploration and investigation experiences. During exploration students would need to record descriptions of their exploration, evoking writing and observation skills. They were part of an interdisciplinary approach that would eventually include math and social science skills. Through the creation of spoken-word hip-hop science poetry, as an art form, student descriptions could be fleshed out to create meaning, deciphering chunks of important information necessary for understanding the flow of an investigation. This meaning development created depth of understanding, as an introduction toward extension into inquiry science learning—a type of experiential learning which fosters science literacy skills.Dewey (1923) and Kolb (1984) inspired the virtue of experiential learning as well. It was expected that science poetry would prepare learners to retain and reflect upon science concepts learned through creation of science poetry, while progressing through science inquiry investigations and science problem-based experiences.

Jerome Bruner's (1966) instructional scaffolding proposed that learner exploration allow for integration of new knowledge into an existing knowledge base (background of student prior literacy experiences), as work was done through problem solving tasks. In the approach to

develop science literacy, learners would need to advance toward problem-based science learning through a series of overlapping steps (scaffolding), starting with exploration of the existing literacy skills and knowledge base in science. Ausubel (1968), Wittrock (1974), and Engestrom (1984) were proponents of establishing relationships between prior knowledge as well, as a means of influencing learning and retention of new, meaningful information. Proposed was a multilayered process, in which people learned from their prior experiences. They also suggested that the cognitive strengths of learners be addressed, in order for the learner to formulate concept connections. This approach presented in the study of development of science literacy skills, sought to develop cognitive strengths by connecting away- from-school communication processes to classroom literacy. By creating hip-hop science poetry presentations, using learned science concepts developed through science inquiry investigations, it was expected that science learners would more effectively retain the science concepts and use them in reflective processes, while exploring, investigating, and creating/performing concept related hip-hop science poetry. This approach proposed to develop long term memory of science concepts, so that youth could quickly retrieve and project learned concepts into discussion, for problem-solving in science inquiry and problem-based experiences.

Gardner (1984) and Gagne (19 84) presented the different ways of learning through the multiple intelligences as a descriptor of the learning mode (Gardner), and through conditions of learning (Gagne). Both postulated that addressing these conditions for the learner facilitated a succession of learning triumphs, as successful learning took place in different ways. Science literacy skills have been addressed through potential ways of learning within a spoken-word hip-hop science poetry format that reinforced science concept development, while students

participated in investigative science experiences. These experiences could then be expanded and extended toward inquiry and problem-based learning.

Goodnough (2001) reinforced Gardner's (1984) learning mode descriptor and postulated that the theory of multiple intelligences offered education a common sense framework with which to make pedagogic decisions that foster active, student-centered learning, and acknowledges each person's unique cognitive profile. It codified many good teaching practices, representing a philosophical stance to science teaching and learning. If students became engaged in the learning of science and developed positive attitudes toward science, there was a greater probability that they will develop high levels of science literacy.

To a lesser degree, this study toward developing science literacy skills was undergirded by the theories of Brandsford (1984) and Granger (Net Theory, 1996). They perceived that establishing a sequence for learning is the most effective approach, attaching bits of learning to prior associations. Both Brandsford and Granger contended that experiential activities anchor learning that could be used in real-world situations and problem solving experiences. Brandsford presented a position on brain and memory functioning in *How People Learn* (The National Research Council, 2000). Brandsford worked with a committee that paired neuroscience studies with successful learning in education. This topic was explored in more depth in a section of this paper regarding the brain, memory, and science connections. In reinforcing learned science concepts through hip-hop spoken-word science poetry, intertwined with inquiry science experiments, it was expected that learners would develop long-term memory retention and reflective skills that would allow them to more readily access skills that aid in projection into new situations during experiential science activities. Projecting these science reflections could elucidate connections to real-world situations. It was expected that urban students would have

opportunity to participate in science experiential activities that would reinforce learned concepts developed further though hip-hop science performance events.

Cornerstone researchers, psychologists, and philosophers of human learning reflected positions that considered epistemologies that have formed the traditional perspectives on human learning, and were vital as part of new research on ways of understanding the circumstances under which the brain decoded and retained that learning. However, as with cornerstone researchers, new information was added to, or infused into, existing foundation of theories.

Historic Considerations

The historical context that supported public schools sanctioning inequity through race, promulgated the environment of inequity that originated in the past, yet thrives presently. Schools that were segregated in the past continue to produce "segregated" results that restricted the educational development of those receiving educational services, separate from and in a vacuum, from those who had been endowed with more privileges. An achievement gap between the dominant culture and African-Americans continued to prevail in school systems. While resources such as school, community, pedagogical content, and family knowledge could provide a means necessary to effect change in the system, resources alone usually couldn't effect significant change. Those resources and opportunities directly within the system that counter unequal educational development had to be employed, and the agents of change had to be critically reflective, so that they became aware of the need for change, and were willing to speak confidently about the problem and the solution. Change agents, confident in their ability to make a difference, minimized a continued skewed shaping of history, which obscured the past.

A decade of federal legislation under the No Child Left Behind bill (No Child Left Behind Act, 2001), failed to eliminate the inequities it sought to remedy in local public schools. What started out as a noble effort to remedy inequities of the past, became drowned in superfluous posturing, with few resources to support it. What was designed to repair the discrepancies in learning for the poor and disadvantaged, and bring school systems to a level of meeting national educational standards, was menial at best.

Resistance to change could be manifested in choosing not to act, as experienced in this study. All school districts did not buy in. It could also be manifested in not having sound and reflective direction within classrooms and the districts. If the needs of a multi-ethnic society were to be addressed and met, dominant structures and programs required a force moving at progressive speed, to effect a change on the achievement gap. Large numbers of people in urban centers could be caught up in an institutionalized, ever-widening achievement gap. Until extemporaneous change agents made decisions through critical reflection to apply effort over a long enough period of time to support a paradigm shift in educational practices, the system as is, remains as it is (Lewis et al, 2002, King, 1991; Howard, 2003; Brown-Jeffy & Cooper, 2011). Effort that caused significant movement, and empowered change at a rate that kept the momentum going in critically reflective positive directions, could overcome the frictional forces of past inequalities and disparities. Those trying to change the massive structure of the institutions would face overwhelming and continuing obstacles if the empowered dominant group benefitted in an environment in which those who are relegated to deficient or appropriate resources do not benefit.

Educational Trends

Dewey (1923) saw schools as microcosms of society in which celebration of cultural heritage differences promoted opportunities for groups to give and receive knowledge from other groups. Dewey also realized that exchanges in cultural heritage promoted societal bonding that encouraged harmony among people. Social cohesion was minimized when students experienced negative portrayals of themselves in the media and the educational environment. They would more likely experience that which would devalue them, or not trust that schools would do anything to offset the negative portrayals. Constant negative exposure continued this invalidation, and students were more likely not to achieve as well at academic tasks. Gay (2001) noted that in negative learning environments, students' motivation for learning was negatively affected, and engagement in the learning process was diminished.

Public education in the United States of America was designed to create workers for an industrialized society, and to socialize students into social, political, and economic ideologies that transmitted the ideology of the dominant culture (Wlodkowski & Ginsberg, 1995). This perspective, in part, promulgated the achievement gap. Wlodkowski and Ginsberg (1995) contended that this perspective only gave students facts, skills, and knowledge, considered necessary for economic and social success in the United States. They posited that this type of education robbed children of their heritage and identity, as well as motivation for people of color—while labeling them as "culturally deprived." Banks (1993), Nieto (1994), and Delpit (1992) observed that this education model required students to" leave their culture at the school door". According to Wlodkowski and Ginsberg (1995), this view also painted a picture that labeled students as dysfunctional, dependent, and incapable of self motivation—needing help from those who are in a position of power. This positioning gave rise to what has been coined as

a "deficit model" (Bernard, 1996), perpetuating differences as personal deficiencies, with an inability to assimilate oneself appropriately into the prescribed cultural value system (Thompson, 2000).

Literacy Needs of Youth in Urban Centers

Recent research examined the use of culturally relevant/responsive instruction that engaged urban students, and sparked marked interest in academic achievement. Hip-hop spoken-word poetry (Petchauer, 2009,2011; Davis, 2000; Alexander-Smith, 2004,) was offered as a strategy for increasing science literacy and science literacy skills for students in urban communities, because concepts could be taught using the least amount of words. Hip-hop spoken-word science poetry incorporated main ideas retrieved in small chunks into science poetry of a repetitive, and often, rhyming nature for long term memory retention of learned science concepts. Hip-hop science poetry, intertwined with science inquiry experiments, was examined as a means of connecting to the worlds of students and validating away-from-school communication skills brought with them to the classroom, and for increasing science achievement. Thus student voices could be privileged to be affirmed, rather than muted (Bruce and Davis (2002); Brown (2011); Baszile (2009)); Low (2010); Irby & Hall (2011); Dyson (2003); Banks, 2010, Perry & Delpit, 1998), Skerrett & Bomer, 2011, Paul, 2000. Morrell and Duncan-Andrade (2002) discussed Freire as a proponent of a consciousness regarding urban youth who are trying to gain a voice and become efficiently literate in an environment of ideologies perceived as oppressive to them—propelling those youth toward mistrust, alienation, apathy, and misogyny (disrespectful communication regarding African-American females). This clearly reinforced the need for creating a culturally responsive environment for urban youth that was validating and affirming.

The NAEP (National Assessment of Educational Progress) Report

The Nations Report Card, from the National Center for Educational Statistics, of the U.S. Department of Education, Institute of Education Sciences, publishes a National Assessment of Educational Progress (NAEP) reported updated progress for science achievement. The 2009 report disaggregated scores by gender, race/ethnicity, and eligibility for school lunch programs. Eligibility for school lunch programs had been noted as a chief indicator of African-American and Hispanic children, and an indicator of low family income. Science content was divided into physical science, life science, and Earth and space science. The tests consisted of multiple choice and written response questions.

Since studies were conducted in large Midwest districts, scores for tested grades, grades 4 and 8 were analyzed. The information discovered was based on averaged science scores of Whites, Blacks, and Hispanics. The lower percent of fourth grade science scores in the Midwest districts of public schools investigated showed 21 % in the below basic range, compared with a score of 29%, nationally. Thirty-nine percent scored in the basic range at the national average. Thirty-nine percent scored within the proficient range, compared to a score of 32% nationally. Only 1% scored at an advanced level for the Midwest and nationally.

Science score and achievement gaps for Black students, on average, was 37 points lower than the averaged science scores of Whites, and 32 points lower, nationally. Science score and achievement gaps for Hispanic students, on average, was 23 points lower than the averaged science scores of White students, and 32 points lower, nationally.

These averaged scores clearly showed that there was an achievement gap in science scores between the majority of Blacks and Hispanic/Latinos students in urban centers, and

Whites. At the eighth grade level, there were similar science achievement gaps. Missouri Black student science scores averaged 32 points lower than Whites, and 36 points lower nationally. Hispanic students averaged 11 points lower than Whites and 30 points lower nationally.

This report indicated that there was an evident gap in science test score averages among Black, White and Latino learners, requiring serious attention to what compensatory measures had been employed for these students, and how they had been implemented. Clearly, past remedial and compensatory methods had not decreased that achievement gap. At the eighth grade level this trend was especially alarming in science, because these students had participated in a deficient model from elementary school through middle school that would not encourage them to take classes in science in high school, necessary for career exploration in science.

The National Assessment of Educational Progress (NAEP) also indicated achievement gaps in STEM fields between boys and girls, with boys scoring higher in science fields than girls, as reported by Robelen (2012). Even more alarming however, beyond the achievement gaps, was that only 1% of all ethnic groups in the United States, score in the advanced level in science, at the fourth and eighth grade levels, which strengthened the President's concern about how students have been educated in science in the United States.

Most recent reports from the National Assessment of Educational Progress (NAEP) highlighted that elementary, middle and high schools had not demonstrated understanding of science in depth. The report indicated that in interactive computer tasks administered in 2011, measuring how students could conduct and reason through real life science situations, findings were consistent across grade levels (Fleming, 2012). Students were challenged in grasping the necessary science concepts occurring in the investigations. Twelfth grade students scored 15%

lower than younger students. This posited a question as to what happens to depth in understanding of science concepts, between lower and upper grades. This also questioned the nature of science tests at the elementary school levels, and what was done in lower grades to develop a seemingly in-depth understanding of science concepts allowing students to relate concepts properly to science investigations, showcasing real-life situations. Also, it could be questioned as to whether concepts related to science investigations are tested, as well as relationships to real-life situations, at elementary grade levels.

Again, African-American and Hispanic students scored lower than White and Asian students. Students were challenged in manipulating more than one variable, in order to make decisions about running an experiment. Students were able to draw right conclusions in experiments at the eighth grade level, but were unable to provide explanations or justification for the answers chosen based on their findings, indicating a shallow understanding of concepts related to the running experiment. Obviously, students needed a long-term memory retention connection in which to recall science concepts in more depth, while they were participating in inquiry and problem-based learning in science. Are educational trends progressing toward strategies that diminish shortsightedness of the past, building on insight from cornerstone researchers? Some answers could be found in exploring and re-visiting the insight from their discoveries. What role might investigation of self, play in development of the possessed intellectual and social capital of youth throughout cultures?

The Education of African-American Students

Factors That Affect School Performance and Achievement for African-Americans

Early in the 1970's government agencies funded urban medical institutes to explain why African Americans children in their studies, seemed to be violent and aggressive. Perceiving a widespread social abnormality to be the case among the youth, ruminations regarding genetic defects and brain disease surfaced (Breggin & Breggin, 1998). In Mississippi psychosurgical operations were performed on the brains of African-American children who were considered to be hyperactive and aggressive (Breggin & Breggin, 1998). The ideology that genetic deficits and brain disease plagued African-Americans started to sweep the country, and in 1992, the highest-ranking psychiatrist, Dr. Frederick Goodwin, developed a "violence prevention initiative" to ferret out those African-American children who might possibly have a predisposition to growing up to be violent. Dr. Goodwin, then head of the NIMH (National Institute of Mental Health) advocated psychiatric brain surgery for 100,000 inner city children. Although the "violence prevention initiative" programs were abandoned due to critic denouncement, the politics of the "deficit model" surfaced and still persists. The pervading thought surfacing was that a deficit persists within a child who acts out, appears angry much of the time, and is unable to put the sentiment into words. Consideration of a forced lifestyle and living environment of violence and aggression was not explored (Zeichner, 1995 & Tough, 2012). This environment precipitated a traumatic and stressful state much of the time, such that children and their parents were forced to live a "fright or flight", non-nurturing existence, in order to survive in the environment. They couldn't seem to find a way to transform the plight in their lives, so they continued to react to and transmit evidence of this existence. This existence followed them to their school environments, forcing a lack of focus on cognitive skills (Tough, 2012; Borrero, Yeh, Cruz, &

Suda, 2012), which posited cause for re-dress of societal impact on youth development, because the youth found themselves questioning their identity and placement in society.

The school environment is a powerful context in which socializing agents can reinforce institutional ideology. It will shape students' expectations about finding their place in a stratified society, as their parents find their place, as well (Grant & Sleeter, 1988). American academic and cultural worlds have often been at odds with youth of color (Xiu, 2006), and has caused them to feel disconnected, and to feel that they must give up their ethnic identity to have a place in an academic environment (Nasir & Saxe, 2003; Olsen, 1997), even though they have brought a rich cultural agency to society. They experience an "other" effect, which is a concept (Kumashiro, 2000) made reference to groups which had been traditionally marginalized in society—those who were considered to be other than the norm, such as "students of color, and students from under-or unemployed families". "Othering" was further defined by Kumashiro (2000) as a "personal, social, cultural, and historical experience involving (a) cultural and racial ambiguity, (b) categorization and labeling, (c) hierarchical power dynamics, and (d) limited access to resources." The importance of one group had been diminished in comparison to another group, which had garnered more social capital and resources, than the marginalized group. Thus "othering" evolved as a "socially constructed practice" that silenced voices of the other groups' customs, which in turn caused them to create protecting actions that would distance the advantaged from the marginalized. Students would find themselves in longstanding stereotypes that epitheted them as being poor, primitive, uneducated, lazy, unmotivated, and unresponsive to interventions and programs (Kana'iaupuni, 2005). These stereotypes could have reinforced a persistent belief that minority students are low achievers and uneducable (Howard, 2003). This promoted incessant culturally alienating structures in schools at the expense of the perpetuation

of white middle class norms (Zentella, 1997; Ogbu & Sleeter, 1988). Schools could unwittingly reinforce and socially reproduce these relational structures. Since the ruling society seldom saw these students living within their environment, the need to explore a means of knowing more about their societal structure seldom arose. The societal structures could serve as a causal effect of learning difficulties could be dismissed, and not be addressed (Wlodkowski & Ginsberg, 1995; Delpit, 1992). In the meantime, prevailing views tended to see a need to bring under control, those behaviors that appeared to be far from the norm of ruling culture-prescribed behavior, absolving school systems who educated these alienated students, of responsibility for adequately educating them appropriately (Bernard, 1996).

The existing curriculum relegated hip-hop to other than the norm. Students, then, became resigned to choose from the traditional nature of school science curriculums, rather than the culture of hip-hop. The connections that urban students found between each other and hip-hop, effectively resulted in effective bonds that brought them together into a collective group as "other" than the experiences in the science classroom. They then, could become hostile within the traditional science classroom environment. Thus students could cause disruption in the classroom, or become apathetic to classroom instruction. Those who were marginalized in society tended to form a bond to each other, and developed within a distinct culture that positioned itself around a stance as the "other' and the features of hip-hop culture, in which participants regularly engaged (Emdin, 2010).

The achievement disparity in science resonated especially throughout urban communities, across the United States. Some researchers had identified poverty, family dysfunction, transience, and lack of emphasis on academic achievement, as possible causes (McGinnis & Stefanich, 2007). Middle school urban students performed at deficient levels in science literacy.

Research revealed that students in high poverty areas had limited access to high level math and science classes (Oakes, 2000), and socio-cultural positioning had created an environment that supported absence of science for those who are in low- track urban schools (Barton & Tobin, 2001). This type of environment advanced science achievement disparities between urban schools and dominant ethnic groups in non-urban schools (Norman, Ault Jr., Bentz, & Meskimen, 2001). Large numbers of students had been excused from the science arena, and achievement in science classes was minimal. Low achievement levels in science on high stakes tests, particularly in urban communities with large populations African-American and Latino students, prevented learners who had intellectual capabilities, from considering becoming career scientists. Lack of exposure to effective science instruction in urban centers affected student motivation.

The factors that affected school performance and achievement shaped self-efficacy (Florence, 2010) of students. Self-efficacy is defined in this sense as the individual's confidence in the ability to complete academically oriented tasks. It is the critical factor in academic performance and school success for African-American youth (Johnson-Reid et al, 2005). As observed in the research of Wakefield and Hudley (2001), attention to racial and ethnic identity processes increased academic performance and motivation, and an individual's confidence in inherent ability. The need to belong and a sense of belonging in a dominant society is an overwhelming desire of human nature. As adolescent mental health was addressed, levels of delinquency, violence, and drug abuse decreased.

Underdeveloped self-efficacy of students will decrease residual effectiveness of academic programs, often affecting academic skills, aspirations, and social integration. The reality students live shape their identity and perception of their place in society. In addition, what they live will

have an impact on individual cultural advantages. These are the factors that will affect school performance and achievement, and shape self-efficacy (Florence, 2010). The trend of future social development in the society of groups in urban communities, and their productive impact within the dominant society, are implicated. What is the prognosis for students in urban communities? Will they become productive citizens making positive contributions, or become a burden to society (Strayhorn, 2011& Florence, 2010)? The decision made by society in that regard, will paint a picture of evolving future social development for these youth, and the future educational success trends of the nation.

School performance and achievement is interpreted through the lens of African-American students and their parents in the context of "cultural identity", as to who they feel they are in a larger society, and their relationship to Whites who control schools. In addition concerns arose regarding their upward mobility status (Gibson and Ogbu, 1991). Their school and academic performance was based on factors which they felt they had very little power to control. The decisions that were made with very little input from them, would affect career decisions, planning, and self-efficacy (Perry, Liu, & Pabian, 2011). Those who decided what is important for learning continue to be influenced by their own limited background and experiences, reflecting on factors that affect opportunities for upward mobility of diverse people, possibly leaving out the viewpoints of many who could be deprived of that which should be part of their world (Delpit, 1992 & Nieto, 2004). There is compelling evidence that these marginalized groups don't realize a direct correlation between acquisition of academic skills and upper mobility in society, as expressed by Ogbu and Gibson (1991) and Perry. Liu, & Pabian (2011).

The *Critical Race Theory* (CRT) reminds society that racism is "so enmeshed in the fabric of our social order, it appears normal and natural to people in this culture" (Ladson-

Billings, 2009). Those who benefitted from the current social order in American institutions such as schools, government, and economics, tended not to challenge the status quo. "Dysconscious racism", or lack of awareness or unwillingness to acknowledge societal inequalities has crept in, placing teachers in a role of relinquished empowerment. They are paralyzed, often unable to bring equitable outcomes for students from all walks of life (King, 1991; Delpit, 1998; Lewis et al, 2002,; Howard, 2003; Brown-Jeffy & Cooper, 2011; Borrero, Yeh, Cruz, & Suda, 2012). Teachers have been influenced by lack of knowledge about diversity within their student populations, and further, those cultural differences could contribute to deficits in learning progress.

Wright (2011) and Emdin (2011) contended that research into areas of the *Critical Race Theory* offer an expanded view of science learning among African American students, an expanded view that highlights and validates everyday practices of African-American students. They challenged teachers and educators to develop pedagogy and curriculum strategies in ways that do not trivialize the connections between everyday knowledge and school-based knowledge. This expanded perception required not only development of a deep understanding of the subject matter, but a capacity to overcome deficit assumptions regarding the nature of everyday literacy practices of the students, themselves. When these "co-constructed environments" are established, they value and build in ways that have the potential to act as a catalyst, which nurtures social and academic identities, spurring future learning and engagement in STEM (Science, Technology, Engineering, Mathematics)--the STEM initiatives, particularly promoted by President Obama to spur innovative competition with other industrialized nations. These types of initiatives could bring about possible proliferation of increasing numbers of African American students

graduating from high school with strong foundations in science and mathematics, to confidently seek and pursue post secondary education and careers in STEM.

How responsively could we address this dilemma, and create schools that engage students toward successful science educational experiences? In addressing science for students from all walks of life, a paradigm shift away from the present public education ideology could be addressed, as future science career involvement is explored. Zeichner (1995) & Tough (2012) reinforced the premise that adults from school, home, and community play a reflectively significant role in influencing student learning. When this information and power are reflectively and sensitively shared and compared, youth are more likely to be motivated by the system, become engaged in the learning process, and perform better within this learning environment, especially urban youth performing in culturally responsive environments. Even though the student population is becoming more diverse, the teacher population remains primarily White, middle-class, and female (National Center for Education Statistics, 2007). This could suggest that traditional university-trained instructional approaches, alone, are not enough to motivate and engage students in taking a role in the learning process. Conglomerates of adult influences, parents and community resources, and an examination of the success of these dynamics could play a vital role (Delpit 1992 &1998).

The everyday funds of knowledge helping youth to make meaning of their positioning in society and among themselves, those which students bring with them historically to school from non-dominant communities, could be often missed, or dismissed, as having no real intellectual value in the classroom. Since African-American youth routinely navigated every day life outside of school, and how their roles related to their learning and achievement, critical professional development for teachers is needed to help them understand that even unfamiliar and off-topic,

responses from students, could often be those that continually help them make better sense of their worlds (Delpit, 1998; Nasir, Roseberry, Warren & Lee, 2006; Wright, 2011).

Norman, Ault Jr., Bentz, & Meskimen (2001) posed for inspection a model representing deficiency, in which poor students were tracked into low-level classes devoid of science classes, precipitating a persistent achievement gap in science. They explored how addressing socio-cultural factors in urban classrooms could give insight into understanding the achievement gap for African-American students in urban science classrooms. This ideology also addressed Ogbu's (1991) questions regarding the ever widening achievement gap, and this researcher's personal views. Norman, Ault Jr., Bentz, and Meskimen (2001) contended that addressing how students responded to societal disparities could contribute to effective research-based classroom practices, reducing and eventually eliminating the achievement gap. They also examined the "demographic divide" of urban vs. suburban school districts, and the resources available to urban vs. suburban schools. Emdin (2011) supported the reality proffered by Norman, Ault Jr., Bentz and Meskimen (2001), who maintained that student consciousness was raised concerning socio-political factors affecting their learning, when teachers moved beyond being simply traditional disseminators of information. This empowered their teaching style within and beyond the classroom, because youth away-from-school literacy was included in the teaching pedagogy. The traditional teaching style would need to take into account how urban youth make sense of their world (Emdin, 2010 & Delpit 1992), otherwise it could inhibit ways of knowing for Black urban youth.

Norman, Ault Jr., Bentz, and Meskimen (2001) offered an approach that minimizes blaming society for the problem, or blaming the victim and their family for the problem. Students who had historically been relegated to a tracking system in schools, and in like manner had been subconsciously relegated to positions in society, could inadvertently perpetuate an

achievement divide. If remedial and compensatory programs were not decreasing or eliminating the achievement gap in science, then the goal had to that they be replaced with programs that addressed the disparity, with more significant results. The change should be reflective and progressively influenced by evidenced issues projected, to empower, rather than relinquish influence.

