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The Schoolyard as an Outdoor Classroom: Learning Through Experience

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BY

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We abuse land because we regard it as a commodity belonging to us.
When we see land as a community to which we belong,
we may begin to use it with love and respect.

Aldo Leopold (1949)

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Abstract

When teaching ecology concepts, teachers often overlook utilizing the schoolyard as an outdoor classroom. This study examined the use of the schoolyard to teach ecology concepts in order to improve environmental knowledge and attitudes among fifth grade African-American students. The "Nature Unleashed" curriculum was the primary source for the lessons. This curriculum encompasses experiential learning and place-based education. The curriculum, taught over a six-week period, utilized hands-on activities inside and outside of the classroom. There were 248 fifth grade African-American students (N = 248) who participated in the research study. Students responded to a pre- and post-assessment to measure knowledge gains and changes in attitudes towards nature. The assessment that accompanied the "Nature Unleashed" curriculum measured knowledge gains. The Children's Environmental Attitude and Knowledge Scale (CHEAKS) measured changes in attitude.

Results of the study indicated there was a statistically significant gain in environmental knowledge. The study also indicated there was not a statistically significant change in attitudes toward the environment. Analysis of the subgroups verbal commitment, actual commitment and affect also indicated there was not a significant change.

Keywords: schoolyard, experiential learning, environmental education, African-American students

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Chapter 1

Do your students suffer from "nature-deficit disorder?" Richard Louv (2005) describes this disorder as the "human cost of alienation from nature, among them, diminished use of the senses, attention difficulties, and higher rates of physical and emotional illnesses" (p. 36). Since the introduction of technology, children spend more time with technology and less time outside with nature (Power, 2009). In addition, overprotective parents and schedules filled with organized experiences, such as sports, hobbies and art activities, have caused children to lose touch with nature (Broda, 2007; Louv, 2005). Because children spend less time outdoors, childhood obesity has increased and more children have been diagnosed with attention deficit disorder (Louv, 2005). According to the Centers for Disease Control [CDC] (2013), 17% of all children are obese, which has tripled from just one generation ago. One of the main causes of childhood obesity is television and entertainment media, which is causing children to stay indoors more (CDC, 2013). In addition, the CDC (2013) reports that as of 2007 there has been a 22% increase of children diagnosed with attention deficit hyperactive disorder.

Reading and mathematics are the priority at the elementary school level, due to high stakes test; therefore, science is rarely taught (Appleton, 2007; Trautmann, Makinster, & Avery, 2004). If ecology is taught, elementary teachers tend to teach more about exotic places instead of local places. In addition, if ecology is taught, then it is often taught using a traditional instructional approach where the teacher disseminates information and the students memorize information and reproduce it on a test. At the end of the unit, the culminating activity is a field trip to a park or nature center where students participate in several quick activities (Fisman, 2005). These short field trips are isolated experiences, which do not afford students the opportunity to conduct scientific experiments. Seldom are students afforded the opportunity to conduct long-term observations to observe changes over time. In addition, they are seldom afforded the opportunity to manipulate variables to be tested (Carrier Martin, 2003; Drissner, Haase & Hille, 2010).

Elementary teachers fail to realize they have the best place to teach ecology, which is right outside their door. The schoolyard provides teachers the opportunity to help students overcome their fears of nature. It also provides teachers the opportunity to teach about the interaction of living and non-living things, habitats, ecosystems and predator-prey relationships, to name a few. Using the schoolyard as an outdoor classroom to teach ecology also provides students the opportunity to make long-term observations, manipulate variables, observe, and document changes over time. The use of the schoolyard may assist in improving students' knowledge of the environment and improve students' attitudes towards the environment. Children today are the environmental stewards of the future and schools have the potential to influence behaviors and change attitudes (Carrier Martin, 2003; Drissner et al., 2010).

Theoretical Framework

The theoretical framework employed for this study was experiential learning. Dewey (1938) believed traditional education disseminates knowledge that has already been discovered in the past. In this case, the life experiences of students are irrelevant because the knowledge they receive is predetermined and controlled. Thus, students are not afforded the opportunity to relate their learning to real life experiences. Dewey (1938) was an advocate for teaching science and asserted that science should be experienced and should relate to everyday life. Kolb (1984) also believed that students learn best through authentic experiences; therefore, he developed the experiential learning theory. Kolb (1984) defines learning as "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping and transforming experience" (p. 41).