Emdin (2011) suggested "reality pedagogy' as a means of addressing the challenges teachers face in educating urban students in science. This could move them beyond hyper-focus on academic deficiencies of urban youth. He posited that teacher effectiveness should not just be based on credentials, or even mastery of content knowledge in science. "Reality pedagogy" could build urban youth to support them with culturally relevant pedagogy, and address the necessary critical issues of teacher and student engagement and experiences in learning. Culturally relevant pedagogy, interchangeably defined as culturally responsive pedagogy acknowledges cultural differences, validates them, and uses them as the focus of student encouragement and increased achievement. "Reality pedagogy" could assist diverse populations by teaching them how to embrace a belief in human responsibility for each other, and the value of individual differences, to transform the roles students can play in social settings (Appiah, 2006).

While it appears that White dominance may go unrecognized most of the time, the beliefs and attitudes of White children do not go unaffected (Derman-Sparks & Ramsay, 2006). Creating an atmosphere of social justice within a diverse classroom of acceptance and respect, could aid White students in reflectively assessing if the role of being White could perpetuate racism, inequality, and entitlement to advantages. Earnest understanding within this positioning could better propel them toward understanding and reflecting upon why directions should be

taken toward activating changing societal attitudes and beliefs. As classroom populations become increasingly more diverse, with the majority of White females becoming teachers of these students, teachers are challenged to re-construct the learning environment to accommodate a growing diverse population. The learning environment will remain as it is, unless significant movement empowers change in critically reflective positive directions. This movement could empower White students to realize whether the role of being White could perpetuate a sense of entitlement, possibly affecting gains in addressing past inequalities and disparities. The past, or present, will not change unless high expectations bring about a significant enough unbalancing force to engender a significant change in direction, overcoming the pervasive inequalities in achievement, today.

African-American Youth Responses to Educational Trends in Urban Schools

Devaluation of youth in urban centers by the dominant population has been transformed into a stigma which has attached itself to the school environment. Unsuccessful attempts of urban youth to gain visibility in education and related fields, and the eventual choice made toward consistent efforts to be accepted in school have been translated into engagement in hip-hop, often perceived as a an anti-school identity. Urban youth have been strongly influenced by, and would embrace elements of the hip-hop culture, despite the cultural capital they possess to connect to science. Elements of the hip-hop culture would then, become a liability and their potential for learning would not be recognized. In reality, this would be an attempt toward making strides toward the identity valued by the participants to be congruent to those valued by the dominant culture. This identity valued by participants in hip-hop could become an actualized part of their intellectual storehouse. The lack of recognition has resulted in low academic achievement in school, and diminished presence of urban youth in careers in science. A barrier

that is almost impenetrable could be created, positioned around who the youth are and who they could become in society. They would be painted into a corner in which embracing hip-hop culture could be mistaken for an unwarranted inability to do well in school, resulting in disconnect from school. If we have inadvertently supported and accepted status quo traditional educational systems, approaches to pedagogy, and teacher preparedness, we have forced upon these students, a negative mindset against school that would suppress interest. The school and society environments in which students navigated would play a role that could foster or disfigure interest in achievement in school (Emdin, 2011).

A subculture of youth perceived to be abandoned by the larger society has surfaced. A behavior, sometimes defined as deviant, has presented itself in response to people who either enact oppression, or those who feel forced to respond to what is perceived as oppressive practices. Teachers who may have unwittingly enacted classroom practices that are perceived as oppressive to African-Americans could foster a subculture among students that stands in opposition to the traditional classroom, and could cause the students not see themselves as being represented within that social space, or as being seen as invisible in the traditional classroom. The expectation that African-American male students would be docile and engage in practices proffered within the traditional classroom, could induce a student who repudiated and did not engage in these practices to appear to be an outsider (Emdin, 2011). Emdin's perspective drew from Becker (1963), in regards to the relationship of cultures to subculture, with subculture being represented by those who are not considered to be of the dominant society. The position focused on the culture of youth that are perceived as deviant, and how their cultural understandings could be considered as subculture responses to the rules and regulations of a larger culture, based on who they felt they were. Youthful rebelliousness, appearing to be grounded in deviance, had

strong connections to feelings of urban youth. The rebellious nature could sustain some educators' justification for heightened focus on behavior management and discipline, in lieu of a focus which would address self-efficacy issues. The rebellious context is impressed in gifted African-American males, and could pose contradictions and ironies in the environment in which they have been impacted. Visceral concern from parents and educators arose out of the role of hip-hop and its influence in shaping the identity of gifted males in popular youth culture (Callahan & Grantham, 2012). Of special concern, was the possibility that gifted African-American males might reject participating in traditional gifted programs, or there would be a down-play in the significance of high academic achievement. In this scenario, Callahan and Grantham posited ideology that educational structures should be built to bridge the gap between teacher and student in order to overcome teacher misgivings about hip-hop culture.

Denial of inequalities in society tended to cause groups in urban centers to act out and develop animosities against dominant social groups, while seeking a positive collective culture within their group. In doing so, marginalized groups had resisted the values of the structures that threatened injustice, often surrendering skills necessary for school and workplace environments (Florence, 2010). These groups often became suspicious about acquisition of academic skills and learning, as proposed from the ruling social group. They tended to perceive this as a form of acquiescence to the dominant value system that historically kept them oppressed, thereby they resisted the notion of ruling social group education, because they felt invisible in a system in which they may be forced to "act White" in order to be appropriately educated, which often caused them to relinquish credential-building that would allow access to flourishing careers.

Oppression was considered to be any act that excerpted or limited a person from a possible position of power and acceptance. This form of oppression could alienate youth from academic

success in school. Therefore, seemingly negative and aggressive behaviors in school may be engendered by reactions to felt oppression in that environment, causing youth to form strong ties with fellow participants, as a collective survival group in this culture shared with one another (Emdin, 2011). There was compelling evidence that these marginalized groups did not have a realization of the direct correlation between acquisition of academic skills and upper mobility in society, as expressed by Ogbu and Gibson (1991). This researcher contended that if away-from-school literacy was blended, or infused into traditional classroom instruction, students would begin to see value in their cultural offerings, and would relish using them as advantages toward acquiring necessary academic skills. Otherwise, reactions to felt oppression in that environment could precipitate a climate of failed schools in urban centers.

The Failure of Urban Schools

Are there beneficiaries of failed urban schools? Blanchett proposed institutionalized system structures, policies, and practices created and perpetuated a climate for failing urban school systems, and a covert collusion that undermined educational progress and the upward economic mobility of marginalized students and their parents. In the publication *"A Retrospective Examination of Urban Education",* Haberman (2003b) identified those beneficiaries of failed urban schools as central office employees, students outside of the district competing for college entry, work and careers, consultants, federal, state, and elected officials, the media, and universities.

Haberman (2003b) professed that central office employees seemingly protected the current distribution of funds within financial coffers. They secured power status and privileges they had

not actually earned for themselves. This status could often be secured, as well, for others in the realm of their influence.

Majority ethnic group students outside the urban school districts benefitted by being compared to urban students, who suffer from less resourceful and under-educating practices. Urban youth hope was diminished in hoping to compete for jobs and careers that better educated majority groups, who would be seeking those same jobs and careers, in time. Although education funds may be poured into a state to better educate all, funds might be found unequally distributed between urban and suburban school districts (Haberman 2003b).

Consultants, promising to create a climate of solutions, would make lucrative deals with urban districts, often leaving the district with the monies received, and the problems unsolved. The consultants promised that their products would engender a learning atmosphere that would open students' minds to new ways of learning, with guaranteed success. However, contacting consultants was found to be difficult, if questions arose as to the most effective ways of implementing materials left behind.

Political candidates, knowing that parents were concerned about the best education for their children, often ran on platforms that highlighted their compassion for parents as they campaigned. They made promises that were often hollow, sometimes unavailable to constituents who had questions about their policies on education.

The media used urban schools as scapegoats, perpetuating, and often, reinforcing preconceived notions about school districts, spreading negative press. Often this press revolved around failing scores of district students. State websites published district demographic profiles revolving around discipline incidents related to number of acts of violence, in-school

suspensions, expulsions, and weapons found among students. Sensationalized in the news on radio and television commentaries, this perspective often reinforced negative perceptions about the district.

Profoundly, even universities that were given large amounts of grant monies to conduct research in urban districts also failed these districts, purported Haberman (2003b). First, teacher and administrator certification could be questioned in regard to accountability for the future products that graduate from the schools. Universities developing partnerships with schools in urban centers to close the achievement gap, continued to operate as usual, leaving the schools with the same issues intact, even after the conclusion of the partnership. If universities within the community of the urban schools could develop an initiative that would adopt those schools as community ongoing projects, even after the grant money was gone, pre-service university teachers might be used as proponents of researched successful educating practices. This effort might have reinforced commitment to achieving parity that would begin to erase the achievement gap, and create an environment supportive to high academic achievement in the districts served—investing in the community.

This researcher's proposal espoused to infuse new research on human learning into an existing established base. This researcher proposed to infuse the cultural way of knowing into existing traditional perspectives, as a means of tapping into away-from-school literacy practices of youth, proven to be more culturally validating and affirming. This exploration was employed in order to develop optimal learning experiences that teach to the strengths of students.

Science Literacy in Urban Schools

The goal of **s**cience literacy is to help learners understand key concepts, theories, and principles of the natural world (Great Source Education Group, 2002), to include habits that assist a population in acquiring an understanding of the nature of basic scientific experiences. This scientific knowledge and scientific ways of thinking should be recognized by individuals in their daily lives (Taylor & Francis, 2010). Science literacy in the 21st century was broadened to emphasize understanding of the interdependence of science, math, and technology and its strengths and limitations (Nelson, 1999). Science instruction in the classroom must take into account that learners need time to explore, observe, and test ideas, often to repeat the same investigations in order to assess possible deviations in the process and the outcomes. The textbook method of instruction can be a hindrance toward science literacy progress. The textbook method can offer more quantity of information, but less depth on information and experiences. Science learners need to be empowered to apply concepts and skills to real life situations, so depth of information would be important (Taylor & Francis, 2010).

Students who are encouraged to work as teams to share and discover science ideas will extend intellectual capabilities and potential in science, especially in underrepresented groups (Nelson, 1999; Taylor & Francis, 2010). The researcher proposed to direct study that included underrepresented groups, as a basic priority toward pursuit of science literacy. This opened up an environment of exchange for introducing science literacy skills through investigative inquiry. Investigative inquiry utilized higher order thinking skills during the experience that processed science learners through necessary scientific thinking skills. Through these means, science learners can be facilitated through a process which allowed them to reassess and re-evaluate

science concepts in order to acquire depth in science literacy, while collaborating with student team members.

Exploring New Strategies/Trends for Erasing the Achievement Gap in Science

Culturally responsive and relevant strategies emerged as successful means of teaching science to students in urban centers (Montgomery, 2001; Morrell, 2002; Wakefield & Hudley, 2005; Moses –Snipes & Snipes, 2005; Johnson-Reid et al, 2005; Delpit, 2006; Petchauer, 2009,2011; Alexander- Smith, 2004; Davis 2000, Irby & Hall, 2011). Cultural relevant pedagogy proposed critical reflection in meeting the needs of African-American and Hispanic students. Geneva Gay's description of culturally relevant pedagogy included those elements that use the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students. Gay considered these elements to be those that make learning more relevant and effective for students, while teaching through their strengths. These elements tended to be "culturally validating and affirming" (Gay, 2000). In order to teach urban youth, it was critical to navigate beyond the traditional modes observed in science instruction currently, towards instruction in which stakeholders would be willing to employ themes from elements of hip-hop culture. This goal may be established by focusing explicitly on advantages of hip-hop culture that are conducive to, and empower traditional science educators in the classroom (Emdin, 2012).

Being enabled to transfer away-from-school competencies, aided in affirming and validating cultural experiences, and honored cultural diversity that could help youth thrive in learning experiences (Florence, 2010; Baszile, 2009; Brown, 2010, Low, 2010; Dyson, 2003). Students might be affirmed in their personal cultural experiences and may discover that their own

competencies and the prior knowledge from those experiences, could serve as a viable learning resource for them. These students have negotiated a sophisticated form of language through rhyming games, rap songs, and imaginative drama improvisations of familiar stories and themes, as very young children (Delpit, 1998; Dyson, 2003; Baszile, 2009; Florence, 2010; Brown, 2010; Low, 2010; Perry, Liu, &, Pabian, 2010). These experiences provided fertile ground for use of science hip-hop poetry as a tool for advancing science literacy, and for enhancement of science literacy skills. Students are affirmed in their personal cultural experiences and discover that their own competencies and the prior knowledge from those experiences, can serve as learning empowerment for them (Florence, 2010; Baszile, 2009; Brown, 2010, Low, 2010, Emdin 2012; Cross, 2013). This can be addressed by refocusing on elements of hip-hop culture and its value to, and for education. It could be a fundamental piece of a larger framework that explicates what makes hip-hop youth who they are, and how this information can become a tool for increasing their academic potential supporting their academic success.

As a result of researched tenets of learning theories and advances in cognitive science, to increase achievement in science and other literacy skills, this researcher proposed that science hip-hop poetry, a culturally responsive approach to learning, be used as an initial strategy for establishing a foundation which could address urban student achievement in science literacy and science literacy skills. This strategy, when intertwined with science inquiry investigations, promised to be a culturally responsive potent tool for inviting, preparing, and including students from all walks of life into the science arena.

Everyday practices of African-American youth will challenge teachers and teacher educators not to trivialize the connections between everyday knowledge and classroom instruction. This would require the educator to develop a deep understanding of the subject matter and the

capacity to overcome what was coined by Bernard (1996) as the "deficit model". These deficit assumptions about the nature of the everyday practices and the students themselves (Delpit, 1992 & Wright, 2011), could critically affect the broader impact of STEM (Science, Technology, Engineering, Math) learning. President Obama envisioned the STEM initiative as an avenue towards involving youth from all walks of life, and a means of preparing them to compete innovatively in a growing global economic market.

Gay (2000) uncovered results in programs positioning activity-based instruction in science and mathematics, such as science and math clubs, math competitions, school banking programs, science fairs, career awareness education, self-esteem building, professional development for teachers, and increased instruction in after school programs in science and math. These programs showed significant increase in African-American student success in STEM. These programs structured opportunities of learning for urban youth that deeply engaged them in science and math. The programs purposefully valued and built on the existing banks of practice of African-American students, nurturing their social and academic identities, and potentially spurring future learning and engagement in STEM.

Emdin (2011) purported that the social capital, born from Portes' (1998) concept, can be viewed as the accumulated benefits of social relationships, occurring when individuals have engaged with one another. This concept fitted comfortably into the study of African-American youth in urban settings, because of the complex nature of Black culture, its schema, and practices. Youth perceived de-valued contribution to a broader society, the urban culture adopted by many African-American students, surfaced in school settings (Emdin, 2011). Therefore a unique mechanism was formed by urban students, which allowed them to communicate and identify with one another as a "collectively marginalized" population, which could flourish

outside of mainstream society. Hip-hop then, became the headline under which the striations of social life that were typically classified as lifestyle manifested itself as a significant part of this population's identity. Hip-hop spoken-word science poetry arose as an innocuous tool that could offset the negative sub-culture perceptions of the hip-hop rap culture (Cross, 2013). This tool could allow youth to be pushed to creative boundaries, often limited by emerging "oppressive representations" of hip-hop and rap. Hip-hop spoken-word poetry and music of the culture promised to be the tool that could motivate youth to make connections between science and experiences that they were familiarized with daily, suggested Elmesky (2009). Music, a universal art form, although diverse, can capture the human spirit and act as a catalyst that could bond cultures. Hip-hop culture embraced music in its rap music, and was embodied in the Black urban experience. In its presentation, rap music validated the struggles in the Black urban experience, and other globally disenfranchised groups, often ignored by other parts of society. Elements of the hip-hop culture became the means through which those who have not been considered to be the "best and brightest" communicated their intelligence, and exercised their value in society. They insinuated that they did not have the space to exercise this in urban classrooms (Emdin, 2012).

Elements of hip-hop culture could be nurtured in the arts, as youth explored their creative potential. Spoken-word poetry could become the art form that transcends subject lines, and serve as a means used by educators to be infused into, and to improve their teaching practices. Spoken-word can be perceived as that which does not trigger society's fears of violent black male youth and disrespect to black females, inviting non-blacks, non-rappers, and females, who are considered to be outsiders, into the creative arena of hip-hop culture.

The goal was to validate and affirm to increase incentive toward achievement, cultural away-from-school knowledge, frames of reference, and performance styles so that students would be embraced by education caregivers such as teachers, administrators, and researchers. Embracing such factors could promote optimum learning environments that build self-efficacy in urban students. Morrell and Duncan-Andrade (2002) witnessed the influence of hip-hop music and culture on urban high school students in Northern California, transcending race for students coming from a variety of ethnic backgrounds. Analytical and critical discourse skills were developed. These skills were considered to be critical for science problem-based and inquiry learning and reflection. This knowledge could be infused into at-school literacy to aid in establishing a thriving learning environment, in which performance-based experiences would enhance identity-building experiences for urban youth. The researcher argued that this optimum learning environment would increase science literacy skills, through training with spoken-word hip-hop science poetry performances that were intertwined with science inquiry investigations.

Hip-hop spoken-word science poetry, intertwined with science investigations, generated a set of actions and behaviors which accommodated urban students in science classrooms. Promoting appropriate hip-hop lyrics could provide an avenue for urban youth to enact hip-hop practices that would allow them to fully value participating in their culture, and could activate tools necessary for connecting students to science literacy. Rap music, an element associated with the hip-hop culture, embodied spoken and written word produced by hip-hop, and one medium through which it is expressed. Rap music, backgrounds of which are rooted in oral African traditions, apprised African-American urban youth of valued connections to their past, and connected the struggle of these youth to others in different spaces around the world. There is a common struggle of the oppressed around the world which continues to deny the marginalized

full participation in society. Their voices could be somewhat silenced, in that, their histories, traditions, and voices different from that of the dominant group in society may be devalued.

Participants in hip-hop found a connectedness to each other, because of their common struggle, resulting in a very powerful affiliation of hip-hop around the world, in its varied forms. If the passion students have for hip-hop could be ignited and harnessed within the conventional educational setting, an alliance between hip-hop and science could primarily be retooled for urban science education. Moderate changes, or supplements to, the existing curricula could develop this learning environment. Therefore a reframing of goals could be provided, an avenue through which social injustice could be set forth to be remedied, in which the voice of the urban student could be heard and valued. A close-up focus on the delicate relationship between affiliation and alienation in hip-hop culture can then be established, especially that which would underpin reasons why urban students continued to ignore possibilities in the science arena. Those who possessed the intellectual capital to be more fully involved in science might reassess their place in science. They chose to express their culture in ways far removed from the understanding of the dominant group in society, by celebrating their positioning as "other" than that of success in school (Emdin, 2010). Even if hip-hop was arguably a distinct culture, cultural resources would be an important part of how urban youth engaged freely in society, in school, and further, in science (Elmesky 2005).

Hip-hop and urban science education needed to be closely connected in a way that would augment the relevance of science and the science curriculum to student real-life situations. Urban science education must include those community issues relevant to student daily living. If the curriculum can not navigate toward and reflect on this relationship, some students will choose to embrace hip-hop culture without fully realizing the relevance of science in their lives. They

could feel accepted in their positioning, their "otherness" within the dominant society, rather than the science arena. This would be especially culturally nihilistic to future urban scientists, when it has been known that hip-hop culture is replete with graphic design, sound engineering, and other opportunities of technology and engineering careers.

"Street fiction", a popular new genre of the arts for linking students' away from school experiences with classroom literacy emerged. It was touted as useful in connecting the hip-hop culture, developing positive images of hip-hop music, and of spoken-word poetry performances for urban students. Novels focusing on the everyday lives of students in urban neighborhoods were created for use in the classroom. Although the street fiction novels included familiar themes such as romance and tragedy, they often dealt with a heavy focus on sex, drugs and violence, often played out in urban neighborhoods. Hill, Perez and Irby (2008) suggested use of the novels in the classroom as a tool for addressing social issues of identity, power, and differences, and for forging connections to student interests and lived experiences.

Criticism surrounding "street fiction" included weak sentence structure, poor grammar, and improperly used words. "Street fiction" was criticized as promoting unhealthy health choices, illegal employment, and immoral behavior, although designed to discourage youth from gravitating toward that type of street life, ostensibly while being surrounded by it. However, in the wake of this criticism, teachers may still empower students by linking classroom literary practices that aid youth in assessing language and grammar practices. Hill, Perez, and Irby (2008) suggested that teachers may empower students through use of this strategy. They further promoted the use of published novels of other authors for activities such as writing alternative outcomes and characters into them, or developing texts into raps and spoken-word poetry as art forms. Morrell & Duncan-Andrade (2002) concurred, that the use of the power in the message

for good will, to teach richness in imagery, metaphor, and point of view, could develop critical skills.

Hip-hop music has been heavily critiqued for promoting immoral behaviors such as foul language, drug use and selling, and sexual impropriety (Hill, Perez & Irby, 2008, Cross 2013), often inculcated into the culture, because young people actually live within that reality. Historical bias and media misrepresentation have plagued establishment of effective intervention strategies by educators, to utilize urban hip-hop culture as an advantage in increasing literacy (Thompson, 2000, Cross 2013). This stance challenged teachers in urban communities to create an environment that was culturally relevant, to remove any impediment that could positively alter the course of literacy in science.

Most recently the "Obama Effect", which refers to President Obama, has been touted as an impetus with possibilities toward how hip-hop could engender science success in urban school settings. Examined were, the impact of cultural artifacts of hip-hop, which might play a role in generating pronounced achievement in science education for identity building .This development of social capital in urban youth, and use of knowledge generated as a tool might support academic success in science. The findings of the study, gained through data from observations of teacher and student engagement (Emdin and Lee, 2012) suggested that when teachers made use of hip-hop artifacts in science instruction, interest and involvement in classroom science experiences were noted that hadn't surfaced previously. Utilization of student "hip'hopness" (Emdin, 2012), manifesting itself in cultural mannerisms and cultural artifacts in the science classroom, served as an integral part of instruction, and evidenced markers of motivation appeared to sustain students' connection to science. Exploration of student away-

from-school literacy, and “hip-hopness”, became a focal determinant of significant student science achievement.

Findings were especially noted, as youth consistently observed President Obama and his family in the media. Hip-hop cultural mannerisms were observed and discussed in collaborative groups in science classrooms. Students began to develop an emotional connection to behavior observed, to be evidence of subtle Obama ”hip-hopness” (Emdin, 2012) related to the roles they play in the larger society. They connected their identity roles as being forced to enact role identities that made them more acceptable to society, to the one they felt the President must be required to play as president. They related to President Obama coming from a single parent, a bi-racial household, and who was empowered by being exposed to existing resources that would allow him to enter an Ivy League school and excel.

Through President Obama’s unswerving initiatives toward development in science, technology, engineering, and math as innovative and necessary toward America’s competition in a global society, they began to see how those initiatives affected their daily lives. Students became interested in scientists he nominated to head science ventures, began to research some science societal issues, and began to see themselves as literate enough participants in science discourse to interest them in considering future science positions. The election and inauguration of President Obama positively influenced African-American youth, and forged a preliminary perspective that resonated with them, which has resurrected a visibility that sparks interest in science fields previously closed to them.

Recently, President Obama launched a CEO-led effort to dramatically improve education in science, technology, engineering, and math. This effort was coined *Change the Equation*

*(*Sabochik, *2009)*. A non- profit organization was established, designed to assemble and marshal in those in the business community, to improve the quality of education in science, technology, engineering and math, (STEM). The President emphasized that the companies' future survival depended upon the ability to harness the creativity, talents, ingenuity, and insight of the future generation from all walks of life. The President proffered that leadership in these areas in the future, depended on how America's children are being educated today, and especially in the areas of science, technology, engineering, and math, and can affect how Americans lead the world in business and new industries.

Teacher Preparation

Help would be needed from teachers to assist students in distinguishing between assimilation and education in a dominant group society. Conveying that relationships can exist between effort, educational outcomes, "educational credentials", and opportunities for the future could empower educational achievement outcomes for students in urban centers (Gibson, 1991; Lewis et al, 2002; Jonson-Reid et al, 2005; Howard, 2003). Necessary help needed from the dominant ruling group in society to convey this message is required, as well. Teachers' perception of students' performance in school will strongly influence students' actual performance and will shape teachers' expectations. Teacher role in working to improve students' achievement could have a profound impact (Lewis et al, 2002). Teachers are solicited to challenge themselves to better relate to their students, especially in light of the changing ethnic global population base coming into their classrooms.

Teacher preparation would require introspection into perspectives about teaching in culturally responsive classroom environments in order to overcome negative attitudes and low

expectations. Teacher education coming from university training and professional development, may need not just to be examined for understanding of subject matter taught, but also for professional training toward working in culturally responsive classrooms. Recent studies have shown that structuring effective practicum experiences for pre-service teachers better prepared them for classroom teaching, for those in the final stages of their study. Studies were initiated to examine factors that identified strengths and/or weaknesses in organizational structure and preparedness to teach effectively. Data was analyzed for comfort level of teachers for classroom management, teaching to a variety of learners, and adolescent development issues (Wyss, Siebert, & Dowling, 2013). Suggestions were proposed to make beginner teaching easier and more productive (Botwinik & Press, 2013).

Several descriptor-of-disposition assessments were utilized to measure pre-service teacher dispositions/attitudes toward practicum experiences. It was perceived that dispositions tend to cause individuals to act in a given manner, and were predictive of patterns of actions during teaching experiences in the classroom (Johnston, Almerico, Henriott & Shapiro, 2013). Descriptors of dispositions included (a) use of systematic instruction techniques, (b) high expectations of students and themselves, (c) willingness to tailor teaching to students' needs, (d) belief in their own efficacy as a caring individual, concerned with perceptual meanings rather than facts and events, and (e) comfortable interaction with others, which showcases good management skills, flexibility, and imagination. Researchers determined that teachers met requirements of content knowledge and pedagogical skills, yet lacked dispositions essential to effective teaching, which reduced the successful facilitation of learning in the classroom. It was suggested that teacher disposition played a crucial role in the quality of student learning.

Pre-service teachers would bring baggage to the teaching equation that could be overwhelming. The baggage included completion of higher degrees, certification requirements, and/or new teacher training. In addition, they would have to teach to state standards, and could be placed in schools with more difficult conditions, such as low performing students, special needs students and other diverse populations, and could experience classroom management problems. This is the setting that most presented itself in urban school districts, but was not normally prevalent in affluent schools. A pre-support assessment process appeared to position itself as being required for pre-service teachers as a result, perhaps giving more insight into ways to better support them. Planning success into their teaching experiences would prepare them for teaching in difficult situations. Allowing pre-service teachers to operate in urban classrooms early, during internships and early teaching experiences, could show promise in helping them to develop an evolving perspective of the new culturally diverse classroom environment.

New teachers coming into teaching arena, having met requirements of content knowledge and pedagogical skills, have been found to lack the dispositions essential to effective teaching of diverse students. This could reduce successful facilitation of learning in the classroom. Since 70% (National Center for Education Statistics, 2007) of the future teaching force trended toward White females in the future, who would teach diverse groups of youth, it was suggested that teacher disposition plays such a crucial a role in the quality of student learning. Teacher preparation to teach this population of youth required a re-dress. Teacher dispositions/attitudes toward practicum experiences had been assessed, and it had been perceived that dispositions tended to cause individuals to fall into positional stances, predicting patterns of actions during teaching experiences in the classroom. These factors established the tone for the learning

environment in a diverse classroom of students, and caused teachers to relinquish empowerment to become change agents, if not addressed before entering the classroom.

Current Research

Use of the Arts in Science Learning and Teaching

Since cognitive science research espoused that centers in the brain responded best and reacted through experiences with the arts, performing arts experiences would be used throughout the researcher's study to establish a more in-depth learning experience that improved science concept learning, long term memory development, and projection of knowledge learned to other learning experiences throughout life. The arts have been noted to be culturally affirming and validating within all cultures and can address student away-from-school literacy, if infused into in-school learning. Hip-hop, as an art form, has been known to be culturally affirming in urban communities, where many marginalized students live. A history of hip-hop related possible indigenous attraction to hip-hop as an away-from-school literacy that is affirming and validating. As the investigating researcher sought to develop culturally responsive experiences that enhance learning for urban students, the arts was explored to increase science literacy skills. Utilization of an acquired science knowledge base on which to reflect and to develop in-depth discourse necessary for science inquiry and problem-based learning is the trajectory path being promoted in this study. Expected was that science investigations, interlocked with science literacy development, and precipitated through a culturally relevant art form, would encapsulate science learning achievement.

Having realized successful arts-based science teaching experiences with student learning in the urban science classroom that showed significant strides in science literacy and science

literacy skills of students, this investigative researcher hoped to explore other breakthroughs in the arts that enhanced student learning. Through research, arts-based promotion of science literacy skills has not yet surfaced definitively, so this researcher hoped to bring a new dimension to successful science arts-based programs in urban centers. To date, hip-hop poetry has been used for literacy in communication arts and social justice expression of societal issues. Socially it emerged as a means of battling, in performance, perceived oppression in the social environment (Bruce and Davis, 2002; Brown, 2011; Baszile, 2009; Low, 2010; Irby & Hall, 2011; Banks, 2010, Au, 2005), but not for development of science literacy skills. The cloud of negative connotations hovering over the hip-hop art form proved pervasive. The arts, however, have been used to increase scores on high stakes testing, globally.

Goldberg (2012), Winston (1998), and Brown & Pleydell (1999) offered forceful arguments about the use of the arts in cultivating cultural and personal identity, as gifts to society. Science poetry, painting, music, dance, singing, and drama have been promoted. Winston, (1998) professed that there is historical evidence that drama as an art form, actively questions, reinterprets, and renews understanding of concepts, by establishing individual engagement that is emotional and cognitive in nature. Brown & Pleydell (1999) suggested the impact of dramatic presentations on classroom practice, and offered a method of assessment. Rubrics were offered as a means of evaluating presentations in the arts, to alleviate teacher difficulty in assessing other than traditional learning activities. The study proposal as presented by this investigating researcher included rubrics for assessing science poetry, as well as for arts performances (Appendix I).

According to Eisner (2002), The National Arts Education Association proposed that the arts teach lessons related to critical thinking skills. Children can be empowered to make good

judgments when working with qualitative relationships. Children can better enabled to see that there is more than one solution to a problem, celebrating multiple ways of seeing and interpreting the world. The literal form of knowledge could not exhaust what can be known, as the arts are explored.

Eisner (2002) propounded that children can be empowered to change with circumstances, and to allow themselves to surrender their skills and talents to unanticipated possibilities. Children can discover the wide range and variety of experiences of which they are capable through the arts. Small subtleties in interpretation of their world could encourage sensitive observations. Children are enabled to express themselves, even when they do not know how to explain an idea. Thereby, the arts could symbolize to children what adults see as important in the school curriculum.

These skills would be those needed for developing science literacy skills, as inquiry is promoted within children, and allowing them to explore their capabilities. Science inquiry engagement required a cycle of processes that foster observation, discovery, questioning, reflection, and scientific thinking, while investigating an experience. Empowering children in this manner promoted problem-based science learning, in which children would engage in science experiential activities closely aligned to real-world experiences that elicit critical thinking skills.

As a result of researched tenets of learning theories and advances in cognitive science, the researcher proposed that spoken-word science hip-hop poetry be used as a beginning strategy for establishing a foundation to address urban student achievement in science. The researcher proposed that this culturally responsive approach could be used as a tool to prepare and include

students from all walks of life to enter the science arena, while increasing achievement in science. Since cognitive science research espoused that centers in the brain respond best and reacted through experiences with the arts, culturally relevant/responsive arts experiences would be used to establish a more in-depth learning experience that improved concept learning in science, long term memory development, and projection of science knowledge learned, to other learning experiences throughout life. The arts are proposed as a vehicle that would serve as a bridge connecting and reinforcing science concept formation during science investigative experiences.

The investigating researcher found compelling evidence from other researchers, of pronounced ways of presenting the arts as significantly successful in developing skills necessary for science literacy. The investigating researcher posited that the arts integrate away-from-school literacy with in-school literacy development to heighten engagement, positioning learners to better acquire learning and skills necessary for developing science literacy skills. It was proposed that training teachers and students to operate within a performance arts-based approach would facilitate significant strides in science literacy skills for students of many ethnic backgrounds, as long as students from all walks of life were partnered with resources necessary to its development. These resources should include community-based organizations. Not only might the achievement gap issue be erased, but students might be empowered to compete with and lead students in industrialized nations, who currently surpass the United States in achievement in STEM (Science, Technology, Engineering, and Mathematics) subject areas.

Since culturally responsive programs can foster "social cohesion" among those of different cultures by simultaneously celebrating the culture of other groups, spoken-word hip-hop science poetry performances, which is arguably an art form proposed by this researcher, was

advanced as that which could best be realized through the arts . Recent research examined the use of culturally relevant/responsive instruction as one that engaged urban students, and sparked marked interest in academic achievement. Hip-hop spoken-word poetry, which was intertwined with science inquiry experiments, was examined as a means of connecting to the worlds of urban students and validating students' away-from-school communication skills, increasing science literacy and science literacy skills for students in urban centers. This strategy focused explicitly on advantages of hip-hop culture that are conducive to empowering traditional science educators in the classroom. The researcher posited that integrating away-from-school literacy with in-school literacy, within a performance arts approach, would heighten engagement, and position learners to better acquire learning and skills necessary for developing science literacy skills.

Celebration of cultural differences has been best realized through the arts. It was been noted that music, a catalyst, united diverse groups of people, serving as a means to create common ways of thinking, and the building of strong bonds (Benzon, 2001). Through this type of engagement, even students in urban centers are affirmed and validated that their cultural heritage is of value to society. In realizing this, these groups were more motivated to achieve, in what they may perceived as an oppressive environment. This type of social cohesiveness promoted celebration of cultural heritage, as well as emulation of cultural influences. Gibson (2010) was attracted to the notion of Dewey, who proposed that people would begin to realize the value of role models that could shape their future, when engaged in social cohesiveness that celebrated cultural heritage. Sharing of the hip-hop urban art form offered opportunities to take and receive cultural heritage, which offset sterile traditional classroom routines.

When youth were not engaged in "diverse stimuli" noted Florence (2010, p.10) a sterile routine was established, in which the environment was devoid of opportunities to exchange and

receive more of a global perspective of engagement, in a world where things were seen and done differently. Individuals become more balanced in their point of view and position, when exposed to a variety of views from other individuals, not necessarily from their culture (Florence, 2010). Therefore it is important that ethnic groups be exposed to, exchange with, and affirm the cultural offerings of all groups. This exchange enabled students to develop linguistic, cognitive, and interpersonal skills. Cultural exchange expanded them towards more discerning and alert minds necessary for developing critical thinking skills, especially crucial to the sciences.

Science spoken-word science poetry was advanced as a strategy for increasing science literacy skills for students in urban centers. The performance arts form of hip-hop spoken-word science poetry was examined as a means of connecting to the worlds of urban students and validating students' away-from-school communication skills, brought with them to the classroom (Bruce and Davis (2002); Brown (2011); Baszile (2009)); Low (2010); Irby & Hall (2011); Dyson (2003); Banks, 2010. The hip-hop poetry art form was proposed by this researcher, as a culturally responsive tool that could develop science literacy skills critical to student science achievement in urban schools.

Significant Successes: The Arts in Science Learning

Flynn (2012) reinforced the improvement in test scores for third and fourth graders in San Marcos, California through the DREAM (Developing Reading Education with Arts Methods) program, integrating the arts of music, drama, singing, visual art, and dance movements, into their classroom curriculum literacy learning. Flynn emphasized that studies he had researched showed that when students were engaged in this manner, they were most likely to retain what they have learned. Standardized tests improved almost 90 points, within a two year period. The

program, in operation for three years in ten school districts in San Marcos, planned to increase its influence across several other districts in San Marcos.

Finland tops the international registry in literacy, because the curriculum gave very high priority to music-based learning experiences. Music, dance, folk songs, and action songs were central to their teaching methods, starting from pre-school professed Palmer (2012). Rhythm was considered to be an indicator of later academic success, in the development of an awareness of rhyming patterns for language development, with music helping to develop listening skills crucial for development of attention span. Elements of rhythm, pattern, and repetition involved sequences that made memorization easier, stressed Palmer. As with Silverman (2010) it was suggested that long term memory may be enhanced when information is paired with a familiar melody and rhythm. Harman (2012) promoted studies of Brewer & Campbell (1991) regarding movement and rhythm, proffering that rhythm stimulated the frontal lobes of the brain which enhanced language and motor development. Harman contended that rhythm and movement were natural partners to music, as was drama. The ability to learn and retain is increased and made more concrete. Music prepared the brain for tasks that were more difficult, and allowed the brain to process higher-order thinking skills. These researchers reinforced the manner in which traditional ways of learning presented by past theorists, might allow for infusion of new ways of engagement to enhance learning and development of critical thinking skills, as was suggested by this investigating researcher's study proposal.

The Arts: Music in Learning Science

Recent studies with music, movement and rhythm suggested that the brain's memory skills and retention processes were more fully activated, enhancing and facilitating better recall

and retention. Music had been examined as a means of alleviating and minimizing developmental delays in young children while being exposed " in utero", still in the mother's womb (Harman, 2012, Richards, 2010, Silverman, 2010, & Palmer 2012).Within the context of cultural literacy (Jones, 2005), skills had been known to be enhanced through arts experiences and activities.

Of the arts, music showed the most promise for organized development of memory functioning skills. "Children are not predisposed to be able to understand one particular style of music, over another. Rather they learn traits of the style of their culture, just as they learn the grammar and syntax of their native tongue", says Jones (2005), authoring *Music, the Brain, and Education*. This ideology reinforced the premise that students' away-from-school literacy must be tapped in the classroom setting, as a means of laying the foundation for learning. Jones contended that as this manifested itself, the child's brain became accustomed and attuned to the sounds of his/her personal culture and society. The child learned how to process incoming stimuli heard through repeated exposure to cultural ways on knowing, as might be implemented in a school curriculum. This helped the brain to coordinate body movements, aiding the brain in acquiring new information, as it aided the mind in developing and focusing. This promoted the goal of the researcher's proposal, in that culturally responsive instruction must take into account cultural ways of knowing of children, to elicit prior experiences, frames of reference, and performance styles of ethnically diverse students. These experiences can make learning more relevant and effective for students. Benzon (2001) proposed that music created order in an individual's brain. Playing of a song that had emotional implications for Alzheimer's patients, had shown to increase periods of clarity for those patients, believed so because music stimulated a part of the brain related to memory. Benzon also suggested that music united diverse groups of

people, serving as a catalyst that created common ways of thinking, and the building of strong bonds, crucial to societal bonding. A review of Jourdain (1997) studies promulgated that test scores had increased through use of culturally definitive, personalized music, although he mused that any music could cause the brain to order itself in enough different ways to cause beneficial effects.

Elizabeth Margulis' book, On Repeat—How Music Plays the Brain (2014) reflects upon how the brain responded while listening to music with repetitive phrases. In her research at the Music Cognition lab at the University of Arkansas, samples of music were played by renowned 20th century composer, Elliot Carter and Luciano Berio. Segments of excerpts were extracted and then reinserted to feature repetition. Their listeners consistently rated as more enjoyable, the music with repetitive inserts, although they had not been told of any alterations in the music stream. The listeners were college undergraduates with no prior training or experience in evaluating contemporary music.

This study revealed a theory about the way in which people perceive music that is new to them. Repetition had served as a blueprint to shape the manner in which the music was communicated. Repetition in music seemingly caused people to want to express themselves by moving or singing along. Repetition helped to intensify the rate at which facts were learned when set to music, and captured sequencing, which made a person anticipate upcoming sequences in the music. Thus people had a tendency to move to a rhythm when they heard music, as supported by the research of Richards, 2010; Harman, 2012 & Silverman, 2010).

Margulis' findings can be related to fields that include (a) music theory, (b) the psycholinguistic influence of psychological factors on the development, use, and interpretation

of language, (c) the neuroscience of the nervous system and the brain, (d) and cognitive psychology examination of the nature of various mental tasks and processes that enable them to be performed. Margulis examined the mechanisms associated with repetition, in the characterization of our behavior while responding to music, and other implications in language development, learning, and communication. Music we listen to daily can have repetitive phrases that cause the brain to want to sing along, seeking the next installment in sequence. Harnessing this way of "brain singing" may develop mental landscapes of images that cause important concepts to get stuck and stay in the brain for future use.

The Arts: Drama in Learning Science

The researcher's study was established in elementary school grades 1-6, to examine the ways in which science was taught in those grades, and to address the decline in incorporating science into the curriculum. Observed was that more attention was being directed toward teaching of communication arts and math. Therefore it had been postulated that students might be experiencing limited, and possibly uninteresting, transmission of science-based knowledge, as well as in other major content areas.

Recently drama surfaced as a teaching approach that develops acting techniques allowing for exploration of concepts and ideas of science. This technique developed science process skills and created more passion for science. Drama had been proposed (McGregor & Precious, 2010) as an art form that involved all children in a classroom in an artistic way that represented science ideas and understanding of them. Drama has been shown to be an unconventional method of engaging learners not naturally drawn to science. Through drama, elementary school children were exposed to process skills that included formulating questions,

predicting, observing and inferring, classifying, communication, and reflecting and assessment. These process skills particularly enhanced identification of patterns, as concepts were applied, and higher-order thinking skills were developed. The enhanced skills can then be directed to accommodate science content standards, proposed by the *Next Generational Science Standards*, as promoted by the National Science Foundation (2012).

As students enacted scientific phenomena and concepts with their body movements, fun and imagining in science was generated. A way of knowing the world engaged the child both physically and intellectually, expressing and interpreting in a scientific context (Nicholas & Ng, 2008). Drama allowed children an opportunity to link their personal experiences with a world unknown to them, establishing links between their actual world and an imaginary world (Varelas, Pappas, Tucker-Raymond, Kane, Hankes, Oritz, & Keblawe-Shamah, 2010; Nicholas & Ng, 2008).

Although drama, on the surface, would seem to be an unconventional method of teaching science, it assisted students in representing science ideas and understanding of them. This method was especially helpful in elementary school, when children may be unable to express themselves, or not know how to explain a concept. Children became physically engaged with expressing a science concept. This was an especially crucial experience to a child who was not naturally drawn to the natural wonders of the world of science. This proposal sought to help children make connections in what they do and see daily, with away from school experiences. This proposal sought to assist children in acting out the drama of science, as they acted out personally created science poetry, during hip-hop science poetry productions which included music, drama, rhyme and rhythm. The proposal projected to foster student-centered learning that validated and celebrated the unique cognitive profile of each individual. If students became engaged in a type

of learning that assisted them in developing positive attitudes, it might be replicated toward increasing science learning. This created a greater probability that they would develop high levels of scientific literacy posited Goodnough (2001). This probability could be translated into increased science literacy skills necessary for navigating within the current technological and innovative society, and into STEM (Science, Technology, Engineering, Mathematics) federal initiatives currently espoused, to better prepare young scientists from all walks of life for the future.

The Arts: Visual Design/Engineering in Learning Science

With the advent of STEM (Science, Technology, Engineering, and Math) education, designers studied the skills needed in the design process to solve problems, produce products, design outcomes, advertisements, and even design software. The design process created an infusion that incorporated experiences which heightened student engagement. Bequette & Bequette (2012) posited that elevation of the arts to the public in STEM (Science, Technology, Engineering, Math) learning, enabled people to conceptualize design thinking in STEM and art. Maeda (2012), President of the Rhode Island School of Design, considered the arts, as "articulately expressed" in something created with the hands, because innovative products and solutions to scientific problems were formed in this environment. Pomeroy (2012) reinforced this perspective in citing the "artist-scientist" phenomena of legendary thinkers such as artist Leonardo da Vinci and the birthing of flight, Earl Baaken and his musical metronome used in creation of the pacemaker, Mae Jamison, female African-American astronaut, dancer, doctor, and other builders, inventors, poets, and Nobel laureates whose art form lead to unique innovations in medical stents and technological advances. This included the invention of the vehicle airbag as inspiration from the folded paper designs of Japanese origami. The Dana Arts

and Cognition Consortium, a philanthropic organization assembled scientists from several different universities to study whether or not the arts influenced learning. Several reports from this study related arts training to heightened attention span, cognition, working memory, and reading fluency, as well as improvements to math and reading scores.

Properties of arts experiences, performing and visual, have been examined as a means of alleviating and minimizing developmental delays in young children when exposing them in utero, still in the mother's womb (Harman, 2012, Richards, 2010 & Silverman, 2010). Jones (2005) portended that this was evident especially within the context of cultural literacy enhancing skills. Studies have shown that even playing of a song that has emotional implications for Alzheimer's patients increased periods of clarity, for some patients. This was believed so, because music was thought to stimulate a part of the brain related to memory. Arts music experiences have been studied for their creation of order in an individual's brain, suggesting that music could unite diverse groups of people, creating common ways of thinking, and building strong bonds among groups of people. The performing arts have shown to be an unconventional method of engaging learners not naturally drawn to science, exposing them to process skills. Learners have been found to better develop skills, unifying patterns as concepts are applied, exercising higher-order thinking skills. This proposal suggested that the performing arts could best be manifested in urban school districts, culturally positioned in poetry, music, and drama performances. The researcher posited that integrating away-from-school literacy within school literacy within an arts approach, heightened engagement, and positioned learners to better acquire learning and skills necessary for developing science literacy skills.

The Brain and Memory Retention: Supporting Experiences with the Arts

New studies with the brain offered promising research that long term memory functioning may be enhanced, making learning more concrete. Recollection of necessary concepts has shown to be more pronounced, with mental activity in the brain being measurably realized. Discussions around the link between neuroscience and education have brought challenges that oversimplify educational arguments, regarding interaction within the brain and the connection to mind, behavior and social interaction. Although education can benefit from neuroscience insights, brain function and how we develop and learn can be a bit more complex (Howard-Jones, 2008). Neuroscience and education became a part of mainstream educational research, as brain, mind, and behavior were explored as components of learning.

Mike Cohen (2011), a neuropsychologist at the University of Amsterdam emphasized that specific rhythmic brain activity can determine memory retention. Test subjects were asked to observe drawings on a computer screen for a few seconds, as they used short term memory, and to remember the images after they were removed from the screen. In a second test subjects were asked to look at a second set of drawings, to indicate whether any of the drawings appeared in the first test, in order to check long-term memory functioning. An Electroencephalogram (EEG) measured electrical activity in the pre-frontal cortex of the brain, positioned directly behind the forehead, while they participated in the task.

Test subjects with slower brain rhythm in the first test remembered more of the drawings from first test, while participating in the second test, evidencing long-term memory development. Cohen (2011) surmised that test subjects exhibiting strong connections between the pre-frontal cortex, which had been proven to be most involved in short- term working memory, and the hippocampus, most involved in long-term memory, performed better in long-term memory

exercises. Slower brain activity in the pre-frontal cortex enabled those subjects to be better at creating memories. This indicated to the researcher that people who appeared to be more reflective when given a task might be accessing their long-term memory more effectively, developing better long term memory skills.

The medial pre-frontal cortex was revealed as a recollection triggering mechanism of the brain, reports Jeremy Hsu (2009) of *Live Science*, reporting on a study conducted by Janata (2009) from an article in *The Journal of Cerebral Cortex*. Familiar music from 30 different songs from a top 100 billboard collection, were randomly selected from a period when test subjects were between the ages of 8-18 from 13 University of California—Davis students. Their brain responses were monitored under an fMRI brain scanner while music was played, and the brain responded quickly to the music signature and time scale. Test subjects were to signal when music triggered personal "autobiographical' memories of events from their lives. Test subjects filled out detailed surveys about their memories immediately after the brain scan.

The strongest memories were linked to spikes in mental activity in the medial pre-frontal cortex area of the brain, indicating to Janata (2009), a cognitive neuroscientist, that more mental activity occurred during those times when a tune triggered personal recollections about a particular person or place. Since research has determined that the pre-frontal cortex is among the last parts of the brain to atrophy, Janata (2009) determined that the reason Alzheimer's patients' behavior brightened excitedly, and could recall songs from a very distant past, was because music had the ability to trigger very strong memory recollection. Janata proposed providing iPods to Alzheimer's patients to create a better memory recollection environment.

Uncapher (2006) and colleagues set out to determine how memories for events are woven, in looking at how memories are processed in the brain's memory center, the hippocampus, for sounds, smells, sights, and tastes. Test subjects were presented with a series of words in different colors on different quadrants of a display screen. fMRI (functional Magnetic Resonance Imaging) scanned their brains for regions showing blood flow, which is considered to reflect brain activity. These scans involved using harmless radio waves to measure blood flow. Later on, a second set of words including new words were shown, and test subjects were asked to tell whether the words were old or new. If old, subjects were told to identify the color and location of the word on the screen.

As the researchers retrieved and correlated the data from the fMRI brain scans for the first and second set of words, asking for different features of color and location of words on the screen, they found out that regions of the brain involved in processing color were active in the formation of memories for both sets of words. It was found that successful recall of all word features initiated brain activity in another brain region, the intraparietal sulcus. Researchers concluded that both brain regions co-join to encode or store a memory, a "common perceptual representation" during the test subjects' initial experience.

Proposed in the investigative researcher's study was the use of the arts, particularly music, to develop in-depth learning of science concepts, within a science poetry framework. Proposed was that the elements of music, rhythm, pattern, and repetition involved sequences that made development of long term-memories easier. Recollection of necessary concepts were made better, as more pronounced mental activity in the brain was realized. According to neuroscientists and other researchers, the memory center located most particularly in the hippocampus and medial pre-frontal cortex regions of the brain were areas of the brain which

responded most readily during arts-related activities, particularly with music and rhythm patterns. The brain actually rewired itself to make more and stronger connections (Witherell, 2000). This knowledge would tend to highlight the need to facilitate student learning toward those performing arts activities that nurture recall in the long-term memory retention centers in the brain, with the pre-frontal cortex being among the last parts of the brain to atrophy. Neuroscience promoted measured synaptic connections that showed brain firing measurement of blood flow, to support learning activity in the brain.

Although there may be flaws in oversimplifying the process that takes place, there should be pause to understand the biological occurrences. The mind is influenced by internal and external factors that affect meaning and understanding in people. As neuroscientists and educators explored the complex behavior of brain, mind, and behavior in regards to learning, the ideas about cognitive functioning brought with it, a need for introspection. The impending importance of examining social and cultural factors of learning surfaced, as an interface with brain, mind, and education was examined. A "tri-modal" examination (Howard-Jones, 2008) of learning was created that included biological and neuro-physiological processes, interpretation of learning systems to gain meaning during participation, attempts to investigate how concept formation was influenced, and that of self-awareness and reflective processes. There was much enthusiasm surrounding these new studies, but they would best be informed by examining the" tri-modal" components that influence learning.