The experiential learning theory consists of four stages: concrete experience, abstract conceptualization, reflective observation and active experimentation. Concrete experiences are the basis for observations and reflections. It is through these reflections that the learner is able to understand abstract concepts. These abstract concepts then lead to new experiences to be tested (Kolb, Boyatzis & Mainemelis, 1999). It is through experience-based learning activities that students become actively engaged in real life learning. These activities afford students the opportunity to process information deeply. The outcomes from experience-based learning activities are more endearing than the outcomes from teacher-directed learning (Ballantyne & Packer, 2009).

In this study, experiential learning took place in the schoolyard to link classroom learning to the real world (Eyler, 2009). This instructional approach is referred to as place-based education (Sobel, 2006). This approach takes students into their immediate surroundings to facilitate learning from their experiences. When students purposefully interact in their local surroundings, they are able to relate more closely to their world (Knapp, 2005).

Since there has been little research using the schoolyard to improve environmental knowledge in urban students (Bodzin, 2005), the hypothesis for this study was the notion that using the schoolyard will improve environmental knowledge in African-American students, as well as improve their attitudes toward the environment. There are two reasons why African-American students were selected for this study. First, the populations of the studies conducted previously in which the schoolyard was used have been predominately Caucasian students coming from low to middle income families in suburban and rural districts (Carrier, 2007, 2009; Carrier-Martin, 2003; Cronin-Jones, 2000). The students in this study were from an urban district, where the majority of their families are socioeconomically disadvantaged. The second reason African-American students were chosen for this study was they tend to be less engaged in science and are under-represented in the science workforce. The earlier we engage African-American students in science, the more likely they may be to pursue careers in science (McPhail, 2011).

Purpose of the Study

It is never too early to expose children to nature. The sooner teachers introduce children to the environment the more likely they are to develop appropriate and responsible behaviors, as well as positive attitudes towards the environment. The schoolyard is an excellent way to enhance environmental knowledge in order to develop these positive attitudes and responsible behaviors.

The purpose of this study was to examine the effectiveness of using the schoolyard as an outdoor classroom to improve environmental knowledge and attitudes among African-American students.

Research Questions

The following questions guided this study:

1. Does utilizing the schoolyard as an outdoor classroom improve environmental knowledge in 5^{th} grade African-American students?
2. Does utilizing the schoolyard as an outdoor classroom improve environmental attitudes in 5^{th} grade African-American students?

Research Hypotheses

The following hypotheses guided this study.

Null Hypotheses

1. There is no significant change in environmental knowledge after participating in schoolyard activities in 5^{th} grade African-American students.
2. There is no significant change in environmental attitudes after participating in schoolyard activities in 5^{th} grade African-American students.

Research Hypotheses

1. There is a significant change in environmental knowledge after participating in schoolyard activities in 5^{th} grade African-American students.
2. There is a significant change in environmental attitudes after participating in schoolyard activities in 5^{th} grade African-American students.

Significance of the Study

The research conducted regarding the improvement of environmental knowledge has been based on field trips to nature centers and parks. There is very limited research on the use of the schoolyard as an outdoor classroom to increase environmental knowledge and improve attitudes (Bodzin, 2008). The few studies focused on the effectiveness of the schoolyard have investigated changes in environmental knowledge and attitudes in Caucasian students. They have also focused on gender differences and learning styles. Cronin-Jones (2000) studied the effectiveness of schoolyard learning and improvements in environmental knowledge and attitudes. Cronin-Jones (2000) suggested “further studies are needed to determine if the effectiveness of schoolyard learning experiences differ for elementary students of different ages, genders, ability levels or ethnicities” (p. 208). This study will contribute to the literature related to the effectiveness of using the schoolyard to improve environmental knowledge and attitudes among African-American students.

Delimitations

For the purpose of this study, the participants were fifth grade African-American students enrolled in a Midwestern urban school district. The “Nature Unleashed” curriculum focused on the Missouri Grade Level Expectations (GLEs) for ecology at the fourth grade level, but the district the researcher worked in decided to use this curriculum with fifth grade students. The study was conducted from early April to mid-May 2014, so students were able to observe the changes in the seasons. The schoolyards that were utilized were not the typical urban schoolyards that have an abundance of asphalt. The schoolyards in this study were large green spaces, having trees or wooded areas at the perimeter.