US News' Alexandra Pannoni (2014) reported the use of music incorporated into the core curriculum of high school. Top high schools suggested integration of music into English, math, and science. Improvisational rap music battles had been established to help students to understand and decipher difficult poetry pieces, as rhythm patterns were examined. Problem

solving and critical-thinking skills necessary for engineering, and other STEM (Science, Technology, Engineering, Mathematics) areas had been encouraged and honed, as concepts were made more applicable to student lives and away-from-school everyday literacy practices.US News' Jason Koebler (2011) discussed the White House initiative to make use of the performing arts as a means of increasing the impact of arts connections in the core curriculum, and student engagement in classroom learning.

Richards (2012) proposed that integrating music and rhythm with storybooks gave children the opportunity to connect stories with rap, songs, and rhythm. This prepared the groundwork for them to have fun discovering patterns in words, and developing expressive vocabulary, word recognition, and reading fluency, critical for processing language more smoothly. Literacy development was thus stimulated in a positive environment. Richards reinforced the success found in Finland, introducing storybook connections that enhanced language development in an atmosphere that was not just a fun of way learning, but also addressed how the brain learns, as proposed by Harman (2012) and Silverman (2010). Music and rhythm appeared to play a vital role in learning for children of many cultural backgrounds. This investigative proposal suggested that the performing arts could best be manifested in urban school districts, culturally positioned in poetry, music, and drama performances, because the roots of their culture present themselves in the hip-hop performance art form.

A History of Hip-Hop as an Art Form

Elements of hip-hop culture comprise richness in art form through creative expression. Consider the African oral traditions of the village griot that conveyed history. The rhythm of drums, dance movement, and oral presentation of repetitious rhythm and rhyming of words,

transmitted several arts forms. Slaves on plantations sang spiritual songs to rhythm, inducing others to add to the songs and rhythm/beat as a means of communication, coined "call and response". The "call and response" activity reinforced concept formation and engagement of all. Slaves sang about personal problems and social ills of the time through Negro spirituals, ushered in art forms leading to the "Blues" era.

Influences of Hip-Hop and Uses in Today's Culture

Hip-hop culture influenced segments of many cultural societies. It has shown global appeal because of the appearance of rap music on the internet, which reached many ethnic backgrounds. Poetic renditions pervaded social media. Free-expression of urban African-American and Hispanic youth reflecting hopes, concerns, and aspirations (Morrell & Duncan-Andrade, 2002) were translated as cultural pride to youth, and gave them a forum to develop positive self identity. Hip-hop music had generated collective identity among youth, allowing them to explore and share the similar experiences. This fostered an ideal environment that encouraged sustainable human development (Forchu, 2012). Hip-hop music could produce conditions in which the unity, harmony and accord of people can be felt," irrespective of their race, nationality and socio-cultural affiliations"(Forchu, 2012). Hip-hop music has influenced media promotions, and has brought lucrative benefits to the media.

Influences of Hip-hop and Uses in Education

Currently, Doug E. Fresh (2007) decided after building his career and fame that he could use his success to educate and empower youth. Believing that good health is essential for a fulfilling life, he embarked on a venture with Dr. Olajide Williams, a neurologist at New York Presbyterian/Columbia University Medical Center, to fight against childhood obesity, a crusade

of First Lady Michelle, Obama. The project became known as Hip Hop Public Health, which educated African-American and Latino children about obesity and the chronic and serious diseases they caused. Youth were informed through rap music, video, comic books, and live hip-hop shows that touedr schools in New York. In partnering with this program, Doug E. Fresh explained that he was empowered to use hip-hop as a tool to get kids motivated. This reinforced the investigator researcher's message that rap music can be used as an advantage to education, bringing the power of beneficial messages to and from a population that is considered to be marginally educated. Hip-hop can serve as a tool which already widely influenced African-American and Latino youth, while it addressed the science and social issue of obesity, which is problem-based and a real-life experience for some urban children. It has been affirmed as an element of their culture, and a conduit of culturally relevant teaching and learning experiences that can better educate them about their reality, and be of nurturing exposure to other cultures.

In a related report, Nasir Jones (2013) celebrated rapper lyricist, was honored by Harvard University with the Nasir Hip-Hop Fellowship at its W.E.B. Dubois Institute. Nasir, most known for his "reflective rhymes", and his storytelling using hip-hop, earned him Grammy nominations. The fellowship was established to assist students who show exceptional ability in the arts, in the area of hip-hop. A hip-hop archive was established at Harvard University in 2002, to support research in hip-hop. This represented an oasis of hip-hop affirmation, and of rap and hip-hop music as an art form, validated through an Ivy League school. This offered validation to an art form procreated in African-American and Latino neighborhoods in New York.

A Global Perspective of Hip-Hop (Informative Views from "The Globalization of Black Popular Culture" (2012): Hip-hop Literacy Conference I

New understandings of hip-hop's global appeal as an art form (Hip-hop Literacy Conference, Ohio State University, 2012) offered possibilities for increasing literacy globally. A recent conference, "The Globalization of Black Popular Culture" (2012), at Ohio State University, sponsored a conference to explore factors that influence youth identity formation, while offering possibilities for cross-curricular methodology. The conference explored methodologies that offered understanding of new horizons, that presented opportunities to uncover hip-hop as a legitimate art form of value toward developing learning strategies for urban youth.

The researcher/investigator attended this conference to determine how hip-hop might be best utilized in the educational arena to develop science literacy. Topics particularly interesting to the researcher were (1) "Using hip-hop for knowledge formation, identity construction, and learning", (2) "New emerging responses to hip-hop globally as a tool for socio-economic, political, and cultural ,expressions that influence youth identity formation", (3) "Consideration of the methodology of hip-hop as an art form of value, which may be used as an instrument of inter-disciplinary study", (4) "Use of hip-hop as a post-industrial form of global information, electronic media, and digital literacy", and (5) "Opportunities to legitimize hip-hop as an art form that could uncover new forms of learnin".

The hip-hop literacy conference was held on the campus of Ohio University in Columbus, Ohio. This investigator left the conference with an understanding that subsequent conferences would take place, adding practitioners, speakers, and others to the conversation, with new facets

of understanding of the hip-hop culture and its value to society. This investigator was served with opportunities to exchange conversation with several practitioners, and became aware that literacy in the schools, using hip-hop, would be part of the conversation at the next conference, inviting practitioners from the National Council of Teachers of English (NCTE). Science literacy was brought into the conversation, juxtaposing the use of hip-hop artists as disseminators of hip-hop literacy productions for school systems. This conversation was of special interest, as it addressed what was being proposed for the investigative researcher's current study.

A Global Perspective of Hip-Hop (Informative Views From "The Globalization of Black Popular Culture" (2013): Hip-hop Literacy Conference II

The main focus of this conference was to develop pedagogies for social change, incorporating acculturated learning activism in education. Vanderbilt University joined Ohio State University in an assessment of the role identity-building plays in affirming and validating urban students in the use of away-from- school literacy of elements of hip-hop culture, to develop self image. "Open-mic" formats were established to facilitate melding of ideology and pedagogy. Grammy nominated hip-hop artists were featured in performance, one of which was an educator, to demonstrate the influence hip-hop music has on urban youth and the disenfranchised of society around the world. These opportunities afforded participants in the conference with an opportunity to express themselves. This investigative researcher was most interested in the use of hip-hop in science education, and inquired about the possible movement of hip-hop artists in developing an education genre and business venture that creates performances teaching literacy, particularly in science.

Some of the topics the researcher was particularly interested in included (1)"Innovative and Critical Education for a Better World", (2) "Using Hip-hop to Explore Common Core standards and Complex Hip-hop Generation", (3)"Hip-Hop Leadership Pedagogy (HPLP): Hip-hop 2020's Recipe for Education & Social Change Philosophy on Inclusiveness", (4) "A Style Nobody Can Deal With: Artists and Social Responsibility", (5) "Contributions to the Struggle: Recognizing Social Change and Empowerment in Hip-hop", (6) "Hip-hop as Teaching and Healing", and (7) "Rap: The Poetry of Hip-hop".

Many of the topics covered the need to address self-identity issues for urban youth, and the use of identity-forming programs that jumpstart incentive for them. Participants determined that addressing self-identity issues allows urban students to communicate and identify with one another as a "collectively marginalized" population, which can flourish outside of mainstream society. Hip-hop then, became the manner under which lifestyle manifests itself as a significant part of a population's identity.

Sessions offered a refocusing on elements of hip-hop culture and its value to, and for education, unpacking a fundamental piece of a larger framework that constructs what makes hip-hop youth who they are. Consideration given as to how this information could become a tool for increasing youth academic potential and support of their academic success, pervaded discussion in most sessions of the conference.

"Reality pedagogy" surfaced as Christopher Emdin of Teachers College at Columbia University presented teaching and learning pedagogies. He promoted this ideology as one that built urban youth and supported them culturally, while addressing the necessary critical issues of teacher and student engagement and experiences in learning. He reinforced the idea of culturally

relevant/culturally responsive pedagogy, as one that acknowledged cultural differences, validated them, and used them as the focus of student encouragement to increase achievement. "Reality pedagogy" was considered to have ramifications that assisted diverse populations by teaching them how to embrace a belief in human responsibility for each other, and the value of individual differences. This ideology was touted to transform the roles students can play in social settings. Youth can come to situate rap practices as an attractive and valued way of learning and being, within a global collective, and could allay suspicions about dominant culture traditional instruction. As an art form, rap music can become the learning tool that could captivate learning trends for African-American youth, and bring academic abilities to the surface, opening avenues to filling the pipelines with future science success stories.

Chapter Summary

Though research, arts-based promotion of science literacy skills had not yet surfaced definitively, this researcher hoped to bring a new dimension to successful science performance arts-based programs, of which there had not been widespread use in urban school districts for science literacy skills. To date, hip-hop poetry had been used for literacy in communication arts and social justice expression of societal issues, and as a means of battling, in performance, perceived oppression in the social environment (Bruce and Davis, 2002; Brown, 2011; Baszile, 2009; Low, 2010; Irby & Hall, 2011; Banks, 2010, Au, 2005). Hip-hop spoken-word science poetry had not been utilized for development of science literacy skills, much because of the cloud of negative connotations surrounding the hip-hop art form. The arts, however, have been used to increase scores on high stakes testing, globally, and hip-hop has been situated among art forms demonstrating use of music and rhythm to increase optimal learning.

This study sought to address the issue of how middle school African-American and Latino students have been educated in science. A culturally responsive/relevant approach promoting hip-hop spoken-word science poetry, intertwined with science inquiry experiences, was projected as a means of empowering urban students toward science literacy skills. This was projected to propel students toward interest and achievement in science, technology, engineering, and math. This approach was designed to open the minds of urban learners to a realization, that they have been empowered to matriculate into the science arena, (1) confident in their science literacy, science inquiry, and problem-based skills, (2) enabled to offer service and leadership within a community of science learners, and (3) possessed with a type of self-expressive learning indigenous to personal culture, serving as an advantage rather than an expression considered to evoke negative connotations. Sub-culture 'Gangsta" rap exposure has been considered to serve as an impediment to learning for urban youth (Davis, 2000), but the image can be overcome with positive self-expression with the researcher's approach toward celebrating elements of hip-hop culture, as a science learning tool.

Self-efficacy has been shown to be a crucial factor in African-American youth academic performance and school success. Being able to value oneself, and trust schools to construct a learning environment that would offset negative portrayals is critical. Constant exposure to negative portrayals can invalidate youth, so they would tend to search for a collective norm of youth hip--hop culture that validated and affirmed among others who are socially treated like them. This invalidating expectation of youth in urban centers tended to follow them to their school environments, decreasing their focus on cognitive skills, which they considered to be of the dominant group in society.

Additional research into the use of cultural capital as a means of empowering urban youth to matriculate into the science arena, may become critical in bringing along new generations of urban youth. History has shown to be replete with African-American scientists who contributed to innovation society continues to benefit from, and of current African-American scientists not visible to youth in urban communities. What motivated them to become scientists? How were they prepared to enter the science arena? What motivated these budding scientists to address science issues of society? How were they able to overcome the stigma of the "deficit model"? Postulation from the researcher/investigator suggested that change agents established a system that gave rise to an environment of flourishing investigation and preparation, thus reinforcing and mentoring efforts to value cultural capital, in order to empower.

The connections that urban students found among each other and within the hip-hop culture, have resulted in effective bonds that bring them together into a collective position as "other". They had considered themselves to be "other" than what was experienced in the traditional science classroom. A hostility related to the traditional science classroom environment was then created, establishing urban students as invisible in the classroom.

Culturally responsive/culturally relevant programs can cultivate "social cohesion" among those of different cultures. One group learned from and celebrated the culture of another group. Being empowered to transfer away-from-school competencies, would aid in affirming and validating cultural experiences, and honor cultural diversity that would help youth thrive in learning experiences of urban communities (Florence, 2010; Baszile, 2009; Brown, 2010, Low, 2010; Dyson, 2003). Students were affirmed in their personal cultural experiences, and discovered their own competency and prior knowledge from those experiences served as a viable learning resource for them.

***Celebration of cultural differences has been activated through the arts. Music, a catalyst, united diverse groups of people, serving as a means of creating common threads of thinking, and the building of strong bonds (Benzon, 2001). This type of engagement affirmed even students in urban communities and validated their cultural heritage as of value to society. In experiencing this, these groups were more motivated to achieve, in what they might perceive as an oppressive environment. This type of social cohesiveness promoted celebration of cultural heritage, and allowed for emulation of cultural influences. When youth were not engaged in this type of "diverse stimuli" a sterile routine was established. The environment became devoid of opportunities to exchange and receive more of a global perspective of engagement, in a world where things were seen and done differently. Participating individuals became more balanced in their point of view and position, when exposed to a variety of views from other individuals, not necessarily from their culture. It would seem important that ethnic groups be exposed to, exchange with, and affirm the cultural offerings of all groups. This exchange would enable students to develop linguistic, cognitive, and interpersonal skills, which would expand them towards more discerning and alert minds, necessary for developing critical thinking skills especially crucial to the sciences.

Geneva Gay's elements of culturally relevant pedagogy included those that use the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students. Gay considered these elements to be crucial to learning, making them more relevant and effective for students, teaching through strengths, and tending to be "culturally validating and affirming".

Research has proposed that rhythm and movement are natural partners to music, as is drama. Music has prepared the brain for tasks that are more difficult, and has allowed the brain to

process higher-order thinking skills as we listen and participate through movement. It is composed of repetitive phrases that cause the brain to participate by singing along. Harnessing this way of "brain singing" may develop mental scenery of images that cause important concepts to stay in the brain for expansive thinking and for future use in connection to other science concept development. The hip-hop music of African-American and Latino populations in urban America could lend itself toward creating mental scenery of images that insinuate themselves into critical thinking skills and long term memory development, which can be of benefit to brain nurturing development to all humankind.

The literature affirmed that rap music can be used as an advantage to science education, bringing the power of beneficial messages to and from a population that is considered to be marginally educated. Hip-hop music can serve as a tool which daily and widely influences African-American and Latino youth. As an element of their culture, it can be considered to be a culturally relevant teaching and learning tool that could better educate them, and be of nurturing exposure to other cultures.

To improve the quality of education in science, technology, engineering and math, (STEM), the President has emphasized that companies' future survival is dependent upon the ability to harness the creativity, talents, ingenuity, and insight of the future generation from all walks of life. Through this study the researcher proposed to harness the cultural capital, creativity, ingenuity, and insight of youth in urban centers. Leadership in these areas in the future would be dependent upon how America's children are being educated today, especially in the areas of science, technology, engineering, and math. How Americans lead the world in business and new industries could be affected.

The awareness of the bleak outcomes of one's future after leaving school, the devaluing of students' culture in society and schools, and the lack of self-worth and confidence that comes with it in the classroom, can be poignant cultural concerns that could eventually lead to lack of interest in science by urban youth. As educators and researchers, we must become aware of these concerns and their implications toward teaching and learning for urban students. Much consideration should be taken in designing instruction intended to meet the needs of growing diverse populations, strongly influenced by elements of hip-hop culture. Future trends of societal productivity, innovation, and competition with other industrialized nations could become an estranged environment for urban students.

CHAPTER 3

METHODOLOGY

How might culturally responsive programs using hip-hop spoken-word science poetry, which is intertwined with science inquiry investigations/experiments, prepare middle school urban youth for development of science literacy skills? Could the creation of written hip-hop science poetry build and increase science literacy skills, and be used to establish a culturally responsive tool for teaching science literacy skills to middle school urban youth? This study examines an approach toward developing teaching strategy, with a premise as to how this goal might be achieved.

Purpose

One purpose of this study is to undergird the self-efficacy African-American and Latino urban students, while increasing science literacy skills. The plausibility of using spoken-word science poetry productions, intertwined with science inquiry experiments, as an intervention which could propel middle school students toward significant development of science literacy skills that increase science achievement was investigated. The second purpose of this study was to explore how to increase science literacy skills in urban schools, and improve interest and achievement, in order to develop future needed scientists from all walks of life. This proposal was designed as a strategy for urban learners to envision entering the field of science study, having achieved a level of science literacy skills gained in a culturally responsive environment, through performance arts and science investigative experiences.

Proposed Setting and Sampling (purposive/convenience)

The proposed study is of a purposive/convenience nature due to the fact that the population of youth needed for conducting the study attended middle school in urban communities. The districts were purposely chosen because of the large populations of African-American and Latino students, in a large Midwest area. The study took place during school hours, as designated by administrative and teaching staff. The study was initially conducted from the Midwest Challenger Learning Center, as a base of operations to recruit teacher participation, and to assess teacher and student engagement in science.

Description of Sample

Middle school students in grades 6-8 were chosen for this study, as those navigating through the most tumultuous years of learning throughout the K-12 years of schooling. The researcher conducted a study with 53 grade 6 student participants and two science teachers over a time frame of one year. This study proposed to reinforce and embellish science literacy skills for youth who showed little interest in science and lacked proficient science skills. The goal was to prepare grade 6 students toward increasing science achievement that would continue throughout the middle school years, into grade 8. The hope was to motivate students to enroll in high school science classes that would best prepare science learners to enter universities, with the confidence to enter science classes that lead to science careers.

Design: Mixed Methods (Concurrent Parallel-Transformative)

A mixed methods approach has been explored for this study. A review of Tashakkori and Teddlie (2003) indicates that purposive sampling of a representative group, to create greater depth of information from a smaller number of cases, is part of a mixed methods design.

Tashakkori and Teddlie report that the advantage in using this design is that it provides more insight into phenomena while collecting qualitative data. This design was chosen because the study includes quantitative and qualitative instrumentation. Quantitative instrumentation used included teacher and student science attitudinal surveys. Qualitative instrumentation used for science included rubrics, informal assessments, science inquiry tools, graphic organizers, field notes from teacher professional development workshops, and sessions with students recruited at the Midwest Challenger Learning Center facility. The design for this study was chosen as a means of gathering quantitative and qualitative data through researcher developed instrumentation and field notes, relating information to increased student science achievement

The research design used for this study was of a *Concurrent Parallel-Transformative* nature (Borg et al., 2007; Plano and Creswell, 2010; Tashakori and Teddlie, 2010a, 2010b).This design enabled better understanding of general quantitative data from the surveys that the researcher initiated. This design generated a better understanding of the complexity of social phenomena being studied (Creswell, Clark, Gutmann & Hanson, 2002). This design can also be labeled as QUAN + QUAL, following the structure used in the mixed methods approach of conducting research (Plano and Creswell, 2010; Tashakori and Teddlie, 2010a, 2010b).

The researcher used *Concurrent Parallel-Transformative* mixed methods design because 1) the qualitative and quantitative components of the research study had equal priority, 2) the qualitative and quantitative data were collected within the same time frame, 3) the qualitative and quantitative data were separately analyzed but within the same time period, 4) the qualitative findings and the quantitative results were merged and interpreted for a better understanding of the phenomenon of a study using performance arts to build a foundation to increase science literacy skills for urban youth (Plano and Creswell, 2010), and 5) finally the design has a

transformative component to examine the success of outcomes from a study that was intended to empower urban youth and their advocates toward social justice in science (Plano and Creswell, 2010).

Science spoken-word poetry was used in a hip-hop format performance, to reach into the world of urban student literacy practices and music away from school, and spark interest in science learning. This approach is being used to build a foundation to more expediently prepare urban middle school youth to use acquired knowledge and science skills, and to address critical thinking skills in inquiry science experiences and problem-based science experiences. It is hoped that these skills can be utilized to develop possible solutions to real-world science issues, and be informally and formally assessed and evaluated through teacher-created science tests and assessment.

Procedures

Teachers participated in a professional development experience to introduce spoken-word science poetry, intertwined with a science inquiry experiment, during a visit to the Challenger Learning Center. The researcher had been scheduled as co-presenter for part of the regularly scheduled Challenger Learning Center professional development presentations. Those teachers not able to attend The Challenger Learning Center were professionally developed throughout the duration of in-school student-training, through mini conferences.

The researcher arranged with recruited teachers, follow-up school visits after the scheduled Challenger Learning Center visit, using signed recruitment letters and forms. The follow-up classroom visits were used to develop skills in student science poetry presentations, using science standards current to the curriculum at that time (Appendix T). Teachers and middle

school students completed pre-attitudinal Likert science surveys, at the school site of recruited teachers, addressing experiences toward science learning, on the initial visit (Appendices A, C).

Informal assessments were made available for use throughout the study (Appendices E, G, H, I, and time permitting, Appendix F). In addition, science unit sample poetry with word banks were used as informal assessment. All student groups received training for science spoken-word poetry production/performances that were intertwined with science inquiry experiments, and science poetry was evaluated through a researcher-created rubric (Appendix G). A researcher established "writing clinic" format (Appendix S) assisted students in writing science poetry for the completed science inquiry investigation. Performances involved reciting science spoken-word poetry, and acting out science concepts through body movements/dance, to a rhythmic hip-hop music backdrop. Students within each classroom worked as collaborative teams of 3-4 to complete the training and performance productions, receiving the same intervention strategies. Students were videotaped during presentations/productions, for triangular analysis.

A final (post) Likert science survey was administered at the close of the study for students and teachers, assessing attitudes toward the science teaching approach through the performance arts (Appendices B, D). All Likert science surveys and other forms of assessment were coded for each student, based on grade level, gender, student, teacher, and school. They are stored in a metal file cabinet in the researcher's home office, and will be destroyed upon completion of the study.

The investigating researcher conducted the study during regularly scheduled science classes, asking classroom teachers to relinquish some classroom time to assist with four projected classroom visits. Scheduling in some school buildings increased researcher intervention visits to six visits. Only classes at grade level 6 participated, so as to complete a comparison study of

achievement by grade level. Time constraints prevented participation of grades 7 and 8, although students had opportunity to observe posted written posters and artifacts of the training process in the classroom during the time they came for class. The researcher sat in on some of these classes and was questioned about the posted artifacts. Consent forms informed that all documentation would possibly be shared with other researchers and educators in the form of presentations and/or publications. Teacher consent and consultation were established with a recruitment letter, a recruitment form, and a teacher consent form. All assessments were examined and used as artifacts for analysis, coded for interpretation toward research results, and briefly reviewed with the classroom teacher. The investigator created a journal to record discussions and conferences with teachers.

The researcher created a framework for science poetry writing as a model (Appendices J-R) to establish expectations and to assist students in making improvements. The hip-hop science poetry training sessions included connections to a science inquiry investigation experiences. The researcher created science poetry to accommodate teacher directed science concepts, and engaged students in a writing clinic (Appendix S) to create poetry for the inquiry investigation in which students had participated. Students create and enact re-interpreted science concepts using written science observations and graphic organizers (Appendices H, I) for a hip-hop science performance.

The evaluation system was established by the researcher to develop critical thinking skills for students. Marzano (2001, 2007) and Bloom's Revised Taxonomy (2009) place critical thinking skills such as "evaluating", "creating", "revising knowledge", "reflecting on learning", and "examining errors in reasoning" at the top of the registry for skills necessary for attaining problem solving skills. The skills listed are the least manifested in traditional classrooms. The

researcher determined that teachers needed concrete examples as to what kinds of experiences would help to develop these skills. The researcher sequenced these skills into every science unit created, determining through the experiences, which order the skills should be implemented to properly scaffold critical thinking skills.

Although science surveys were developed to examine teacher and student attitudes toward science learning during formative years, researcher constructed evaluation measures were created to assess progress of sequential development of science literacy skills. Figure 2 outlines this rationale..

Figure 2: Measures of Researcher Constructed Instrumentation

Instrumentation Rationale (Plan of Implementation)

Science Attitudinal Surveys (teacher and student) **Appendices A,B,C, D**	**Science Poetry Rubric (G), Science Poetry Models(J-P), Inquiry Investigation (H) Graphic Organizer Model (Appendix I) ;** *(Informal sequenced concept development tools-used between pre and post science surveys, to determine developmental level of process skills)*	**Informal Assessments** --poetry performance (**Appendices E, F), Cooperative/Collaborative Learning Tool (Appendix T); Writing Clinic Format (Appendix S)**
Pre: To examine general impressions of science learning throughout formative years of science learning (pre—A, C) for students and teachers; cultural relevance for teachers; *administered first in the study*	**Science Poetry Models**: Science concept development (J-P) **Graphic Organizer**: Reinforce science concept development; "chunking" method of linking and connecting science concepts; assess and expand concept formation (Appendix I)	Informal **Student Self Assessment**: (Appendix E) Assess relevance and value of science hip-hop science poetry training; to teach students evaluation skills
Final (post): To examine evolving impressions of science learning through the arts (B, D) for students and teachers; cultural relevance directed to teachers; *end of study*	**Science Poetry Rubric** (Appendix G) Account for performance style in enactment of hip-hop science poetry; to teach students evaluation skills	**Cooperative/Collaborative Team Learning** assessment (S) Assess value of team performance; to develop collaborative skills among students
	Inquiry Investigation Tool (H): To develop science inquiry (science process) skills and science literacy skills	**Classroom Teacher Survey Questions:** Brief informal teacher assessment of student concept formation

The study was implemented in four phases of two class visits per each phase, dependent upon scheduled class time, expanded to a total of eight visits for one of the schools participating in the study. Phase I included a *Pre-Science Learning Survey* for students and teachers, a poetry

creative expression activity, spoken-word science poetry expressing the science unit theme, and an introductory experience to the science unit through a *Inquiry Investigation* tool. Phase II promoted the science unit introductory spoken-word poetry theme and continued progression through the science *Inquiry Investigation* tool experience. Phase III reviewed the spoken-word science poetry introductory science unit theme, continued progression through the science *Inquiry Investigation* tool toward completion of the experience with written entries, introduction of a science unit graphic organizer (Ausubel, 1968; Knight, Spooner, Browder, Smith, & Wood, 2013) and a word bank completion of introductory science poetry. The writing clinic introductory experience included the format for writing about the investigation (Appendix S). Phase IV progressed through the science poetry writing clinic experience, by creating science poetry based on findings of the inquiry investigation. Students were then assisted in preparing creative expression performances to prepare for team science performance productions evaluated by members of audience teams.

Depending upon the scheduled class time, team science performance productions and evaluations were completed on the eighth visit in Phase IV, along with discussions about productions and the final science attitudinal survey. This was implemented to help students make more concrete science concept connections from Phase I, II and Phase III, and to develop a working understanding of science process skills.

A classroom management system was established to insure expedient delivery and implementation for the scheduled period the project would be instituted. A written, "Order of Implementation" lesson plan schedule was prepared for the classroom teachers to guide them through the project. This schedule was discussed with the classroom teacher at the end of each

visit, to help them prepare for events of the next visit, and for input regarding the successes of the experience, or adjustments needed.

A briefing chart listing expected behaviors was posted for students and teacher at the first visit to establish how the researcher might best carry out the mission in a timely manner. The chart was reviewed at the beginning of each visit. This chart was used as a means of reinforcing team behaviors, earning positive representative rewards for appropriately expressed participation. The cumulative reward representations were then deposited in a team pouch, to be traded in at the end of the project for larger rewards. Team cooperation/collaboration badges were worn by students during each class period. Reward representations were distributed most to best team players (Appendix T). Students responded well to expected badge descriptions and duties, so the researcher was empowered to have team members working on more than one duty at a time, making sure other team members accumulated the same information they had received, though working within their duties. This allowed the researcher to complete more experiences during each visit, and coerce students into making sure their team was prepared to earn reward points for most cooperative/collaborative and prepared team. Team members were rewarded with points individually and words of commendation for helping their team become more prepared. Teachers helped to reinforce best team cooperation.

First name badges were created by students to assist the researcher in getting to know students better. On the back of these badges, students wrote two important things that they felt people should know about them. This helped the researcher to establish a better rapport with students, and seemed to motivate students to respond to the implementation of the project with more enthusiasm. Attributes were briefly discussed individually and openly in class, to establish

the worthy individual contributions and style. Students always responded positively to this approach, allowing the researcher to offset negative and inappropriate behavior.

Constructing Validity and Reliability

Threats to internal validity might included investigator posed questions such as (1) Is there congruence of findings with actual reality realized in the study (experiment)? (2) Do measurements of the reality reflect what actually transpired during the study? (3) Do measurements reflect what the investigator initially planned to measure? (4) Does the interpretation of data collectively mirror the perspectives of individuals who are involved in the study, and the investigator?

Internal validity was addressed through (1) Triangulation that included voices from students, teachers, site education caregivers, and multiple assessment instrumentation methods, such as Likert surveys, informal evaluations, rubrics, graphic organizers, and an *Inquiry Investigation* tool; (2) Multiple sources of data from middle school youth coming from several Midwest school districts, specifically tagging data from minority students and teachers; (3) researcher addressed biases, assumptions, reflections, and personal experiences through log journaling memos; (4) videotaping of student experiences, and teacher-permitted audio taping of informal discussions.

For external validity the investigator posed queries such as (1) Can findings of the study be applied or transferred to other situations? (2) Can the results be generalized to other settings or other people? (3) Can in-depth understanding of the phenomena be acquired from the results of the study? (4) Can monitoring of "situation-specific conditions" be developed and evaluated, to make future decisions? (5) Can a generalization be made through extrapolation of events and interactions, in order to construe deeper meaning?

External validity was addressed through a working and evolving hypothesis (Crombach, 1975, Merriam 2009). To establish a context for the study the researcher reflected on the situations and conditions under which data was collected. Additionally, external validity was addressed through conduction of the study at more than one school site, so as to determine if the study could be applied or transferred to other situations, or be generalized for other settings, or other people. Further, to insure external validity, state science standards and other common standards current to the curriculum were addressed so as to assure that the same standards were being addressed for other students, at other locations. This was facilitated through aligning researcher-created assessments with state standards, and assisting teachers in recognizing those standards within their science unit tests.

Reliability was established by setting up an audit trail, and a personal researcher log with memos (Lincoln & Guba, 1985, Merriam 2009) which would support the findings. The researcher referred back to situations and conditions under which certain results were obtained, in order to assess and develop explanations for analyses of some data. Although some assumptions needed to be made about the realities observed, the researcher examined participant interactions in detail, as recorded in the log. This was established as a means of balancing possible biases. Above all, the researcher reviewed the audit trail to try to make sure findings were consistent with the data that emerged, and its interpretation.

Insight and conclusions developed from a study must be those that are true to the realm of experiences of the readers, practitioners, participant subjects, and other researchers (Merriam, 2009). Careful and rigorous attention was given to the way in which this study was conducted, and how data is collected, analyzed, and interpreted, so that the research design supports what was actually being investigated Understanding that reality has many dimensions and is ever-

changing for the investigator, as well as the participants in the investigation, the investigator worked through levels of coding for more in depth revelations.

Shaping the Study

Experiences of a Science Teacher Teaching Hip-Hop Poetry

With the understanding that research has promulgated hip-hop music as heavily critiqued for communication that promotes messages of immoral behavior such as foul language, drug use and selling, sexual impropriety, etc. (Hill, Perez & Irby, 2008), the researcher helped students to develop different types of messages in the science classroom. Those messages that developed a science knowledge base were instituted. Personal teaching experiences in the middle school science classroom setting allowed the researcher to experience significant understanding and retention of science concepts science literacy developed by learners, using spoken-word hip-hop poetry in the science classroom as an art form. This was employed to address science concepts, and increased the science knowledge base and science literacy skills of the urban middle school students. The population of students taught represented numbers of African-American and White students, with a sprinkling of students from Asian, Hispanic, Arab and Indian cultures. The process of creating science poetry by learners was infused into the teaching paradigm as an approach toward retention of learned science concepts. Science concepts were written as rhyming and Haiku poetry. Hip-hop music was used as a backdrop during science poetry presentations by the students. Movement was included in presentations for dramatization of science concepts. As students progressed through inquiry-based investigations and science projects, use of reflection and writing skills were noted throughout the experiential science activities. Teacher recognition of science poetry as an art form became a tool that reinforced concept building during the investigative science teaching experiences.

As the science experiences progressed, students kept organized, extensive science journals in which they recorded reflections. The same students earned highest honors in the regional science fair for their science projects. Some students even influenced, explored, and settled into science careers. Researchers and educators are challenged in their search for strategies that educate students in urban districts, while using opportunities that connect to the worlds of those students. The aforementioned experiences helped to shape the researcher's proposal to conduct this study. The goal is to support other teachers in exploration of a music, drama, and poetry arts-based science teaching approach that might be used as a tool to better facilitate learning for urban youth science literacy skills.

The learning experiences with students have been presented in workshops at the National Science Teachers' Association (NSTA), in hopes of promoting significant strides in science education by students. Significant learning trends in science were also taken to local and regional science teacher conventions for presentation.

A Pilot Study: (I)

Pilot studies shaped the direction of the research study. In a small Midwest, predominantly White school district pilot study, the researcher partnered with another researcher in a qualitative research class. While African American students in this Midwest district had fared better than the state average for all African American students, the state test (MAP) index was lower than the district and state averages for White students. Four White teachers were asked pre-structured questions. The study was initiated from teacher perceptions. The teachers in this Midwest district had taken hours of professional development in social justice advocacy, as part of a year-long study.

The purpose of the research was to elicit through the interviews, approaches, beliefs, and pedagogy by teachers revolving around teaching science to African American students. The importance of this investigation was borne out by research on the demographics of the American teaching force. Since the student population is becoming more diverse and the teacher population is remaining primarily white, middle-class, and female (National Center for Education Statistics, 2007), an examination of this dynamics was explored.

If teacher professional direction was shaped by formative experiences as youth, how was this translated into progressive decisions toward adulthood? What role did teacher pedagogy over time, play in their youth development, and consequently career paths? If teachers can confidently address these queries, how might their teaching practices be influenced? The researcher argues that if teachers can reflectively consider their role in paradigm shifts as change agents in science education, a shift in direction of student science learning could substantiate contentions expressed in this paper.

The time schedule did not permit an opportunity to compare teacher beliefs to actual classroom practices, but implicated the need to revamp how urban students are educated in science surfaced. This information was derived from copious classroom observations and surveys of attitudinal perceptions. As researcher, I approached this study as a former science teacher, who had an interest in racial justice through education.

At the completion of the pilot study the classmate who worked with me as a researcher and I proposed that schools as institutional systems, have been set in motion by the forces of history. The historical context that created public schools sanctioning inequity by race, created the momentum of inequity that originated in the past, yet lives presently. Schools that were

segregated in the past continue to produce "segregated" results. The "segregated' results often exhibit menial education results, perpetuating a growing achievement gap between the dominant group in the system and those of the marginalized group. While resources such as school, community, pedagogical knowledge, content knowledge, and family knowledge can provide a means necessary to effect change in the system, resources alone usually cannot effect significant change. Those resources directly within the system that counter past injustices must be deployed. The agents of change must be critically reflective so that they become aware of the need for change, willing to speak to implementation of appropriate resources.

Teachers are potential agents of change, but if they do not question the outcomes of the system, then they are participants is its persistence. Each of the Midwest teachers in the pilot study shared examples of people or conditions that affected the course of their careers, indicating that role models served as agents of change for them. Teachers surmised that they must act closely within the system to become change agents that change the system to ameliorate disparities, bringing appropriate role models into the equation, for student closer introspection of possible future reality. This pilot study prompted the researcher to examine how teachers can become change agents, and to develop a theory that could seamlessly create a system for them that could ameliorate deficits in the learning process.

Pilot Study II: Incomplete Study with Connecting Human Origins and Cultural Diversity (CHOCD) and the Challenger Learning Center

Pilot Study II became the model for conduction of the final study. Science teacher and students attitudinal surveys targeting Midwest school districts with high African-American populations were administered during a Midwest grant school program and at the Challenger

Learning Center in the Midwest. Arts-based experiences with music, drama, science poetry were explored and implemented for science concept building and development of science literacy skills, during a seven month period. These experiences were intertwined with science inquiry investigations.

In the Midwest grant school program, students participated in several social science, science, and arts experiences. Students did not have opportunity to write hip-hop science poetry, but did write identity-building poetry. Student science surveys indicated that most of them did not perceive themselves as future scientists. The experiential arts and investigative science activities were well received by students, although students were a bit reticent about engaging in hip-hop poetry performances. They seemed to need encouragement to perform their identity poetry in a hip-hop performance format, unless consistently encouraged and validated by adults in the program. Would negative portrayal of hip-hop in the media play a role in the reticence, or are students not confident that their identity portrayal poses will be received well?

A grant program, sponsored by a Midwest university program—Connecting Human Origins and Cultural Diversity (CHOCD), promoted development of self-identity skills. Experiential activities in the program guided and encouraged students to create a personal society in which to live, to include governmental components. Components of this program include historical and archeological evidence of the origins of man that might validate self-identity formation for urban students.

Professional development was carried out at the Midwest Challenger Learning Center, before students came to visit for the simulated, science career-based activities. Since teachers were provided with post visit activities through a thumb-drive storage unit and website drop box,

the researcher solicited to become part of the post visit activities for designated class periods consented to by teachers. The researcher visited the school location for 6-8 visits. The post visits to selected classrooms were established to reinforce the arts/science poetry connection, science concept- building, and science literacy skills with teacher and students. The students were trained through the same processes their classroom teacher had experienced, during professional development. Teachers were very receptive. The tightly scheduled internship period did not allow time for post-visit activities with the students in their classrooms, but posed opportunities for recruitment of teacher participation after Institutional Review Board approval.

At the Challenger Learning Center Program, students address the arts through (1) drama: simulated experiences on space missions—operating within a framework of technology (computer representations and cameras within the system): (2) drama from simulated experiences prompting students to operate within a drama presentation, prompted from a Commander's control board; (3) drama, as students view monitors while viewing launch and exit from earth into space from monitors on the space craft (accompanying music during liftoff and explanation of journey); (4) music, as a victory song was initiated and played for a particular success on a mission (4) visual art, as K-5 students designed rockets (5) drama, as the communications officer used a hand-held video camera to interview astronaut officers on the mission, to be taken back to the school site; and (6) task cards for K-4 represented visual illustrations for carrying out grade level appropriate procedural instructions, as a support system to literacy.

The Challenger Learning Center was chosen as a base of operations for the arts approach, using music, drama, and science poetry to facilitate the learning of science literacy skills, as a

result of teacher and students observations, during an internship with connections to arts-based experiences.

Chapter Summary

Might culturally responsive programs, intertwined with science inquiry investigations/experiments, using hip-hop spoken-word science poetry performances, better prepare middle school urban youth for development of science literacy skills? A methodology was created to build a foundation to more expediently prepare urban middle school youth to use acquired knowledge and science skills, and to address critical thinking skills in inquiry science experiences and problem-based science experiences. The hope was that the obtained skills and knowledge be projected into possible solutions to real-world science issues.

Middle school students (grades 6-8) were chosen for this study because, based on NAEP (National Assessment of Educational Progress, 2009), there is a disconnect in science aptitude for students leaving elementary schools, entering middle school. The researcher used a methodology to examine how the chasm could be breached, in order to raise the level of science achievement during the middle school years. It is hoped that this progress in science achievement would manifest itself in the high school years, possibly soliciting science learners into considering science as a career direction during the college years.

Science spoken-word poetry productions, intertwined with science inquiry investigations were used in a hip-hop format performance, to reach into the world of urban student literacy practices and music away from school. This has been defined as a performance arts approach. This strategy has been prompted in order to determine if the training for the science poetry productions, using multiple assessments and triangulation, enhances learning for a science unit

and elevates science achievement. The procedure for this method was shaped by pilot studies. The methodology was designed to incorporate state science standards and other common science standards current to the curriculum to insure external validity.

CHAPTER 4

RESULTS and ANALYSIS

Will engagement of urban middle school youth in the creation of spoken-word hip-hop science poetry performances engender an increase in science literacy skills? The research study was conducted in middle school settings in school districts having large populations of African-American and Latino students. The study was established as a means of examining a theory of science methodology implementation that could significantly increase science achievement and interest in science for this population of students.

Results and Observations

When the researcher visited the classroom the first time at each school, the students were excited about the rhythmic/musical way of learning science concepts. Interestingly, however, students kept watching the classroom teacher as the researcher was giving instruction, as if needing to get permission to engage in science learning in this manner. A "bridge" had been developed by the researcher to assist the students in realizing the central theme for the science unit. This bridge, which represented repetitious poetry set to be performed with a music backdrop, was performed at the beginning of every visit.

The classroom teacher had been given a copy of the bridge and the music to assist in navigating through mini discussions at the end of each session. All other science poetry related to the science unit was created by the researcher to save time, because the teacher's schedule did not allow enough time for an intense writing clinic that would give training to students and teachers.

The first student teams assessed performance productions by using the entire Science Poetry Rubric page (Appendix G). After reviewing the responses, it was noted that they were being asked to evaluate poetry that had already been written by the researcher. Even though students did not know who created the poetry, their responses tended to steer toward the "B" performance on the evaluation list, regarding the quality of the presentation. Individual students completed a rubric form, even though teams were asked to discuss what was learned, and write that information on the back of the rubric. All of the students did not write responses, or they wrote vague responses. Of the ones who wrote responses, no specific science facts were written. Student performance teams did not adequately express science concepts learned, perhaps, because students had not acquired a firm grasp of the concepts learned through the classroom teacher and through the researcher science poetry training sessions. It was determined that students had to focus on too many categories on the rubric, while evaluating performance, which was overwhelming.

The second set of student teams of two separate classrooms, were assessed through a performance rubric by the classroom teacher and their peers, as well. For these two classrooms, all other areas of the rubric were excerpted, except for the presentation section, to simplify the evaluation process. Students were not asked to write what they had learned on the back of the rubric evaluation sheet. Students were given a sheet with front to back presentation sections only, and told to number each by number of teams in the classroom. They evaluated only the performances of student teams. Students were asked to circle one box on the rubric that best explained the quality of performance of the student team. Discussion ensued after each performance among the teams, but students evaluated each team on their own individual forms. Of the evaluated responses, most students placed teams in the "Admirable B" range. This was

based on listed phrase evaluation standards. This explanation identified students as having "good spoken-word lyrics and movement, kept the audience attention and interest, and "had good flow". The students seemed more focused on team performances as a result.

The Science Poetry Rubric (Appendix G) involved the students in evaluating higher order thinking skills for the peer teams during the final science literacy skill productions/performances. Student teams seemed to understand how to use the rubric better, circling proper categories for each component of the performance section of the rubric. The researcher determined that students needed to participate in creative expression experiences in order to better perform concepts during their performances. The connection to the arts needed to be more thoroughly reviewed before discussing it after their science poetry performance/productions.

The classroom teacher asked students teams to evaluate their own performance after going back to their seats. Of the few teams who chose to evaluate their performance using the performance rubric the largest percentage of them graded themselves in the "B", admirable range. Rubric evaluations were briefly discussed before students began evaluation of teams.

The writing clinic was then relegated to writing poetry for the science inquiry investigation that was begun in the earliest stages of the science literacy skill development training exercises. The researcher established a sequential schedule of experiences for the weeks to come so that the classroom teacher copies on written experiences could coincide with actual progression of experiences.

Student Reflections

Student teams were asked to assess the impact of their performance productions as presentations to classroom students (Appendix E). Most students were able to express what they needed to do in order to perform optimally. Comments for self-assessment question regarding changes they would make in the next performance included specific common comments.

Researcher: What would you change in your next performance?

Student Teams: "To speak louder. I was scared to go help there."

"To speak more loudly"

"How much we laughed"

"Put some more words in it, or more moves"

"More movement"

"I would change how my performance…I would sing"

"The acting"

Students were to act out the concepts learned throughout the science unit, as they spoke the words. They were nervous, but were very interested in performing, as early instruction suggested that student team performances would be part of a contest. Most teams performed best when they were singing a poetry section called the "bridge", a chorus that promotes the main theme of the science unit. While students practiced for part of three class sessions with the hip-hop rhythmic music to be used for performances, when visiting with groups and advising them on moves for acting out the concepts, they tended to be very literal and limited in development of

creative expression. They wanted to use props, instead of developing creative expression through movement of the body, as suggested early on in the study with classroom groups.

Researcher: Based on your spoken-word science poetry, how did you know what to act out in your performance?

Student teams: "We read over and over, so we got it."

"There were words that we could act out."

"There were words that we knew we could make action to."

"It had key words."

"The fill in the blank words helped."

"My group made up dances and what we can do in the play"

Responses indicate to the researcher that students were assisted with their science learning through key science vocabulary words. The key words seemed to reinforce their connection to the science concepts in order for them to determine what kind of action could be performed for their assigned part of the presentation. Vocabulary was emphasized through the connections on their color-coded graphic organizer (Appendix I) establishing science concepts for the complete science unit. Vocabulary specific to a science unit was also emphasized through the vocabulary word bank poetry exercise (Appendices J-P), and the "Word Families" chart used during the writing clinic, to assist students in writing rhyming poetry using vocabulary words from their science unit. Vocabulary development was clearly a critical component in reinforcing science concepts.

Researcher: Did the performance help you understand science better? Explain.

Student teams:"I will say yes, because it was a song, and songs help me."

"Yes, it did, because it talked to me about the food web."

"Yes, because of the way we responded and moved to the words."

"Yes, it was ok at first, the way we was doing—to say it was helping."

"We kind of had more worries with the choreography than the lyrics."

"No, because we barely acted out the performance."

Here again, is mention of a reference to the song, which was written by the researcher as the "bridge" to establish a common theme of science concepts within the science unit. The reference to the song was made during comments regarding what students might consider changing for their next performance, to make the performance better. The singing and reference to the lyrics, reinforced the discovery that students responded better to poetry that was set to create a song. The song seemed to empower them to assess what movements they needed to act out in order to represent the science concept, and to keep the presentation flowing. The researcher had engaged students as a class for the "bridge" movements, and as teams to help them to determine what a move should look like, based on the science concept presented.

Researcher: What advice would you give to someone to help them make science easier to learn?

Student Teams: "Try to put together a fun activity."

"Advice I would give them is to learn science in a creative way."

"I would break it down."

"Study for a little at home."

"Do the songs."

"Do some research at home."

"Try harder."

Again, "Do the songs" was mentioned by teams of students, reinforcing previous researcher reflections. Since large populations of African American and Latino students were serviced through this study, the research gathered by the researcher/investigator tends to reinforce away from school literacy practices of these youth, including those such as rap music. Instrumental rap music was the mainstay backdrop for the science poetry presentation performances. Some students even mentioned that some work should be done at home, fusing their school literacy with their away from school literacy.

Students were asked, "What science concepts did you learn, as you performed?

"Decomposers break them down"

"Producers make their own food."

"Plants make their own food."

"Living things carry out activities to survive."

"The food webs are different."

"There are different animals that eat other animals."

"About the food web."

This group of students worked through a science unit on ecology and food webs. While the students worked in teams of 3-4 to record responses, not all teams responded to all questions. Of those that did respond, the most important concepts were remembered by the students. When a team responded by saying, "Decomposers break them down", the researcher was able to read between the lines to assume that the team meant that decomposers break down remains of living things, because students were able to use the graphic organizer and the word bank poetry to shape their responses.

Student science learning throughout the school year had been of a traditional nature, using a textbook, and possible related science activities. When student comments revolved around developing a fun activity to make science learning easier, or learning science in a creative way, the researcher was supported in a methodological theory that promotes performance arts-based experiences as a mode of learning that assists students in learning science easier. Students gave that same advice to other science learners. The team mentioned that the material should be broken down. The researcher assumed that this would help them understand the material better, so the color-coded graphic organizer was researcher-created to break down information into small meaningful chunks to connect science concepts better. Their classroom teachers marveled at their grasp of science concepts using this method. The graphic organizer (Appendix J) was used to help students complete the word bank exercise. The graphic organizer was utilized as a means for instructor directed development of main concepts of a unit, as the growing document accumulated pockets of science concepts, when new concepts were learned. The graphic organizer also served as a reference for organizing concept flow in small enough chunks that learners would not be overwhelmed. A new graphic organizer was developed for each new science unit.

Since students seemed a bit reticent about learning science through a performance arts-based format, some may not have been motivated to become more engaged in preparing for the performance presentation, so one of the teams mentioned that students should "Try harder" in order to represent their cultural capital. A homework paper was prepared for students to practice at home for the "bridge", but school scheduling did not allow for additional in-school practice beyond the times that the researcher would engage with students.

Team self evaluations indicated that improvement was needed in some areas, but they seemed to be based on audience reaction to performance productions. Most teams felt that they could have been more enthusiastic in their production presentation. Students seemed unsure of how well science concepts were expressed. Time was an element in allowing students to exchange the content of their evaluations and to give feedback to performing teams. However, most teams indicated that they should have been "practicing more". It is crucial to establish discussion time among teams to add to assessment of team productions, and the self evaluations of their performances. The scheduling of the classroom teacher did not allow for practice at times when the researcher was not visiting. Students would have needed follow-through at other times of the week, because the researcher asked for 45-60 minutes per visit once a week, for a total of eight visits, to indoctrinate students. It is very difficult for students to establish continuity without having at least one other day of follow-through.

Since the graphic organizer and the science inquiry tool were established to connect science concept development and to develop science process skills respectively, it was felt that students would better be able to demonstrate learned skills through their performances. Implications are that the tools established by the researcher to address pre-conceived student skills encompassed their skill development, but creative expression was a critical element needed

toward performance productions so that understanding of performed concepts would be addressed more expediently. The students tended to be very literal about how they presented their final productions, not really exploring the science concepts and the engagement of them.

Since teachers were given a folder of activities presented to and implemented with students, some teachers used the same sequential process to implement the science unit to other classes they taught. Discussions indicated that they understood why the sequence had been implemented in that manner. Use of a graphic organizer to connect clusters of concepts was shown to be especially beneficial to students, as espoused by teachers-in-training in this process. Teachers expressed amazement at how comfortably students at the grade 6 level used the graphic organizer to complete concepts using a word bank. The researcher created a custom-made final reflections questionnaire for teachers, to assess if their needs were met through project completion. Teachers interviewed indicated that the investigator-created graphic organizer used to help students connect science concepts thoroughly reflected what was covered in class.

A writing clinic was instituted to give students more training in creating science spoken-word poetry, using the graphic organizer and the inquiry investigation tool. Teachers felt that "more time spent on the writing would have been beneficial". The investigator had hoped that since visits were made only once a week, that teachers might have time to follow-through with the writing process. It is not clear whether teachers lacked enough time in their schedules or were not sure how to follow-through. Implications are that the investigator should spend more time with teachers and students for the writing process, since science teachers were implementing the process. The line-through text revision method was used to help students complete science poetry drafts, by asking them to draw a line through text not to be used as part of the final draft.