Limitations

This study was limited to fifth grade African-American students in a Midwestern school district. The researcher utilized students from his school district. Another limitation was that there was not a control group. A final limitation was that most elementary teachers instructing the program possessed limited background knowledge in science content.

Assumptions

There are several assumptions pertaining to this study. One assumption was that teachers were committed and motivated to follow the “Nature Unleashed” curriculum. Another assumption was that teachers did their best to teach the curriculum, even if they had limited knowledge of ecology. The final assumption was that students answered the environmental attitude pre- and post-survey honestly.

Definition of Terms

1. Environmental Education (Ecology) – Learning about organisms and their physical and biological surroundings, with an emphasis on the components of an ecosystem and the interactions that exist within ecosystems.
2. Grade Level Expectations (GLE) – A Missouri state developed framework that brings focus to teaching, learning and assessing science.
3. Nature Unleashed Curriculum – A science/conservation education program, developed and promoted by the Missouri Department of Conservation (MDC). The program utilizes the immediate school grounds as important resources for student learning. The curriculum design brings students outdoors, close to nature in order for them to explore, investigate, and ask questions about immediate areas around their school.
4. Schoolyard – Refers to the natural surroundings of the school building, which can include developed natural areas and undeveloped areas.

Organization of the Study

The remainder of the study is organized into four Chapters, References and Appendices. Chapter 2 discusses the related literature pertaining to the importance of environmental education and the need for environmental education. Chapter 2 also discusses the experiential learning theory and place-based education. Chapter 3 discusses the research design and methodology of the study, as well as the instruments utilized in the study to gather data along with the procedures followed and the selection of the sample. Chapter 4 presents the analysis of the data and a discussion of the findings. Chapter 5 contains a summary of the findings of the study, conclusions made from the analysis, and recommendations for further studies.

Chapter 2

Review of Literature

Science, in general, is not widely taught at the elementary level due to high stakes tests that focus on communication arts and mathematics (Appleton, 2007; Trautmann, Makinster, & Avery, 2004). The primary reason for this change in focus is due to the No Child Left Behind Act enacted by Congress in 2001 (Griffith & Scharmann, 2008). In addition, elementary teachers often lack the content knowledge necessary to feel confident enough to teach science (Trautmann et al., 2004). Ecology is seldom taught at the elementary level, primarily due to standardized testing (Hart, 2010). Elementary teachers often lack the content knowledge to engage their students in environmental education. Many states in the US do not have environmental education and/or environmental studies standards for teacher certification (Ferreira, Grueber & Yarema, 2012). The lack of teacher certification in environmental studies has caused environmental education to be extremely vague in schools today (Hart, 2010).

The majority of the research on outdoor education focuses on field trips to parks, nature preserves and outdoor experiences in residential centers (Carrier, 2009). There is very limited research regarding nature and outdoor learning as well as using the schoolyard to teach ecology concepts (Bodzin, 2008; Erdoğan, 2011). Erdoğan (2011) posits that more research is needed to determine the effectiveness of environmental education on students' cognitive and affective domains. The purpose of this study was to utilize the schoolyard as an outdoor classroom to help increase knowledge of the environment among African-American students and ideally improve their attitudes towards the environment.

This chapter discusses the importance of environmental education and the need for environmental education. Two effective teaching strategies will also be discussed, experiential learning and place-based education.

Environmental Education

The main goal of environmental education should be to affect behavior changes that have a positive impact on the environment (Saylan & Blumstein, 2011). In order for these changes to occur, students must first have an understanding of the natural processes and systems that make up the environment (North American Association for Environmental Education, 2010). Educators play an important role in helping to develop students' appreciation for the environment by providing students multiple opportunities to experience nature (Eick, 2012; Saylan & Blumstein, 2011). Educators should assist in helping students understand the connection between humans and the biophysical world and instill in them an appreciation for nature (Erdoğan, 2011; Ferreira et al., 2012). Engaging students in outdoor learning increases the opportunity for them to develop a greater understanding of nature; fosters an awareness of how humans fit in with nature; enhances attitudes towards nature; and helps develop sensitivity towards living things (Chawla & Flanders, 2007; Drissner & Hille, 2010; Saylan & Blumstein, 2011).