However a teacher stated: “I believe the use of different colored texts would accurately depict the changes made, while preserving original ideas.”

Results of Likert Science Learning Surveys

Teachers and students were administered a Likert Pre-Science Survey *Pre-Science Learning Survey* (Appendices A, B) at the onset of the study to measure attitudes about previous science learning, before the performance arts/science treatment was implemented, and the Likert *Final Learning Science Survey (*Appendices C,D) at the end of the study. The *Final Learning Science Survey* was administered to determine if the training approach through the performance arts had changed perspectives and attitudes toward science learning. The study was designed to examine the responses exhibited on science survey attitudinal responses on a spectrum of 1.0 (least likely felt) to 5.0 (most likely felt) on Likert *Pre-Science Science Learning Survey* questions (Appendices A, B), for teachers and students participating in the study. Teacher and student Likert *Pre-Science Learning Survey* questions were patterned to match each other, per each listed question. Teacher surveys included a brief culturally responsive component.

The results of the *Student Pre-Science Learning Survey* (Table 4.1) related that, of the 53 students surveyed, they were more likely to feel that they understood the science taught in school (mean 3.62), and that the science that they did learn would help them take better care of their health (mean 3.70). Students were likely to feel that science would help them in their everyday lives (mean 3.13), liked learning about science (mean 3.23), that science could help them in other classes (mean 3.06), and that the sci-fi movies seen on television depict real science (mean 2.58).

Students were not likely to think that science helped them with their chores at home (mean 2.32), help them play video games (mean 2.17), play sports better (mean 2.42), or see

themselves becoming a scientist one day (mean1.92). It would appear that students felt they knew science, but were not able to make connections to the science learned and how that science operated within the confines of their lives. Therefore, they could not see themselves doing science daily, and further, taking that understanding toward becoming a scientist. This reinforced the premise that students must see the function/drama of science concepts in action, in order to see that they are operating within the concepts. The performing arts approach allowed them to operate within and perform within the science concepts in order to see how they were carried out.

TABLE 4.1 *Descriptive Statistics for 6th Grade Student Pre-Learning Science Survey (N=53)*

Science Survey Questions	Mean	Std. Dev.
The things I learn in science help me in my everyday life.	3.13	.921
I understand science taught in my class.	3.62	1.113
I like learning about science.	3.23	1.515
The things I learn in science can help me in my other classes.	3.06	1.045
The things I learn in science can help me with chores in my home.	2.32	1.088
The things I learn in science can help me play video games.	2.17	1.252
The things I learn through science can help me take better care of my health.	3.70	1.102
The Sci-Fi movies seen on television show real science.	2.58	1.167
The things I learn in science can help me play sports better.	2.42	1.278
I can see myself becoming a scientist one day.	1.92	1.313

Note: The table is the output of the SPSS statistical analysis of the Student Pre-Learning Science Survey conducted. 1=least likely. 2= Not likely. 3= Likely. 4=More likely. 5= Most likely. N= Number of students.

In descriptive statistics for *Teacher Pre-Science Learning Survey* questions (Table 4.2), attitudes of teacher swerved toward very positive expressions about science learning. Ninety percent of the responses from the two teachers indicated they were most likely to think along positive lines (mean 4.50 to 5.0) for questions 2 through 9, for the *Pre-Learning Science Survey*. The science teachers understood science taught throughout their school years, helped them take better care of their health, helped them to understand popular events in their lives, and had taken science courses during their college years. Teachers felt that students needed to be better prepared for science learning, that students learned best through exploratory hands-on approaches, and that students learned best when they explored and reflected on what was learned.

Teachers were more likely to have liked learning about science and that culturally responsive approaches exhibited the best practices for teaching science to urban students (mean 4.0). This indicates that science teachers were very open to utilizing science teaching approaches best suited for the population of students they taught. They generally seemed to have had positive experiences during their years of formative science learning, and could connect that science learning to daily living experiences.

TABLE 4.2: *Descriptive Statistics for Grade 6 Teacher Pre-Science Learning Survey (N=2)*

Science Survey Questions	Mean	Std. Dev.
I liked learning about science when I was in school.	4.00	.000
I understood science taught throughout my school years.	4.50	.707
The things I learned through science have helped me take better care of my health.	4.50	.707 .
The things I learned through science have helped me understand popular events in my life better.	5.00	.000
I took science courses during my college years.	5.00	.000
I have considered becoming a science teacher.	5.00	.000
I believe that children need to be better prepared for science learning.	5.00	.000
I believe children learn science best when they can explore it in a hands-on approach.	5.00	.000
I believe children learn science best when they can explore and reflect about what was learned.	4.00	.000 .
Including "culturally responsive" approaches to science learning helps African-American children learn science more easily and better.	4.00	.000 .

Note: The table is the output of the SPSS statistical analysis of the Teacher Pre-Learning Science Survey conducted. 1=least likely. 2= Not likely. 3= Likely. 4=More likely. 5= Most likely. N= Number of teachers.

The final student and teacher *Learning Science Survey* was administered at the end of the last class session. It was designed to measure connections to the arts approach in learning science and to determine if the arts approach engendered enough of a positive attitude toward this method of science learning. This study was developed to see if the arts approach would steer youth toward science careers, if taught science through this method, and to determine if it would engender learning science throughout their further school experiences.

In responding to questions 1-4, of the 53 students surveyed for the *Final Learning Science Survey*, the majority of them indicated that they were likely to understand science when taught using the arts approach, The findings would suggest that (1) students could learn science while listening and moving to music (mean 2.81), and that (2) they could understand science through drawing, painting or photography (mean 3.02). Students indicated that (1) writing poetry or other writing projects could help them understand science (mean 2.51), and (2) that acting in a skit, play, or other drama could help them understand science (mean 3.45). However, even though learning through this method appeared to be fun for them, they did not appear to see how the arts approach to science learning would encourage them to become scientists (mean 2.34). This prompted the researcher to muse over what better connections could have been made during the entire process to help students to make connections between how they had learned science during the sessions to the arts. The researcher could also have made more connections to how scientists learn from their inquiries to develop theories by having them observe scientists investigating to develop theories. During the initial visit to the classroom, while using this method, the researcher did notice some skepticism in student acceptance and engagement. This means student confidence in processing through science inquiry investigations would need to be re-visited consistently.

TABLE 4.3: *Descriptive Statistics for 6th Grade Student Final Learning in Science Survey (N=53)*

Science Survey Questions	Mean	Std. Dev.
I can learn science while listening and moving to music.	2.81	1.110
Drawing, painting, or photography can help me understand science.	3.02	.951
Writing poetry, or other writing projects, can help me understand science.	2.51	1.085
Acting in a skit, play, or other drama can help me understand science.	3.45	1.136
I can see myself becoming a scientist one day.	2.34	1.159

Note: The table is the output of the SPSS statistical analysis of the Student Pre-Learning Science Survey conducted. 1=least likely. 2= Not likely. 3= Likely. 4=More likely. 5= Most likely. N= Number of students.

The two teachers participating in the study continued to exhibit positive thinking directions for science surveys. The *Final Learning Science Survey* showed most likely responses to (1) writing poetry (mean 5.0), (2) acting in a skit, play, or other drama (mean 5.0), and (3) drawing painting, or photography exercises (mean 5.0). More likely responses appeared in the area of using music as a tool for teaching (mean 4.0). Teachers were more likely to think that using culturally responsive approaches in teaching science would meet the learning needs of students (mean 4.0).

TABLE 4.4: *Descriptive Statistics for Teacher Final Learning in Science Survey (N=2)*

Science Survey Questionnaire	Mean
Students can learn science while listening and moving to music.	4.00
Writing poetry or other narratives can help students learn science .	5.0
Drawing, painting, or photography can help students learn science.	5.0 .
Acting in a skit, play, or other drama can help students learn science.	5.0
Including "culturally responsive" approaches allows for the learning needs of students to be met.	4.0

Note: The table is the output of the SPSS statistical analysis of the Teacher Pre-Learning Science Survey conducted. 1=least likely. 2= Not likely. 3= Likely. 4=More likely. 5= Most likely. N= Number of teachers.

C**hapter Summary**

Would creation of spoken-word hip-hop science poetry performances, intertwined with science inquiry investigations/experiments, engender an increase in science literacy skills for middle school students? Responses from teachers and students indicate that this approach, implemented in a scaffolding process, shows promise. During initial visits to classrooms, the researcher did notice some uncertainty and skepticism in student and teacher acceptance and engagement. Student performance teams did struggle with adequately expressing science concepts learned. However, as students progressed through the phases of implementation, both teacher and student seemed to become more engaged and confident, indicative of a need to navigate through the process more consistently, and more often.

Initially, students did not seem to make appropriate connections from learned science to actual operation of those concepts. The researcher surmised that they did not see science operationally enacted in their everyday lives. Students did not seem to envision how science concepts manifested themselves in their daily lives. It was crucial to address real life connection as science was being taught in school by participation in science inquiry investigations, field experiences, and investigations with science professionals. This observation supported the NAEP report that middle school students were less able to explain findings in an investigation, or project them into similar and different circumstances. More consistent efforts in developing science inquiry processes and connecting that process to the performing arts would seem to strengthen student literacy skills and confidence in science learning.

Students did not seem to see themselves doing science daily, and further, taking that understanding to becoming a scientist. This reinforces the premise that students must see the

function/drama of science concepts in action, in order to see that they are operating within the concepts. The performing arts approach allowed them to operate within and perform within the science concepts, in order to see how they exhibited themselves. The performing arts approach would seem to allow students to develop better images of science in operation, by reinforcing better memory retention and process skills that are necessary for problem-solving. Better memory retention skills would allow students to recall science concepts/ideas more readily, in order to project themselves into similar and different science circumstances that would allow them to make transferences.

CHAPTER 5

DISCUSSION/CONCLUSIONS

The theoretical framework for this study was grounded in the use of culturally relevant pedagogy (Gay, 2000) and culturally responsive teaching. Theories surrounding science literacy skill development (Taylor & Francis, 2010), and a review of NAEP (National Achievement of Educational Progress) science scores of African Americans to examine ability levels, prompted the researcher re-examine what perspectives and skills were needed for African-American learners to develop science literacy skills. Theories surrounding science literacy skill development were reviewed through the researcher's training as a science curriculum writer. The researcher embarked on a journey to determine how to re-direct low achievement using the cultural capital of African-American youth to develop a means of motivating middle school students toward higher achievement levels.

This study explored literacy disparities in science. These disparities continued to plague science academic achievement levels in schools in urban communities, and have placed America in an achievement gap compared to industrialized nations around the world. Historical and societal issues presenedt themselves, as an ever-widening gap of underachievement between African-Americans, Latinos, and the dominant White social group. However, while America focused its attention on achievement gaps between social groups in the United States, instead of the manner in which America educated all of its youth in the areas of STEM (Science, Technology, Engineering, Math), critical attention was diverted from its mediocre achievement globally. These areas of learning continue to be gatekeepers to innovation and economic leadership among nations.

Since the achievement gap continued to exist, the researcher initiated this study to decrease or eliminate the disparity in science achievement among urban science learners and learners of the dominant White society. However, research caused a greater issue to surface. Research uncovered the fact that science learners in the United States, fell progressively behind other industrialized nations in math and science performance. This discovery causds the researcher to realize that the issue is not just about an achievement gap, but more about the manner in which science learners have been educated in the United States, prompting a closer look at systemic practices used in science teaching. The researcher's study offered a scaffolding integrative approach using culturally responsive hip-hop performance arts, proven to increase literacy in major subject areas for urban middle school students, in particular, science. Thus the need to blame was decreased, and practices were examined that influenced maximum performance from science learners from all backgrounds, as their creative self awareness was piqued, and their self efficacy is stroked.

This deficit in science performance spoke to a trend that was detrimental to the self-efficacy and advancement of urban youth. Without laying a proper foundation for science literacy, the disturbing trend continued to escalate and these youth would continue to struggle, being branded as working within a "deficit model" throughout middle and high school. How can they then, be empowered to consider becoming a scientist?

If remedial and compensatory programs were not decreasing or eliminating the achievement gap in science, then the goal had to be to replace them with programs that addressed the disparity, with more significant results. This study would overlay the recommendations of Norman, Ault Jr., Bentz, and Meskimen (2001) as an approach that minimized blaming society, or blaming the victim and their family, for the for lack of urban youth science academic

achievement and performance. Urban students, historically relegated to a tracking system in schools, and in like manner subconsciously relegated similarly in society, could inadvertently perpetuate an achievement divide. Curriculum programs should be reflective directly and progressively, toward influencing and ameliorating evidenced issues projected to empower learners, rather than force teachers to relinquish empowerment. The researcher determined that culturally responsive programs using hip-hop art forms of spoken-word poetry and music performances, embedded with science inquiry investigations empowered African-American urban youth self efficacy, as well as science academic achievement. Since the hip-hop science poetry training sessions were connected to science inquiry investigation experiences, students were more engaged in creating and enacting re-interpreted science concepts. Student use of written science observations for poetry from their science Inquiry Investigation tool, and graphic organizer concept-building charts of meaningful information chunks and connections, seemed to better guide students through engaging in science process skills. Students exhibited better understanding of science concepts being taught for science units.

A creativity factor exhibited in the performance arts experience, such as programs with hip-hop art forms, mimicked process skills represented in science inquiry investigations. While participating in a performance arts drama to represent science concepts, students were engaged in comprehension of science concepts from multiple perspectives, ushering in a feeling that science could be fun and exciting (Varelas et al 2010). Nicholas and Ng (2008) proposed that creativity allowed students to draw on communication skills allowed higher-order skills represented in science inquiry process skills to emerge. Abstract science concepts then became more concrete, representing visual images to the learner that constructed unique outcomes. Learners were then

assisted in making better associations and connections to science in action around them, especially crucial to realizing science manifestations in their daily lives.

This study had as its foundation the suggestions of Koballa and Glynn (2007). Science learning experiences that were fun and personally fulfilling could foster positive attitudes and heighten motivation toward science learning, which improved science learning and achievement. Attention to student attitudes meant giving them a voice to motivate effective outcomes of science learning. As a result this study employed elements of the hip-hop culture to heighten motivation for learning science. Science attitudinal surveys were administered to students and teachers at the onset of the study to determine perspectives about learning science in the formative years. From that survey data the researcher postulated that students liked learning about science, but did not see application of everyday experiences as related to science. The researcher developed an approach that appeared to motivate students and elicit responses that showed students having fun learning science. The attitudinal survey showcasing performance arts through learning science administered at the end of the study indicated that acting in a skit, play, or other drama helped students to understand science better. Student teams collaborated to create movements and gestures for their hip-hop science poetry performances to enact science concepts as a part of the drama element of the arts. Teachers completing the science/performing arts survey perceived that this approach would help their urban students learn science more easily, and mean scores exhibited high expectations for the approach. The researcher corroborated the perspective of Koballa and Glynn based on student comments and observations of students participating in the learning process, and high expectations from teachers. Policy makers can play a crucial role as advocates of alterations in traditional science teaching.. Professional development opportunities should be provided for teachers to help prepare them to

encourage unmotivated science learners. Teachers can improve learner attitudes by including instruction that would emphasize active learning exhibited in this study, and the relevance of science in students' daily lives.

The investigating researcher's teaching strategy in this proposal was grounded through the lens of cornerstone theorists, to build an argument for addressing human learning patterns of evolving diverse student populations. Several theorists promoted experiential learning, exploration, and attention to prior knowledge to anchor instruction, to allow for better understanding and relevance to the learner. As the student voices were heard in this study, the research supported the researcher's systematic approach of a cultural performance arts/science connection. This approach seemed to be seamlessly infused into traditional curriculums to address learning for evolving diverse student populations. The research in this study examined mediocre achievement in science literacy and science process skills of youth in urban communities. The goal was to determine what could be done to harness the intellectual capital that youth enter classrooms with in urban communities, which having been demonstrated were elements of their cultural background. The researcher strongly suggested that the elements could steer them toward actualizing science as part of their daily literacy and as a future career goal.

A culturally responsive performance arts/science connection was implemented that could significantly increase science literacy skills of youth in urban communities. Research dictated that a system be developed to harness the intellectual capital that youth in urban communities already possess, which were elements of hip-hop culture, to establish a strategy intertwining science inquiry investigations with performing arts experiences. The researcher theorized that this approach would serve as an innocuous system that would more expediently prepare urban middle school urban youth to use their cultural capital, and their acquired knowledge and skills.

This study was designed to address critical thinking skills in inquiry science and problem-based science learning experiences. In addition, the established system was designed to assist teachers in seamlessly and realistically developing those skills in urban youth. This methodology proposed that the culturally responsive performing arts format, which utilized elements of hip-hop culture, be used for awakening urban youth to a cultural way of knowing, as a means of preparing for science learning achievement and science careers.

The National Arts Education Association (Eisner, 2002), credited the arts with lessons that teach critical thinking skills. Research has shown that skills of the arts promoted science inquiry skills necessary for children to explore their capabilities. Science inquiry required cyclical processes that fostered observation, discovery, questioning, reflection, and scientific thinking, within an investigative experience. Empowering children to address problem-based science learning while engaging in science inquiry investigations, mimic real-world experiences and elicit critical thinking skills.

A 2009 NAEP report clearly indicated that there was an evident gap in science test score averages among Black, White and Latino learners. Serious attention to how African-American and Latino student learners have been educated in science, as well as Whites, was in question. This trend was especially alarming in science, because students may have participated in a deficient model since elementary school. As the trend filtered into middle school, serious re-dress needed to be taken to ameliorate the deficit model, and to prepare all students to compete globally in science career development. Although science achievement among cultural social groups in America needed to be seriously addressed, the NAEP report indicated that the major shortfall in science education was the lack of attention to process skills such as interpreting, analyzing, formulating hypotheses, and discovering patterns in science. Students showed that

they had acquired content knowledge, but were not able to extrapolate that knowledge to project it into new science situations. The researcher intertwined an inquiry investigation using a *Science Inquiry Investigation* tool (Appendix H) with the training for the hip-hop science poetry performance arts production. This approach was established to introduce students to a systematic approach of engaging in science process skills. Since findings of the science inquiry investigation were used to create science poetry and a culminating performance arts production, student comments from the *Middle School Student/s Self-Assessment Journaling Questions* (Appendix E) reinforced to the researcher that science process skills and learning of science content were enhanced.

Studies suggested that some teachers believed that traditional methods were the most effective strategy for teaching science, while others purported their vision of science teaching that was aligned with state and national standards. However, both methods have presented a shortfall in student science achievement. Both strategies were accomplished through this conducted study, with the added flair of motivating urban students through their cultural way of knowing and significantly increasing science achievement, with minimal changes to the traditional science curriculum.

The content knowledge of teachers surfaced as one issue in enacting highly effective science teaching in classrooms, thus teachers avoided teaching science (Jones & Carter, 2007). Difficulty maintaining classroom discipline, and uncertainty about how to implement an inquiry lesson, posed themselves as issues toward effectively teaching science. These issues caused teachers to be unsure as to how to lead a class discussion that helped learners make sense of collected data. However, these issues were more easily addressed than attitudes and beliefs of teachers. Addressing teacher attitudes and beliefs would promote student-centered teacher

practice, significant pre-service teacher induction into the teaching arena, and developmentally sequenced professional development programs. Professional development methods could be crucial to teacher knowledge if teachers were to be supported with sufficient time to develop skills. Thus teachers would be given time to examine attitude and belief systems that would aid in better understanding of the complex systems that shaped them.

Socio-cultural context, significant to understanding instructional practices in the classroom had only recently been recognized as critical. The decision-making process in instructional settings can be complex, especially in regards to the decisive role teacher beliefs play in affecting and reforming science education. According to Jones and Carter (2007) there was emerging evidence that patterns in belief systems can be identified across cultures and contexts, and influenced developmental trends as teachers move along a continuum from novice to expert instructor. This complex belief system influenced how teachers interacted with students and their willingness to try new instructional methods. This belief system had been embedded into the larger socio-cultural context of students, their families, administrators, the community in which they resided, and government policy-making.

Pre-service teachers coming into teaching arena had been found to lack the dispositions to effectively teach diverse students, reducing successful facilitation of learning in the classroom. According the National Center for Education Statistics (2007), 70% of this future teaching force will be White females. It has been suggested that teacher disposition would play a critical role in the quality of student learning, because it along with teacher preparation, tended to determine practice in the classroom.

"Dysconscious racism", which presented itself as a lack of awareness, or unwillingness to acknowledge societal inequalities, seeped in, causing teachers to play a role of relinquished empowerment, stymied to bring equitable outcomes for diverse students. Urban areas would be where many of the future teaching force of White females would be heading to teach (Lewis et al, 2002, King, 1991, Howard, 2003; Brown-Jeffy & Cooper, 2011; Borrero, Yeh, Cruz, & Suda, 2012). Teachers may have been influenced by lack of knowledge about diverse student populations, how cultural differences may contribute to deficits in learning progress, and may not have received proper professional development that could re-shape attitudes and beliefs. They would be coming to a teaching environment in which their foundation and reference may be meager. Therefore the ideology from this study would suggest that curriculum development that utilized cultural way of knowing as a backdrop could empower teachers as co-constructors of a learning environment that would empower the science learning of their urban students.

This study superimposed itself upon the ideology of Wright (2011) and Emdin (2011) that the *Critical Race Theory* can be re-dressed to create an expanded view of African American students as science learners. This expanded view could bring illumination to, and validate the everyday practices of African-American students. Teachers and educators would then be challenged to develop pedagogy and curriculum strategies that would not trivialize the connections between everyday literacy practices of learners and school-based knowledge. This expanded perception required the development of a deep understanding of the subject matter, as well as a capacity to overcome deficit assumptions about the nature of literacy practices of the students, in order to usher in a paradigm shift in teaching practice. Teachers would need to consider personal cultural expectations, or risk unwittingly contributing to persistent attitudinal differences that could cause a disconnection between them and their urban students.

This study posed to create a school environment in which socialization could reinforce and influence institutional ideology, by practices used in engaging with urban students. Narrative comments in this study were explicit as to how this could be realized in a traditional classroom among students, and with students and teachers. Socialization shaped student expectations about their place among each other, their family structure, and in a stratified society (Grant & Sleeter, 1988). Youth of color and students from under-or unemployed families, felt at odds with their academic and cultural worlds (Xiu, 2006), reinforcing a disconnectedness to their academic environment (Nasir & Saxe, 2003; Olsen, 1997), even though they brought a rich personal cultural agency to society. They experienced an "Othering" perception, which created a barrier to academic achievement (Kumashiro, 2000). "Othering" further promulgated personal, social, cultural, and historical experiences involving (a)" cultural and racial ambiguity, (b) categorization and labeling, (c) hierarchical power dynamics, and (d) limited access to resources." (Kumashiro, 2000). The importance of one group can be diminished in comparison to another group supported by more resources and opportunities (Bucholtz & Hall, 2004). This "socially constructed practice" would silence the voices and customs of other groups, creating protecting actions that distanced those that are advantaged, from those who are not. Students may find themselves labeled with deficit model stereotyping, as being "poor, primitive, uneducated, lazy, unmotivated, and unresponsive to interventions and programs" (Kana'iaupuni, 2005). This can reinforce a deficit model with a persistent belief showcasing that minority students as low achievers and uneducable (Howard, 2003. This ideology created culturally alienating structures in schools (Zentella, 1997), and absolved school systems who educated these alienated students of the acute responsibility for adequately educating appropriately (Bernard, 1996). Remnants of this disconnected, unresponsive behavior was specifically observed in youth initial response to

the hip-hop science performance arts approach. Students seemed reluctant to immerse themselves in the approach, often looking at their teachers to get permission to participate. Teachers explained to students that they were learning science in a new creative approach and students responded with more enthusiasm. Therefore this study was established to raise the issue, but also to provide instructors and researchers with tools to offset a negative socially-constructed practice.

Hip-hop, the culture of urban marginalized African-American youth had been considered to be an amalgamation of the thoughts, words, and behaviors/actions of those who dwell in urban settings, and who had been traditionally excused from socioeconomic and educational attainment. It was also the means through which urban youth created and engaged in literacy activities, such as graffiti, break-dancing/b-boying, deejaying, and rapping, indentified as major strands of urban youth culture. Despite the significance of and the insights it provided into understanding of how certain activities that urban youth engaged in were reactions to being ostracized from education and the political process, these learners were excused from educational attainment through those means. This study provided a means to include hip-hop as a means tapping into affective dimensions of urban youth experiences. It had been the chief means through which those who had been devalued by society, institutions, and schools shared their experiences with others who had undergone similar experiences. Hip-hop would lay open the dimensions of self-efficacy for urban youth. This study allowed them to explore their cultural capital through learning science through elements of their cultural context. Students were observed excitedly having fun creating team hip-hop science spoken-word productions.

Being able to value self and having the ability to complete academically oriented tasks that would affect school performance and achievement, were the most crucial factors shaping the

self-efficacy African-American youth academic performance and school success (Florence, 2010). Engaging in an environment in which individuals could trust schools to construct a learning environment that would offset negative portrayals and validated and affirmed was critical. This invalidating experience of youth in urban communities tended to decrease their focus on cognitive skills. Videotaping during this study showed students actively and progressively engaged in the experiences of this study. Teachers remarked about students who were previously non-participants in classroom science activities, but who were now more cooperatively participating. This was especially noted during collaborative duties within teams.