Need for Environmental Education. Unfortunately, children who have access to technology spend less time outdoors. Louv (2005) coined this problem "nature-deficit disorder" (p. 36). Louv described this disorder as "the human cost of alienation from nature, among them: diminished use of the senses, attention difficulties and higher rates of physical and emotional illnesses" (p. 36). In order for society to overcome these issues, environmental education must be taught in schools (Barraza, 2001).

Parents play a pivotal role in whether or not children spend more time outdoors. Sadly, parents in the US can be overprotective of their children and tend to over- manage their lives

(Hacking, Barratt & Scott, 2007; Malone, 2007). The main reason parents are so anxious and protective is attributed to stranger danger, child abductions, and traffic (Hacking et al., 2007; Louv, 2005; Malone, 2007; Power, 2009). Because of parents being so protective and not allowing their children free mobility, the children tend to feel they have little opportunities for free play (Malone, 2007).

Louv (2005) has linked several negative effects to children not spending enough time outdoors, such as childhood obesity and an increase in attention deficit disorder. Obesity now affects 17% of all children and adolescents in the United States – triple the rate from just one generation ago (CDC, 2013). If we do not educate children about the environment and get them outdoors, then childhood obesity will continue to increase (Cleaver, 2007).

Like obesity, attention deficit disorder has increased greatly in recent years. As of 2007, approximately 9.5% or 5.4 million children 4-17 years of age were diagnosed with attention deficit hyperactive disorder, representing a 22% increase in four years (CDC, 2012). Educators play a profound role in breaking this cycle by getting students outdoors, educating them about the environment and embracing a positive attitude towards learning and caring about the environment (Chawla & Flanders, 2007; Littledyke, 2008).

Benefits of Environmental Education. When children are taught about the environment in an outdoors setting, it stimulates cooperation, creativity, problem-solving skills, increases knowledge, and develops values and beliefs about the environment (Dillon, 2006). Environmental education extends beyond traditional knowledge and skills, by empowering students to take responsibility for the environment, affording students the opportunity to participate in hands-on, real-world activities and providing students endless opportunities to learn about interconnections (Dillon, 2006; Dyment, 2005; Lakin, 2006). In addition, environmental education provides students the opportunity to think and perform like scientists by making observations, taking measurements, making predictions, classifying information, and making inferences and drawing conclusions (Eick, 2012).

Environmental education also improves test scores as well as the overall performance of students (Cleaver, 2007; Power, 2009). A study conducted by the California Department of Education in 2005 showed an increase in science test scores by 27%. This increase was attributed to children learning in outdoor classrooms (Cleaver, 2007).

Another example of success occurred in a school in Louisiana where they were destined to close because of low performances on state assessments. This particular school requested that they change their school to a magnet designation. Once the school received this designation, an environmental theme was created, utilizing the Project Learning Tree curriculum. Environmental science concepts were integrated across the curriculum. In 1999, the schools scores on the Iowa Test of Basic Skills was 26 points below the state's average points, but by 2007 the school reached a score of 89, an improvement of 48.6 points, surpassing the state's average points (Haines & Kilpatrick, 2007).

The suggested benefits of environmental education are promising. Environmental education provides students the opportunity to interact and learn about the environment, as well as improve attitudes and behaviors towards the environment. Additionally, environmental education improves problem-solving and critical thinking skills.

Effective Teaching Strategies

Experiential Education. Experiential education is used in a variety of ways. In this study, experiential learning entailed taking students into their local surroundings to link classroom learning and the real world (Eyler, 2009). Experience-based learning activities provide students the opportunity to be actively engaged in real life learning. These activities also afford students the opportunity to process information in-depth. The outcomes from experience-based learning activities are more enduring than the outcomes from teacher-directed learning (Ballantyne & Packer, 2009). It is through these experience-based activities that students will develop their environmental knowledge, attitudes and responsible actions (Littledyke, 2008).

Kolb (1984) created the experiential learning theory. The basis of this theory is to use authentic experiences for learners and to reflect on their learning experiences (Broda, 2007; Kolb, 1984). Kolb (1984) formed his experiential learning theory based on the ideals of Dewey, Lewin, and Piaget. His learning theory incorporates concrete experiences, observations and reflections, suggested by Lewin (1942) in his experiential learning process; observation, judgment, experience, concepts and actions suggested in Dewey's (1938) model of experiential learning; and assimilation and accommodation suggested in Piaget's (1936) model of learning and cognitive development.