Many of the youth participating in this study were reading below grade level. The researcher used graphic organizers to teach science concepts as chunks of information, so that students would not become bogged down with an over abundance of printed material. The chunks of information were pulled from their grade level science textbook through a skill which can be easily taught to teachers and students. Since science units were developed by the researcher to meet teacher emphasized science concept formation, and to coincide with mandated state standards, graphic organizers were developed to allay reading anxiety, and to develop concept formation and connections for students progressing through an inquiry investigation. The graphic organizer and *Inquiry Investigation* tool aided students in developing science concept vocabulary which could be transferred and translated into their science poetry writing. The *Science Inquiry Investigation* tool (Appendix H) navigated students through science process skills seamlessly, to be used as a reference in writing science poetry.

The evaluation system established by the researcher appeared to aide students in self evaluation of their science poetry performances, and those of their classmate teams. The evaluation system seemed to pave the way for reflecting on their learning, and the writing clinic

seemed to help them to revise their perceptions of knowledge obtained. Critical thinking skills crucial to understanding science process and problem solving skills emerged as students created science poetry, and examined errors in reasoning through the *Science Inquiry Investigation* tool. Teacher positive responses to student experiences seemed to offer promise for developing these skills. The scaffolding of skills seemed to awaken teachers to discussions about how the sequence could be implemented into every science unit created.

Researcher establishment of a classroom management system was crucial in expedient delivery and implementation of the project within a strict scheduled environment. Classroom management issues seemed to be somewhat alleviated, as researcher and teacher worked as a team to establish a consistent environment for learning. Since a briefing chart of listed expected behaviors was posted and reviewed in the classroom for each visit, students seemed to become more comfortable with an organized, consistent routine. The behavior chart was used as a means of reinforcing. Team cooperation/collaboration badges worn by students during each class period seemed to organize team effort, and were used as a tool by the researcher and classroom teacher to promote classroom management. After some consistent efforts to review the duties on the badges, students responded well to written badge descriptions and duties. Team members could then be called away from their team by the researcher, to receive and bring back important responsibilities to their team toward project completion, while the rest of the team engaged in duties to which they had been assigned. Thus, the responsibility of each member of the team was to make sure all members of the team were on the same page with completion of team project work. As a result, more experiences were observed being completed during each visit. Students coerced each other into making sure their team was prepared to earn reward points for most cooperative/collaborative and prepared team. Being rewarded with individual points, and words

of commendation for helping their team become more prepared, seemed to become uppermost in expression, even with students who exhibited behavior issues in the classroom, previously. Teachers observed this behavior and remarked about changes they had seen.

Having students create first name badges brought wistful looks and smiles from students as they were acknowledged the important things people should know about them. Students and teachers observed student motivation to engage in the implementation of the project. The researcher recognized that this effort began to address self-identity worth and style for students as students were recognized personally and openly during classroom experiences. The researcher determined early on, that self efficacy would be a prominent factor in developing student achievement. Including self-efficacy as a means of validating a student must be included in a culturally responsive teaching approach for teachers of middle school urban youth, to increase science literacy skills. Validating student cultural capital through the performance arts approach opened the door to opening student minds to developing that cultural capital. This approach offered teachers of diverse students a tool for reaching into their away-from-school literacy, and of progressively framing positive attitudes toward student worth and ability.

The considerable experience of the researcher with several population groups demonstrated that this sequenced and systematic approach elevated all learners toward appreciable science learning achievement. This strategy of practice began in the latter years of the researcher's science teaching career, teaching an amalgamation of learners from various cultural backgrounds, including the dominant White population in society. Student heightened response to this system allowed the researcher/teacher to increase achievement that brought students to prize-winning positions in local and regional science fairs. Student achievement on standardized state science tests was enriched and increased, as well.

Of the performing arts, music showed the most promise for organized development of memory functioning skills and science process skills. Music would lay a foundation in the classroom setting that manifested itself as the child's brain became accustomed and attuned to the sounds of his/her personal culture and society. This study incorporated hip-hop music as a personal element of hip-hop culture, assisting students in processing incoming stimuli through repeated exposure to consistent cultural ways of knowing. Students in the study were at first, bemused by the introduction of hip-hop music into their unit of science learning, but became excited by learning science in this way, and seemingly became motivated to more fully engage.

Margulis (2013) related the findings in music processing to mechanisms associated with why repetition in music could influence our behavior, with implications in language development, learning, and communication. She strongly suggested that the music we listen to daily had repetitive phrases that caused the brain to be inclined to sing along, and to help the brain develop mental scenery of images that could cause important concepts to get stuck and stay in the brain for future use. In keeping with Margulis' findings a "bridge", or central theme poem, was created for each science unit. This was performed through a back-drop of instrumental hip-hop music. The bridge was repeated at the beginning of each science class session. This repetition seemed to intensify the effect of learning the science facts. This ideology supported the researcher findings of learner affinity toward songs, as an aid in helping them to learn concepts easier. Students were originally to create rap presentations for the science poetry, performing to a rhythmic music backdrop. However, although learners were intrigued with this non-traditional way of learning science concepts, they responded with more enthusiasm when a song was developed for the poetry. The researcher heard them singing the theme song for the science concepts as they left the classroom, remembering each word, and developing movements to

favorite parts. Student team evaluations indicated that songs, even calling each line a lyric, helped them to learn information better. A sort of "brain singing" seemed to inspire them to more easily move to the next section of the poetry with ease. A non-participating student who had been visiting the classroom, was also able to sing the theme song, and had not been in the classroom when concepts were being introduced in the science poetry training sessions. The visiting student offered suggestions for enactment of concepts while singing the song. When the student came in the next day with his own class, he came in singing the science poetry rap theme song.

Recollection of concepts has been shown to be triggered most in the medial pre-frontal cortex, measurably realized mental activity in the brain through a fMRI brain scanner. Brain responses were monitored under an fMRI brain scanner while music was being played, and the brain responded quickly to the music. More mental activity occurred during those times when a tune triggered personal recollections of a particular person or place, particularly with Alzheimer patients, who could recall songs from a very distant past. Since music seemed to trigger very strong memory recollection, the researcher used hip-hop science poetry with a music backdrop to generate stronger recollections of science concepts presented throughout the science unit presented to students. Students were more enthusiastic and seemed better able to determine the orchestration of body movements through a science poetry song, as a result, seemingly having fun doing so. They seemed to experience more difficulty orchestrating body movements to science poetry as a rap without music, or without benefit of a created song

Through the science poetry, students created drama skits, for enacting science concepts, with a music backdrop. However, it was not until science poetry was considered as lyrics to a song, did students realize the potential of acting out the science concepts in the poetry. This

performance arts connection resonated understanding of science concept connections, as it appeared that songs revolving around concepts established stronger memory recollection. It would seem that the brain was inclined to sing along as concepts were recollected through song. Student' responses indicated that key words in the song helped them to act out the concepts. Previous creative expression experiences with music backdrop seemed to set the tone for drama re-enactment. The researcher contended that this part of the process captured the imagination of the science learner and prepared the brain for concept internalization.

During this study, comprehending poetry as lyrics to music appeared to help prepare the students for the difficult task of creating a performance for the science concepts. As students were practicing for their science poetry performance productions, the researcher observed students moving to the rhythm of the music, as they prepared their science performance production. Students were observed developing a routine for patterns of movement and enactment of science concepts to prepare for a performance production contest. The repetitious poetry lines and music seemed to effect learning of science concepts better, because students were observed reminding each other of what action/movement needed to take place during a certain music segment.

A sequential system was developed into that which best prepared middle school students toward increasing science achievement that would flourishe throughout the middle school years. The researcher's study was orchestrated to help students develop their own intellectual capital, in order to motivate student entry into high school science classes that would prepare them as science learners, and foster confidence that created the environment directed to enter science classes that advancd science careers. The methodology was developed in sequenced phases to

determine what scaffolding process was needed to lay the foundation for development of science literacy skills. This same process can be used with elementary school learners.

For this study, hip-hop science poetry, intertwined with science inquiry experiments, showed itself to be a means of connecting to the worlds of urban students and of validating students' away-from-school communication skills. This demonstrated the need for creating a culturally responsive environment for urban youth that is validating and affirming, as a compelling directive in understanding how to educate urban youth.

Recommendations

Based on the findings of this study the hip-hop cultural art form can be used by teachers as a tool, to increase science achievement. It was necessary that a science inquiry investigation be infused throughout preparation for the performance arts production to reinforce learning of science concepts and science process skills. Evidence in this study supported marked student interest to learning science in this manner. This approach helped to reach into the world of urban student literacy practices and music away from school, to teach science concepts and science process skills. This strategy was prompted in order to determine if the training for the science poetry productions enhanced learning for a science unit and elevated science achievement.

Qualitative data and quantitative data in this study indicated that students made better connections to science through the performance arts approach. Many of the student responses indicated that they preferred relating to science information in song and movement. *Learning in Science Surveys* quantitative data related that if science could be learned through the performance arts approach, students might learn science better. It becomes highly recommended that students participate in this process for at least two science units. Students did not make

connections to the approach to learning science in this way, to becoming a scientist in the future. More consistent approaches to learning science through this intervention would spark more confidence in becoming a future scientist. Recommended is that African-American scientists visit the classroom during a science unit to assist students in being more specific about observations made during a science inquiry investigations.

Science instruction should rely upon the nature of communication, and the connections among those immersed in hip-hop as the starting point from which science instruction should be delivered, for urban learners. This study entailed engaging a classroom of working teams of students, so that they might be empowered to be creative through the science poetry training process. Teams had equal opportunities to talk and work together to reach a shared goal, as they prepared toward completion of their science unit project. All students seemed to be more engaged as they discussed shared responsibility for completion of their projects, based on the badges they wore. Students seemed to become comfortable with the role they needed to play, and how they needed to engage with certain team members, the more they worked within the role. They seemed to take on the role a career specialist assumes. The observations noted would seem to move teaching and learning science forward, and advanced pedagogical practices toward collaborative learning. This avenue not only fostered a team effort regarding collaborative experiences, but fostered maximum appropriate student participation and creativity.

Even though hip-hop culture was prevalent among urban youth, society at large continues to devalue it. This forged negative consequences on urban youth who have been traditionally marginalized in schooling in a broader sense, and science learning in particular. This study was motivated by the need to address how science educators can capitalize on elements of the hip-hop culture to connect urban youth to science, a school subject that is not typically associated

with urban youth, and that has historically excluded them. The researcher argued that by acknowledging the impact of hip-hop on urban youth, an appreciation and willingness to explore the potential of hip-hop culture in teaching and learning science, posed possibilities for success in teaching science to urban students. According to the research and collected data, youth interest in the discipline of science was further developed. Herein lies potential to penetrate urban youth culture, and to transform urban science education.

An element of hip-hop, often decried as having had a negative impact on youth as a contemporary musical art form, has been largely unfounded. Discovered was that the commercialized forms did not truly reflect urban culture. Youth identified with versions of rap and hip-hop music which were more reflective of the realities of the urban youth experience. Topics such as education and politics, and messages for surviving the challenges of urban settings, were prominent in these versions of the hip-hop culture of which urban youth identify. In addition to its presence as the culture that gave birth to hip-hop music, and the way of knowing and being of urban youth, hip hop also stood as the chief mechanism through which populations that are not accepted into mainstream society affixed solidarity. Hip-hop became the banner under which urban youth formed their own unique ways of communication, allowing them to identify with one another as collectively marginalized and outside of mainstream culture. This allowed them to appreciate their intellectual capital, to become confident in their self efficacy, and to optimally realize the contribution of their culture to mainstream society. Therefore the researcher commended efforts toward instituting the system of learning science through elements of the culture of hip-hop, to facilitate the self-efficacy and acceptability of urban youth as accomplished contributors in the science mainstream.

The investigator/researcher had been affirmed that rap music could be used as an advantage to urban science education, bringing the power of beneficial messages to and from a population that was considered to be marginally educated. Music and rap of the hip-hop culture was highly recommended as a tool of science instruction, which now daily and widely influenced African-American and Latino youth. As an element of their culture, it has been conceded as a culturally responsive/relevant teaching and learning tool that can better educate them, and be of nurturing exposure to other cultures.

As an extension of poetry writing skills, Japanese Haiku poetry was briefly explored with students in science classrooms. Haiku poetry brought elements of another culture, broadening and expanding the arts experience of urban students. It was considered by the researcher as a means of opening a window to comparative views of another culture, to create some common views of thinking that would strengthen bonds (Benzon, 2001). A backdrop of movement to classical music was explored in conjunction to the Haiku poetry performance productions. Science creative expression activities were utilized to aid children in developing flow of movement of poetry with music, to demonstrate science concepts. The researcher realized again that change in the way of knowing could cause pause, until students were more empowered to be creative in other realms of self expression. Research from this study proved that creative expression in the performance arts would appear to intensify memory development and recall. Memory recall seemed to help students to transfer knowledge better, to new and different situations. This was the skill needed for science literacy skills.

Implications for Further Research

Students and teachers participating in this study reinforced the contention that a performance arts connection to learning would better prepare the brain to sort and organize concepts. Throughout analysis of evaluation artifacts, music, rhythm, and drama resonated as the learning mode of choice. Many students indicated that constructing information into a song helped them learn the concepts better. The researcher advised that an established sequence be followed in order for students to develop concept formation. The inquiry tool, graphic organizer, and poetry models seemed to aid in reinforcing science concept formation. However creative expression experiences were necessarily inculcated into the flow of concept and process skill development, to better develop self-expression for students, as students enacted poetry science concepts to a backdrop of music.

The challenges facing hip-hop youth whose literacy needs have caused them to be more or less invisible or literate in schools, have led to transformative work that explored the use of hip-hop in language arts and social studies classrooms. The purpose of this study was not just to validate previous work that described the potential of hip-hop for education, but to highlight the fact that urban youth of color who are particularly missing from the science arena, can benefit from a focus on performance art forms of the hip-hop culture, as a tool for sustaining projected achievement in science. The researcher contended that this devaluing of urban youth culture and its offshoots, stymied science educational attainment.

The absence of Black and Latino youth in careers in science can be addressed by refocusing on hip-hop as having intrinsic value for developing a foundation for educating urban youth. Issues related to urban science education had been examined both through the lens of

urban youth, and from the perspective of schools, within the field of performance arts hip-hop culturally-based education. Implications were that self-efficacy of urban youth required re-dress. The researcher suggested that brief identity building poetry exercises (Appendix V) should become the focal introduction of students to each school year and throughout the year, as morning orientation to the school day and initiation of each classroom's activities. Spoken-word hip- hop science poetry intertwined with science investigations was proposed as a means of significantly increasing science achievement. However, the researcher noticed that urban students were validated through the name badges they created. These name badges had two items of note that introduced student abilities and talents on the back of the badge. The researcher personally applauded these attributes and promoted them to their classmates. This recognition increased cooperative student engagement in classroom experiences. The goal was to find ways of successfully connecting hip-hop youth to schooling in a broader sense, and science learning specifically. The need arose for educators to develop a foundational understanding of the nuances of hip-hop, before embarking on a strategy of using it to improve teaching practice.

Implications from studies of Chorng-Jee Guo (2007) emphasized student ability to apply scientific concepts in their daily lives, understanding of the nature of science, attitudes towards science knowledge and skills for professional careers, and dealing with science-related social issues had not received enough attention. The researcher supported this premise, but also contended that it was seemingly easier to identify problems related to student learning processes and outcomes in science, rather than to find effective strategies that improved it. Data from this study reinforced inability of students to apply concepts to daily lives as well as understanding of science-related social issues in their lives and their community. Further research should include components of curriculum development in teacher professional development sessions to assist

teachers in developing culturally responsive instruction for urban learners. The purpose of this study was to establish and develop a systematic and sequential change in strategy and practice, using a performance arts-based approach, which manifested itself as culturally relevant for urban youth. Urban students should be assigned to, and provided with the means of investigation of science issues in their community, and of approaching recommendations toward improvement and solutions. The investigations can then be developed into hip-hop performances at school auditorium sessions and community centers, as an explanation of findings. This would help students develop science literacy and inquiry process skills, and direct attention to real-life science and problem-based issues.

Culturally responsive programs can foster "social cohesion" among those of different cultures, as one group learns from and celebrates the culture of another group. Such studies can provide opportunities for educators and researchers from a given country to reduce the effects of obstructive variables that plague most individual countries. Well-executed research from international studies gave promise as to which strategies worked best in different contexts, rendered more reliable relationships between related variables, and created a deeper understanding of science phenomena. Student investigative science learning within their community can be expanded to similar science issues internationally. Since the educational goals, instructional environment, teaching practices, and student learning outcomes can be different in countries, a systematic approach to selecting research topics, strategies in teaching practice, and methods in planning of international studies, would be an audacious approach in effecting change among nations in science instruction and research. While urban student investigations strive to become culturally relevant to science issues in their lives and community, community investigations could then become an expansion of global science issues to be

explored. Community organizations such as science centers and arts education programs could undergird teacher paradigm shifts by offering standards-based science programs that could assist in developing culturally relevant pedagogy, and those that would provide resources to aid in community science explorations.

The researcher originally initiated this study to find answers toward significant science academic achievement for African-American and Latino learners in urban education communities. Hope was realized through utilization of elements of performance arts hip-hop culture forms, to access learner self-efficacy and daily science literacy practices. On the journey new revelations surfaced through research discoveries and directed training with learners and teachers reinforcing that (1) Learner achievement can best be accessed through development of self efficacy of the learner; (2) The cultural way of knowing enhanced reception of ideas and processes; (3) Learner achievement can be furthered through validation and exchange with members of society who are not of the same cultural context; (4) All people learned best, barring mental anomalies, through how the brain received ideas into long term memory; (5) All people learned best through reception into certain parts of the brain, processing incoming stimuli, (6) The brain received and stored incoming stimuli, by sorting through and making connections during "brain firing", which brought nourishing blood flow through connections in the brain; and (7) Many people learned best through the arts, because of how the brain perceived incoming stimuli. Development of process skills is the means through which the brain reasons through situations and circumstances, and science lent itself to process skills which promoted "brain firing" and which enhanced higher order thinking skills when connections were made. Connections to real-life science were created in this type learning environment.

With this knowledge in tow, the researcher surmised that the cultural way of knowing had serious potential bearing toward human learning for all. Natural intelligence and learning processing, barring mental anomalies, had no significant connection to literacy, in this case, and the ability to navigate in science with levels of higher achievement. Human learning would depend upon how the brain received stimuli, processed it, and stored it for expanded future learning, in all cultures. Research had shown that the performing arts could intensify learning effects and outcomes, especially with the use of music as a backdrop. How we prepare learners' brains to receive and process ideas would require a paradigm shift in implementation, throughout the K-12 years of schooling, to show measureable science achievement strides. Based on data collected from attitudinal surveys, informal assessments, and student self-assessment, implications were that the performance arts approach can be a formidable tool for teachers of students from all walks of life. Even though the researcher targeted African-American and Latino populations specifically for the hip-hop arts intervention, student classroom populations included White, Asian, and students from other ethnic backgrounds interspersed among the targeted populations. Those students responded in much the same manner as the targeted populations. The classroom teacher influenced their engagement in the hip-hop intervention. This would suggest how much influence teachers have in implementing an approach. This would support reasons why teacher professional development would require components of curriculum development strategies.

Revealing to this study was that only 1% of all ethnic groups in the United States, scored in the advanced level in science. Our intransient attention toward achievement gaps among groups had been diverted from the astounding revelation that so few science learners score at advanced levels necessary for science competitive leadership globally. Researchers might

question a study that on the surface, seems to cater to a primarily African-American population. Questioned, might be why implement what seems to be a separate science curriculum for this group. Research determined that cultural identity would define how a group operates within a larger society, academically or otherwise. Policy makers may argue that the institutionalized system in place has educated many very well, in the United States. However, the United States has been scrutinized for its leadership role in STEM subject areas, in relationship to other industrialized nations. A discrepancy existed in how the United States currently educated and competed, not just in regards to the African-American achievement gap to the larger society, but in relationship to science achievement proficiency, globally.

The researcher proposed middle school youth teaching of the process through which they realized significant strides in science learning to primary elementary school children as an intergenerational approach. Students could become part of an afterschool elementary school program for primary children, to prepare for and teach skills they had learned. This would further help middle school youth gain insight into their abilities and science learning processes. Teaching a process to others can reinforce concept grasp and processes of those who teach, and could help to develop interpersonal and intrapersonal skills important to self-efficacy.

Science and science-related fields could create life choices that maximize potential for propelling more productive urban citizens into the mainstream of society. This study was chosen to examine the use of elements of the hip-hop cultural art form within a diverse group of youth, as a means of creating a space for urban youth to thrive in science, and in doing so, opening avenues of opportunities in science, for youth who currently show themselves as disengaged in traditional science classrooms. The study was offered as a forum for urban learners to envision entering the field of science study, having achieved a level of science

literacy and literacy skills gained in a culturally responsive environment, using strategies through the hip-hop performance arts of their culture, intertwined with science investigative experiences.

There can be crucial relationships between social, emotional and cultural connections of which teachers need preparation, to nurture their academic classroom practices. They would require a tool that can address these issues. The performance arts approach proposed in this study would embrace the social, emotional, and cultural issues of students, and establish a scaffold, sequential approach that would undergird the learning process in science for many different types of learners. This performance arts approach inculcated the theories of cornerstone psychologists and philosophers as a foundation in educating. The performance arts approach brought physical enactment to creative expression of science ideas and concepts. This approach lent itself to critical process skills and optimum concept development, as the learner created a paradigm of movement and drama, to the expression of science concepts. Implications were that science learners who had difficulty understanding science concepts and their connections to their real world be given a variety of ways in which science could be operationally realized. Visual images of action emerged in this study for students that enabled them to express science concepts, while navigating through science process skills.

The investigating researcher hoped to counter the minimal attention to science achievement of urban students, by employing resources such as teachers, administrators, and other education caregivers directly within the system, to engender sparks of social movement that have potential for prompting teachers as social agents of change. It was expected that teachers would become critically reflective, aware of the need for change, and willing to create an environment for science literacy solutions, as they became confident in their ability to make a difference. Successes had been realized in the United States in San Marcos California. The

DREAM (Developing Reading Education with Arts Methods) program had significantly improved standardized tests within two years of the three years it had been established, expanding its program to several other school districts in San Marcos.

This type of progress could just be the impetus that could open up opportunities for scientists, particularly African-American, currently often invisible in the science arena. President Obama is seeking to educate our youth in such manner, that they will be confident and show achievement strides in science. The President seeks the prosperity of America in the 21st century global marketplace through science innovation. The driving force for the researcher's study is nurtured through how students are educated, especially in science, technology, engineering, and mathematics.

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Pre-Learning in Science Survey (Student)—Appendix A

According to Sciencesaurus: A Student Handbook (Great Source Education Group, 2002), "***The goal of science is to answer questions about the natural world."***

On a scale of 1 (least likely) to 5 (most likely) circle the number that best tells how you feel about the statements below.

1. The things I learn in science help me in my everyday life.

1 2 3 4 5

2. I understand science taught in my class.

1 2 3 4 5

3. I like learning about science.

1 2 3 4 5

The things I learn in science can help me in my other classes.

1 2 3 4 5

5. The things I learn in science can help me with chores in my home.

1 2 3 4 5

6. The things I learn in science can help me play video games.

1 2 3 4 5

7. The things I learn through science can help me take better care of my health.

1 2 3 4 5

8. The Sci-Fi movies seen on television show real science.

1 2 3 4 5

9. The things I learn in science can help me play sports better.

1 2 3 4 5

10. I can see myself becoming a scientist one day. 1 2 3 4 5

Great Source Education Group (2002) ,Sciencesaurus: A Student Handbook, A Houghton Mifflin Company, Wilmington, MA.

Pre- Science Learning Survey (Teacher)—Appendix C

I have been teaching for (number of years): 1 3 5 7 9 12 15 (or more)

What grade levels have you taught?_____ What subjects?_____

According to Sciencesaurus: A Student Handbook (Great Source Education Group, 2002), ***"The goal of science is to answer questions about the natural world."***

On a scale of 1 (least) to 5 (most), circle your thoughts about the following questions:

1. I liked learning about science when I was in school. 1 2 3 4 5

2. I understood science taught throughout my school years. 1 2 3 4 5

3. The things I learned through science have helped me take better care of my health.

1 2 3 4 5

4. The things I learned through science have helped me understand popular events in my life better.

1 2 3 4 5

5. I took science courses during my college years. 1 2 3 4 5

6. I have considered becoming a science teacher. 1 2 3 4 5

7. I believe that children need to be better prepared for science learning. 1 2 3 4 5

8. I believe children learn science best when they can explore it in a hands-on approach.

1 2 3 4 5

9. I believe children learn science best when they can explore and reflect about what was learned.

1 2 3 4 5

"Culturally responsive"' teaching has been described by Geneva Gay(2000) , as that which makes use of student cultural knowledge, prior experiences, frames of reference, and performance styles..

10. Including "culturally responsive" approaches to science learning helps African-American children learn science more easily and better. 1 2 3 4 5

Great Source Education Group (2002), Sciencesaurus: A Student Handbook, A Houghton Mifflin Company, Wilmington, MA.

Final Learning in Science Survey (Student)—Appendix B

According to Sciencesaurus: A Student Handbook (Great Source Education Group, 2002), ***"The goal of science is to answer questions about the natural world."***

On a scale of 1 (least likely) to 5 (most likely) circle the number that best tells how you feel about the statements below

1. I can learn science while listening and moving to music.

1 2 3 4 5

2. Drawing, painting, or photography can help me understand science.

1 2 3 4 5

3. Writing poetry, or other writing projects, can help me understand science.

1 2 3 4 5

4. Acting in a skit, play, or other drama can help me understand science.

1 2 3 4 5

5. I can see myself becoming a scientist one day.

1 2 3 4 5

Great Source Education Group (2002), Sciencesaurus: A Student Handbook, A Houghton Mifflin Company, Wilmington, MA.