Kolb (1984) proposes that experiential learning has six main characteristics:

- Learning is best conceived as a process, not in terms of outcomes;
- Learning is a continuous process grounded in experience;
- The process of learning requires the resolution of conflicts between dialectically opposed modes of adaptation to the world;
- Learning is a holistic process of adaptation to the world;
- Learning involves transactions between the person and the environment; and
- Learning is the process of creating knowledge.

These six characteristics are incorporated into the four stages of the experiential learning model, as follows:

- First Stage: Concrete Experience (CE) – The learner actively experiences a new activity, such as a lab session or fieldwork.
- Second Stage: Reflective Observations (RO) – The learner consciously reflects back on the experience and observes these experiences from different perspectives.
- Third Stage: Abstract Conceptualization (AC) – The learner attempts to conceptualize a theory or model based upon observation.
- Fourth Stage: Active Experimentation (AE) – The learner uses the theories developed to make decisions and solve problems in a new experience (Atherton, 2011; Kolb, 1984).

These stages show there are two primary dimensions to the learning process:

- First Dimension - Concrete experiences at one end of the spectrum and abstract conceptualization at the other, called the perception continuum. This describes the learner’s approach to a task, such as preferring to learn by doing or watching.
- Second Dimension – Active experimentation at one end of the spectrum and reflective observation at the other, called the processing continuum. This describes the learner’s emotional response, such as preferring to learn by thinking or feeling (Kolb, 1984).

Kolb (1984) asserted that learners move along these two spectrums in varying degrees.

Kolb theorized that from the perception continuum and the processing continuum, four learning styles could be derived. He believed that learning styles are not fixed traits, but are patterns of behaviors based on the learner’s background and experiences. Thus, Kolb views these patterns as learning preferences instead of styles. The four learning styles are diverging, assimilating, converging and accommodating (Kolb & Kolb, 2005).

The diverging learning style incorporates concrete experiences and reflective observations. The divergent learner is able to look at things from different perspectives and is often sensitive. They prefer to watch instead of do, which enables them to gather information and use their imagination to solve problems. These learners also perform better in situations that require generating ideas. Divergent learners are interested in people and tend to be strong in the arts. They prefer to work in groups and are open-minded (Kolb & Kolb, 2005).

The assimilating learning style incorporates abstract conceptualization and reflective observations. The assimilator prefers a concise, logical learning approach. They feel that ideas and concepts are more important than people are and require good, clear explanations. Learners that encompass this learning style are good at understanding wide-ranging information and organizing it in a clear and logical format. The assimilating learner is more apt to accept logical, sound theories rather than approaches based on practical value. These learners gravitate more to information and science careers (Kolb & Kolb, 2005).

The converging learning style incorporates abstract conceptualization and active experimentation. Convergent learners are able to solve problems and are able to use their learning to solve practical problems. They are less concerned with people because they prefer technical tasks. Convergent learners are best at finding practical uses for ideas and theories. These learners like to experiment with new ideas, create simulations and work with practical applications (Kolb & Kolb, 2005).

The accommodating learning style incorporates concrete experiences and active experimentation. The accommodating learner prefers hands-on learning and is more intuitive than logical. They tend to use others' analyses and often take a practical, experiential approach to situations. Accommodating learners are attracted to new challenges and experiences as well as carrying out plans. This particular learning style is quite prevalent within the general population (Kolb & Kolb, 2005).