Final Learning in Science Survey (Teacher—Appendix D

According to Sciencesaurus: A Student Handbook (Great Source Education Group, 2002), "The goal of science is to answer questions about the natural world."

On a scale of 1 (least likely) to 5 (most likely) circle the number that best tells how you feel about the statements below

1. Students can learn science while listening and moving to music.

1 2 3 4 5

2. Writing poetry or other narratives can help students learn science

1 2 3 4 5

3. Drawing, painting, or photography can help students learn science.

1 2 3 4 5

4. Acting in a skit, play, or other drama can help students learn science.

1 2 3 4 5

"Culturally responsive"' teaching has been described by Geneva Gay, learning theorist, as that which makes use of student cultural knowledge, prior experiences, frames of reference, and performance styles.

5. Including "culturally responsive" approaches allows for the learning needs of students to be met.

1 2 3 4 5

6. "Culturally responsive" teaching in my classroom, is shown when …

_____

_____

_____

_____

_____

_____

Great Source Education Group (2002), Sciencesaurus: A Student Handbook, A Houghton Mifflin Company, Wilmington, MA.

Middle School Student/s Self-Assessment Journaling Questions-Appendix E

1. Based on your hip-hop science poetry, how did you know what to act out in your performance?

2. What did you think people understood most about your performance?

3. How did people respond to your performance? What did they seem to like most?

4. What would you change in your next performance?

5. What science concepts did you learn, as you performed? Explain two (I learned that...).

6. Using the science poetry rubric as a guide for creating hip-hop science poetry, under what circumstances did people appear to learn more? (They learned more when the team…)

7. Does the performance help <u>you</u> understand the science better? Explain.

8. What advice would you give to someone to help them make science easier to learn?

Classroom Teachers Survey Questions-Appendix F

1. On a scale of 1 (least) to 3 (most), circle how well student teams performed today.

1_____2_____3

2. List 1-2 science concepts the team expressed/performed. List/Explain. (They showed how…)

3. What did you like most about their performance?

4. Would you like to see them perform again? Why, or why not?

5. Other comments?

Science Poetry Rubric--Appendix G

	Exceptional	Admirable	Acceptable	Needs Improvement
Descriptive and Active Factual Science Content	*Expressed information effectively * used all the factual concepts	Good expression of information *Includes factual content	*Expressed information adequately * Some factual concepts included	* Express more descriptive information *More factual concepts needed
Organization	* Logical format * Excellent transitions from idea to idea *Excellent teamwork	*Good format *Good transitions from idea to idea * Good teamwork	*Adequate format *Adequate transition from idea to idea *Teamwork evident	*Work on format *A few transitions were made from idea to idea *Teamwork?
Grammar & Spelling	Little or no error	Few errors Made	Some errors made	Several errors made
Presentation	* Original, unique spoken-word lyrics, movement * Engaged audience * Great Flow	* Good spoken-word lyrics, movement *Kept audience attention and interest *Good Flow	*word/lyric flow *Uninterrupted performance-spoken-word lyrics and movement * interested audience	*word/lyrics present *Some interruption-performance *Audience seemed to be distracted

Science Inquiry Investigation— Appendix H

Problem/Question/:_____

Hypothesis_____

Title:

Circumstances, trials, dates, subjects					
1.					
2.					
3.					
4.					
5.					
Total					
Average					

Observations:* **(Important! Describe <u>every</u> observed action!)**

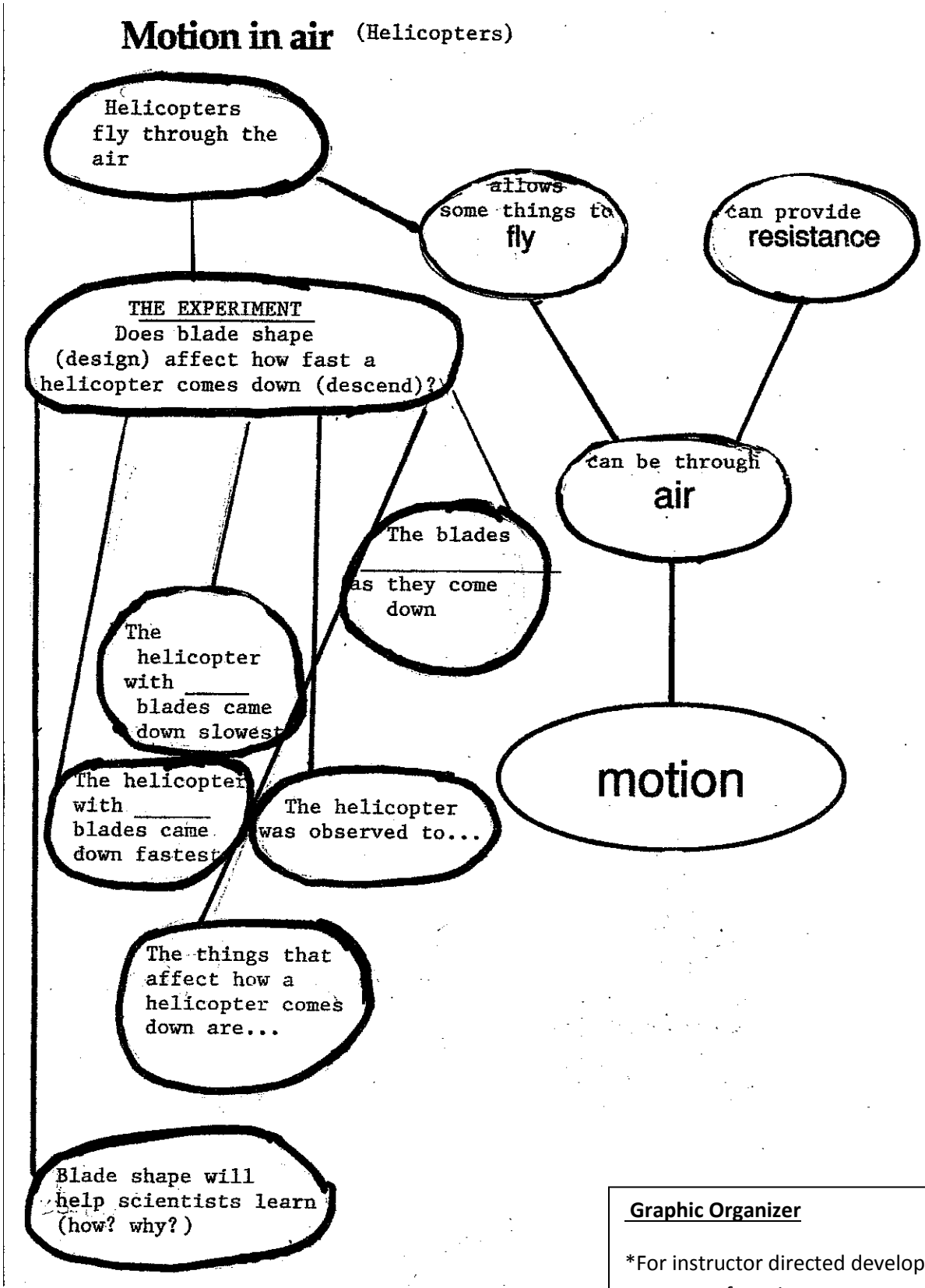
_____

_____

_____

<u>Graph and Interpretation</u>

<u>Conclusion</u> (What did you discover? Did your discovery agree with the hypothesis? Write an interpretation of your graph. What role did variables play in you discovery? Will your discovery help society today? Did new questions arise from your discovery?)



Graphic Organizer

*For instructor directed development of main concepts of a unit

*As a growing document of accumulated pockets of concepts

*As a reference for organizing concept flow

Appendix K

Motion of Helicopters (Challenger Learning Center) J

Motion of Helicopters

_____can be observed all through the air

Objects twisting and turning with such flair

_____whipping and twirling as they descend

Or being whisked upward into the____, as it sends

Floating object to places that never seem to end

_____allows some things to fly,

Birds, leaves, and machines fly by

Planes and helicopters in the sky

Moving with grace as they glide by

Air can provide _____ to motion, we've seen

A feather floats down slowly, observed in a scene

Air affects _____as they _____to the ground,

Helping blades twist and turn until land can be found

Word Bank

air

motion

blades

descend

resistance

helicopters

The Experiment: **Motion of Helicopters**

Does blade design affect helicopter descent?

Blades whipped as through the air they went

Slowing down the descent as they hover around

_____helicopter had the slowest descent,

Down at a slow pace the helicopter went,

Is this good or bad, one might tend to think?

Let's find out how there might be a helicopter link.

_____ helicopter had the fastest descent

It went down fast, and without a hint

Of what the affect of air resistance meant

Is this good or bad, let's explore what it means

Because things are not always the way they seem.

What will society learn from this event?

About helicopter blade design people invent

Would faster descent cause a helicopter crash?

Or would coming down slower help it to last?

Bridge (Motion of Helicopters)

Swoop, swoop watch helicopters float

Swoop, swoop for a landing approach.

Motion of Helicopters (**Haiku**)

Its blades twirl and spin (5 syllables)

While hurling down through the air (7 syllables)

Air resistant force (5 syllables)

Challenger Learning Center--

Mars—Appendix K

It's about half the size of Earth we have found out,

With so little gravity, we would float, even if stout.

Environments favorable for _____life

_____were sent to find the essence of life, on site.

Mars Chorus (Recite after each Mars stanza)

Mars' mountains, valleys, and volcanoes are there.

Rover lasers release gases from the rock to share.

Mars' mountains, valleys, and volcanoes are there.

A _____ will tell about gases Earth shares--

So that one day we might be able to live there.

Mars Word Bank: spectrometer, microbial, probes

Haiku (Mars)

Mountains, valleys there

Maybe life to live there soon

Earth people to move

Challenger Learning Center

Moon-- Appendix L

Earth's moon has no atmosphere.

Breathing becomes a problem here.

Little gravity makes all of us weigh less.

How would you like to float as a guest?

(Recite moon chorus)

_____ _____craters and mountains there,

_____ _____ lava flows on flat plains of where,

Immense _____ _____ on the side that we see,

A dusty surface with rock and mineral pieces to be—

Used for possible Earth life, to very good degree.

Moon Chorus: (Repeat between each moon stanza)

Scientists study the moon's surface from afar,

Looking for a living space that is not too far,

That sustains our life and gives us that space,

To find new beginnings for the human race.

Moon Word Bank: lunar lowland, lunar highland, impact basins

Haiku (Moon)

Highland mountains there

Lava flows on its flat plains

A new place to live?

Comets Appendix M

We worked with NASA to find _____that might collide into Earth,

Where space bodies made of ice, _____, dust, and _____give birth.

We wore special glasses and studied the gas colors to see

If _____analysis would help us launch a _____in the right vicinity.

Chorus (repeat two or more times)

The comet, we named it, a probe found it properly.

The comet, we named it, for a sign of future history.

"Comets" Word Bank: gas, spectral, rock, probe, comets

Haiku (Comet)

Streaking through darkness

Made of ice, rock, dust, and gas

Threat to hit the Earth

C.H.O.C.D. Program

Sunshine on the Skin You're In—Appendix N

Chorus

Let sun shine on the skin you're in,

Take care of the skin you're in,

D vitamin for the skin you're in,

Life saving, for the skin you're in.

D vitamin gives your _____ _____a pick-me-up,

Get a cold and you won't feel like you've been hit by a truck.

It boosts your system—what a stroke of good luck,

And even lowers blood pressure that could run amuck.

This sunshine vitamin helps you to think smart,

While caring for the chest organ-- your_____.

D vitamin keeps you from feeling oh so sad,

Go out and be in sunshine, and you will feel glad.

Miss the D vitamin and _____form bow legs,

Bones don't absorb calcium with the D for which it begs.

Don't take too much calcium (supplements) because,

For _____of inner soft tissue can be caused.

If diabetes runs in your family tree,

Sunshine D is one treatment you'll need.

Multiple sclerosis nerve disease can also occur,

By not getting D vitamin from the sun it deserves.

C.H.O.C.D. Program

(Sunshine on the Skin You're In)

Dark skinned people absorb less sunlight,

So they need more sun to win the health fight.

More brown _____in the skin,

Filters D vitamin from penetrating in.

Beware! Too much sunshine may cause cancer of the skin,

Use sunscreen after 15 minutes, for the skin you're in.

Or go out early morning before the sun gets too hot,

Or spring and fall, when direct rays have not come out.

<u>Word Bank</u>

Heart, rickets, immune system, ossification, melanin

CHOCD Program

Hominid Fossils Appendix O

Chorus:

They walked on two feet (bi-pedal) with a spinal chord attached,

To a skull that can tell us many a fact.

They're the Hominids, fossils of our ancestry,

They're today's Homo sapiens, a part of our history.

Their skulls tell us a lot about their lives,

Over millions of years, and how they survived.

Their teeth tell us what they really did eat.

Some ate plants and some ate meat.

Some of the skulls are very, very, old,

But Lucy is the oldest full-sized fossil, I am told.

Ethiopia in Africa was where she was found,

A short young lady dug out of the ground.

Other _____fossils were found here and there,

Because of _____ of people who went everywhere.

At _____ and _____map points you see.

Skulls were mostly found on Africa, (the continent), indeed.

<u>Word Bank</u>

Longitude Latitude

Hominid migration

CHOCD Program

Museum Station-- Appendix P

Chorus:

Human universals in our body form,

Bring all humans to a common norm,

Our _____bone found from outer wrist to the elbow,

Can determine our height-- standing tall, or squatting low.

They studied many layers of earth (_____) to find,

_____ and _____ of many different kinds.

Lower layer things were older because, of the way the land was stacked,

Being buried under rocks and soil, they really had been packed.

Our ancestors were born to live and survive,

We inherited body changes (_____) that kept them alive.

With great brain power that helped them to strive,

They used everything to help them thrive.

_____tells us about their teeth,

And what they often needed to eat.

They were herbivores, carnivores, and omnivores you see,

And omnivores ate plants and meat as their treat.

Word Bank

stratigraphy, ulna, dentition, adaptations , artifacts, carnivores, fossils, herbivores

Heat Temperature and Weather (Appendix Q)

Bridge:

Temperature in the air affects our weather each day

With important assistance-- from the sun's rays

(Swoosh, swoosh) in the atmosphere, (swoosh, swoosh) in the atmosphere [audience]

Temperature affects_____—a factor of weather

As _____ and air pressure work together

_____air which is dense, cool, and dry

Falls heavily toward moist, light, and warm going by

_____air--moist, less dense, and warm

Floats and takes the place of another swarm

The wind carries _____in the air

Moving to places, while working as a pair

Heat moves through the air by_____

Sometimes causing the air to change its direction

Warm air will _____and cool air will fall

Causing air to seek places to where it is called

Heat causes water to _____into the air

Sun heating the air to move _____up there

Does _____of the air affect the amount of evaporation?

Does heat in the air affect more water formation?

Word Bank

high pressure

temperature

air pressure

heat and moisture

low pressure

rise

conduction

convection

moisture

temperature

evaporate

Warm _____very high in the air

Forms water drops as it cools up there

_____water forms clouds most days

Cirrus, stratus, and _____are made this way

condensed

cumulus

water vapor

Listen to the meteorologist on t.v., and you will see
How temp., air pressure, and moisture act when set free
They affect weather in the atmosphere from day to day
A pattern that influences our climate along the way

(The investigation—Air Temperature and Water Evaporation)

Most water drops were in our hot environment
Looking at the dome made that quite evident
Floating very quickly to where it was sent

In the warm environment were less water drops to see
Less heat made the difference as the drops went free
Less water vapor condensing into drops-- we agree
That heat forms more water vapor to make drops we see

Cold air environment formed no water drops in the dome
Cool air is dry and heavy--it fell down to seek another home
Cool air is dense and falls toward moist, warm, and light
High pressure air falling downward in its flight

Ecology and Food Webs (Appendix R)

Word Bank

Living things need air, light, food, and _____to grow,
Energy from food to reproduce—we all know.
_____ make their own _____ with help from the sun,
Release oxygen for breathing, for living things on the run.

Living things carry out activities to survive,
Using the food supply to move, and stay alive.
Develop and reproduce--responding in their_____
Caring for families--trying to keep up the pace

They all have special roles to play,
While trying to survive for another day,
Plants make their own food using ____ rays,
They are_____, a food supply, in every way.

They are herbivores, omnivores, and _____all found,
Surviving in the _____in water and on the ground,
_____ eat plants and _____ eat plants and meat,
While carnivores delight in meat as a food treat.

food
plants
breathing
water
reproduce
living things
food supply
space
sun
producers
herbivores
omnivores
carnivores
environment

_____wait for the ending round, living things

As _____die and fall to the ground, decomposers

They break down what is left of a meal,

By working in the soil to return its yield.

_____and prey on the way to their quest. prey

Of surviving in the environment like all the rest, predator

All _____ try to survive, eat, and escape,

From predators, while keeping their families safe.

Bridge:

Food web action—survival each day,

Producers, consumers, predator and prey,

Food web action—survival each day,

Decomposers waiting for the end role they play. (spoken by one person in the group)

Food web—survival! Go live it! Go live it! (repeat several times)

Living things need air, light, food, and water to grow,

Energy from food to reproduce—we all know.

Plants make their own food with help from the sun,

Release oxygen for breathing, for living things on the run.

Living things carry out activities to survive,

Using the food supply to move, and stay alive.

Develop and reproduce--responding in their space

Caring for families, trying to keep up the pace

They all have special roles to play,

While trying to survive for another day,

Plants make their own food using sun rays,

They are producers, a food supply, in every way.

They are herbivores, omnivores, and carnivores all found,

Surviving in the environment in water and on the ground,

Herbivores eat plants and omnivores eat plants and meat,

While carnivores delight in meat as a food treat.

Decomposers wait for the ending round,

As living things die and fall to the ground,

They break down what is left of a meal,

By returning it to the soil to increase its yield

Predator and prey on the way to their quest

Of surviving in the environment like all the rest

All prey try to survive, eat, and escape,

From predators while keeping their families safe

The Investigation: Ecology and Food Webs

What effect does removing a consumer species have

On others who live as part of the food web?

If a consumer species is removed from a food web

The species with the most food sources will be fed.

This food web had more omnivores than carnivores

Even of those eating only plants called herbivores

Omnivores survive by eating plants and meat

So they will not meet with food source defeat.

Society might learn that species will survive

If they have more food sources to keep them alive

Scientists will strive to balance the food source

Maintaining a variety of species in an environment—of course!

Haiku : **Ecology and Food Webs**

Plants make their own food (5)

Sun rays taken in produce (7)

Food for consumers (5)

Science Poetry Investigation (The Experiment) Writing Clinic: Appendix S

(Using the graphic organizer, science inquiry tool, and word families chart)

Stanza I: Problem and Hypothesis (four rhyming lines)

Stanza II: Observations (four rhyming lines)

Stanza III & IV: Results and Conclusion (four rhyming lines)

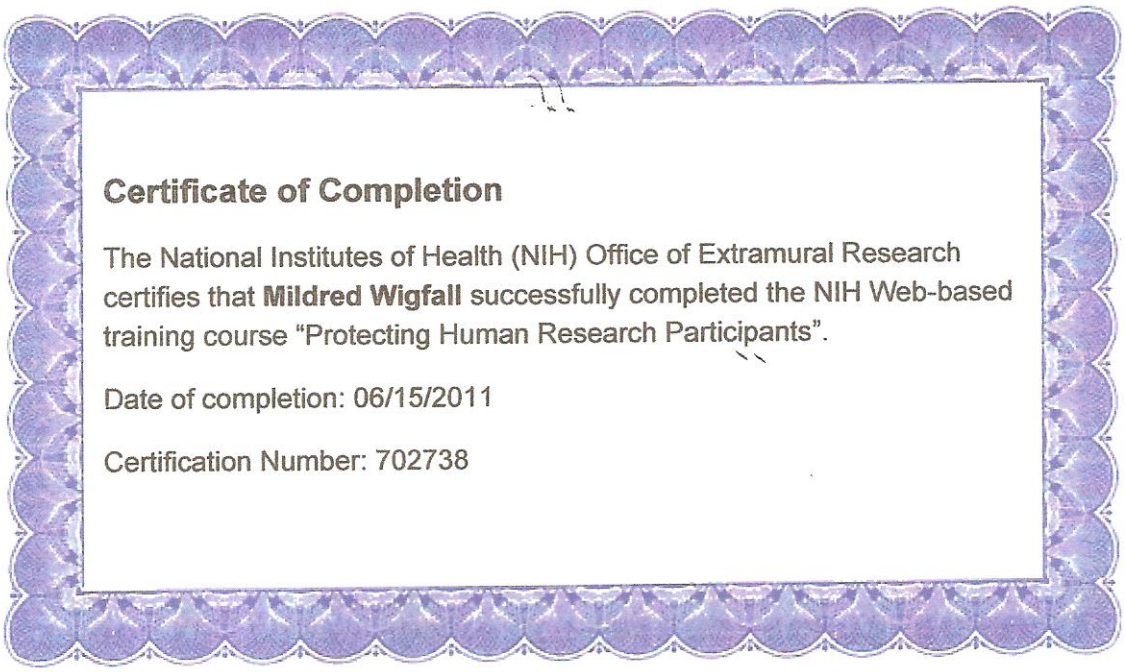
Cooperative/Collaborative Team Learning (job descriptions) **Appendix T**

Project Manager ➢ Helps materials manager collect appropriate project materials ➢ Insures all components of the project are completed in proper order ➢ Test runs constructed product ➢ Trouble-shooter/ problem solving consultant ➢ Encourages team production	**Materials Manager** ➢ Collects and brings necessary materials to the team ➢ Collects and returns unused materials to proper location ➢ Makes sure work area has been cleaned up
Recorder/Data Collector ➢ Prepares data collection document ➢ Records group data in a collection document ➢ Records group observations ➢ Works with Data Analyzer to interpret group findings, and the Reporter/Communicator for proper reporting	**Reporter/Communicator** ➢ Works with the Recorder/Data Collector and Data Analyzer to prepare a proper report ➢ Communicates to **Executive Board** members, and presents a complete report for the team ➢ Works with the Data Collector/Recorder and Data Analyzer to answer any unanswered questions about the report, for the team
Time Manager ➢ Times or measures each team members trial/test run ➢ Works with the Data Collector to insure proper data is collected ➢ Works with the Project Manager to keep the team on schedule	**Sight Engineer** ➢ Oversees appropriate initial measures are being used for each trial/test run ➢ Sights proper ending results for proper reporting to the Data Collector ➢ Principal observer of investigation and production action
Data Analyzer ➢ Finalizes data for the team (totals, averages) ➢ Creates a graph for the team, with input from the Data Collector and Project Manager and interprets it. ➢ Works with the Reporter/Communicator to insure proper understanding of graph interpretation	**Research Consultant** ➢ Reads/explains the experimental design of an activity/investigation ➢ Finds concepts related to an activity/investigation in resource materials ➢ Works with the Project Manager, Data Analyzer, and Reporter/Communicator to explain and include research information in the presented report

Teacher's Name_____ Grade Level Taught_____ Subject Taught_____ Teacher Contact Number_____ School_____ School Address_____ School Telephone Number_____ Availability (45-60 minute intervals) _____ Science Standards to be Taught	Teacher's Name_____ Grade Level Taught_____ Subject Taught_____ Teacher Contact Number_____ School_____ School Address_____ School Telephone Number_____ Availability (45-60 minute intervals) _____ Science Standards to be Taught
Teacher's Name_____ Grade Level Taught_____ Subject Taught_____ Teacher Contact Number_____ School_____ School Address_____ School Telephone Number_____ Availability (45-60 minute intervals) _____ Science Standards to be Taught	Teacher's Name_____ Grade Level Taught_____ Subject Taught_____ Teacher Contact Number_____ School_____ School Address_____ School Telephone Number_____ Availability (45-60 minute intervals) _____ Science Standards to be Taught

ID Me (Mildred Wigfall 2012) 1 My name is _____ ID me closely and you will see There are many dimensions to me I'm good at_____ I invite you to examine my style Some people might see me as troubled youth But I've come to tell you, all of that is not truth I've become somewhat of a super sleuth I dig up the truth so that I don't get boxed in To the image someone else tends to lock me within **Bridge:** ID me, ID me, ID me, and you will see I'm a person who**….** On the way to becoming me.	ID Me (Mildred Wigfall 2012) 2 My name is _____ And I have a story to tell About the trials of my ancestors who fell But that's not how the story ends They came to America and set new trends Hip-hop and rap—I'm sure you have heard Have gone global with music and spoken word **Bridge:** ID me, ID me, ID me, and you will see I'm a person who**….** On the way to becoming me.
ID Me (Mildred Wigfall 2012) 3 The culture of our people is what this all about A village griot tells the story with no doubt That the history he tells by word and the drum Is African- American culture-- where it came from **Bridge:** ID me, ID me, ID me, and you will see I'm a person who**….** On the way to becoming me	ID Me (Mildred Wigfall 2012) 4 I dream about the future and what I can become Instead of looking back at the bad things I come from I'm a _____at heart at the end of the day Because I want to be remembered as one who did not stray From working toward goals that would some day pay **Bridge:** ID me, ID me, ID me, and you will see I'm a person who**….** On the way to becoming me.

Identity-Building Poetry Card Samples **(Appendix V)**



Certificate of Completion

The National Institutes of Health (NIH) Office of Extramural Research certifies that **Mildred Wigfall** successfully completed the NIH Web-based training course "Protecting Human Research Participants".

Date of completion: 06/15/2011

Certification Number: 702738