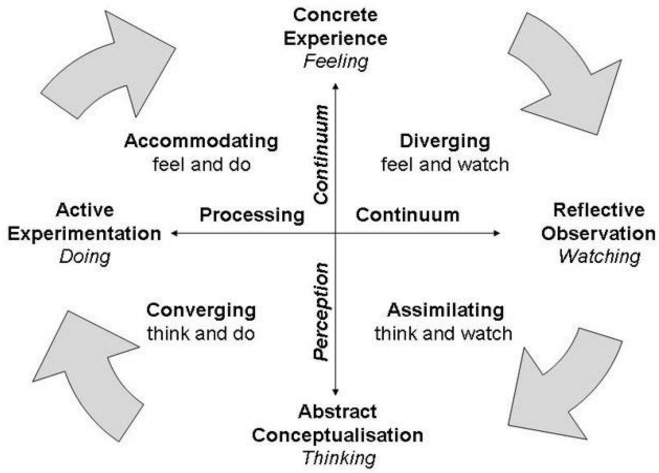

Figure 1. Kolb's Experiential Learning Theory. Reprinted from McLeod, S.A. (2010). Kolb – Learning Styles . Retrieved from http://www.simplypsychology.org/learning-kolb.html. Copyright (2010) by Saul McLeod. Reprinted with permission.

The key to the experiential learning cycle is reflection. Within the learning cycle, reflection is a separate activity. However, Ord & Leather (2011) believe that reflection should not be a separate activity, but should be part of the activity and should take place on the spot. Through these reflections, students are able to make connections between experiences and theory, which deepens their understanding of what they are learning. This connection also assists them in utilizing what they know in other contexts (Eyler, 2009).

Schoolyard as an Outdoor Classroom. Many elementary teachers utilize traditional classroom instruction to teach ecology concepts and then take their students on a field trip as a follow up. Unfortunately, field trips prevent long-term observations from occurring and do not allow students to manipulate variables (Carrier Martin, 2003). Teachers often overlook the one site that is readily available to them, the schoolyard (Biggs & Tap, 1986; Simmons, 1993). Outdoor schoolyard experiences can have greater cognitive and affective gains then traditional indoor classroom instruction or off-campus experiences (Carrier Martin, 2003). Additionally, lessons in the schoolyard offer active learning for all students (Carrier, 2009). Utilizing the schoolyard helps develop problem-solving skills, trust and leadership (Broda, 2007). Schoolyard enhanced learning also provides concrete experiences to clarify abstract concepts, increase student achievement and improve understanding (Broda, 2007). Unfortunately, there is a limited body of knowledge regarding the effectiveness of schoolyards as sites for outdoor elementary science instruction (Bodzin, 2008).

Carrier Martin (2003) discovered there were significant differences in male and female environmental attitudes and behaviors so in 2007 she studied gender and its effects on environmental knowledge, attitudes, behavior and comfort levels among fourth and fifth grade students. The treatment groups participated in outdoor schoolyard activities and the control groups participated in traditional classroom activities. The lessons for the 14-week environmental education program consisted of activities that assisted in developing environmental attitudes and knowledge. “It was hypothesized that gender differences would impact students’ posttest scores in the variables studied” (Carrier, 2007, p. 273). The results of the study are as follows:

- There was no significant effect by grade level for environmental attitudes but there was a significant effect of the treatment group ($p = .0066$).
- There was a significant effect on environmental attitudes by gender in the treatment group ($p = .0017$).
- There were no significant gender differences for environmental knowledge, environmental behaviors or comfort levels.
- Overall, positive attitudes increased after the intervention ($p = .0276$). (Carrier, 2007)

It is important to note that before the intervention, females in the treatment group had higher environmental attitude scores than the males and their scores remained similar over time. The males' low scores before the intervention significantly improved over time after the intervention (Carrier, 2007). In this study, females having higher environmental attitude scores before the intervention can be viewed as a flaw.

Carrier (2009) then conducted a second study with the intent to explore the potential for outdoor strategies to meet the needs of boys in environmental education. The reason for this study was to explore gender effects by measuring gain scores in environmental knowledge, attitudes, behaviors and comfort levels. Carrier hypothesized that using "schoolyard activities would enhance achievement across both genders; however …boys in the treatment group would demonstrate levels of achievement that are comparable to the girls' levels in either condition (p. 4).

There were two groups in the study, an experimental group (schoolyard) and a traditional group (classroom). Each group had a 4th and 5th grade class. Both groups participated in a 14-week environmental education program. Even though the traditional groups' instruction took place in the classroom, the same content topics and many of the same activities from the experimental group were used. "The schoolyard activities were selected from a variety of established environmental education curricular resources, including Project WILD, Activities Integrating Math and Science (AIMS) and The Schoolyard Wildlife Activity Guide" (Carrier, 2009, p. 4). The results of the study are as follows:

- Boys had statistically significant greater score gains in the treatment group than in the traditional group.
- Both boys and girls increased their knowledge scores in the treatment group than in

the traditional group.

- Environmental attitudes in boys increased more in the treatment group than in the traditional group and the girls' environmental attitudes were not statistically significant between groups.
- Both groups increased behavior scores in the treatment group and the traditional group; however, boys behaviors increased more than girls in the treatment group.
- Boys increased their comfort levels more in the treatment group than in the traditional group.
- Differences for girls were not statistically significant for comfort levels.

This study shows that when teachers take into consideration "gender differences, learning styles can have a positive effect on student learning" (Carrier, 2009, p. 10).

Place-Based Education. The concept of place refers to a bounded yet open region where many elements are interconnected and always changing in relation to other places (Beech & Larsen, 2014; Escobar, 2001; Malpas, 1999). Place is a location that "people inhabit, visit, rebuild, make, enjoy, sorrow, describe and recount, hence live it" (van Eijck, 2010, p. 189). Place is a unique feature of the world both historically and conceptually and serves to specify the world. Without place one cannot study the physical world because place determines the nature of things and how things behave. Place is something distinct and separate and enables us to locate things (Casey, 1997). "Place serves as the condition of all living things. Place belongs to the very concept of existence" (Casey, 1997, p. 15).

Place cannot be considered without space. Place is a particular area of physical space or a location within place. The concept of space entails the relationship of space to other organisms within a place or location, however, place is more than a location but the idea of how humans and other organisms interact with the physical surroundings within a specific place (Malpas, 1999). Through these interactions, humans experience place via the body allowing humans to control their behaviors and movements with respect to the objects and events within a place and to form an intimate bond to a place (Casey, 1993; Casey, 1997; Malpas, 1999). It is through these bonds that places anchor and orient us and provide us with a sense of place in the world. (Casey, 1997; Malpas, 1999). More importantly, place makes us feel grounded, provides a sense of safety and security and connects us to our everyday life (Beech & Larsen, 2014; Escobar, 2001).

The premise of place-based education is to ground learning in local phenomena and the lived experiences of students. Place-based education encompasses several thematic patterns in educational settings: cultural studies, nature investigations, real-world problem solving, internships and entrepreneurial opportunities and immersion into community life (Smith, 2002). Through these themes, students learn about the ecological and social aspects of the communities where they live (McInerney, Smyth & Down, 2011).

Place-based education emphasizes hands-on, real world learning experiences and challenges students to learn and solve problems (Karrow & Fazio, 2010; Sobel, 2006; van Eijck, 2010). It is through these experiences that students are able to consider their relationship to nature and can relate more closely to the world around them. The ultimate goal of place-based education is for students to develop a sense of place through meaningful, personal connections to nature (Knapp, 2005).

Place-based education has shown an increase in student achievement, critical thinking skills and improvement on some standardized tests (Smith & Sobel, 2010; Sobel, 2006). Place-based education has also changed students' appreciation for the natural world in a positive way

(Sobel, 2006). Unfortunately, standards-based reforms have forced educators to teach the necessary skills to compete in the global market. This has caused place-based education to become almost obsolete in classrooms today (Ault, 2008; Gruenewald, 2008; Jennings, Swidler & Koliba, 2005). A standards-based curriculum not only decontextualizes the curriculum but also prevents teachers from teaching content beyond what is tested on state assessments. Standards-based curriculums also dismisses place as an experiential and educational context for learning (Gruenewald, 2008; Jennings, et. al, 2005).

The East Feliciana Parish School District, located in southeastern Louisiana in the US, began implementing place-based learning in their elementary schools during the 1999-2000 school year. They used the environment as the theme for their place-based learning. Students studied local soil, rocks and minerals, ecology, topography, weather, biodiversity and water quality. They also received funding to build nature trails and butterfly gardens. Using an environmental theme for their place-based learning yielded positive results. From 1999 to 2002, fourth grade students performing at the unsatisfactory level on the Louisiana Educational Assessment Program for the 21st Century (LEAP 21) decreased by 13.2 percentage points in English language arts. During the same period, students performing at the unsatisfactory level on LEAP 21 in mathematics decreased by 14.1 percentage points and in science by 8.1 percentage points (Emekauwa, 2004).

Fisman (2005) examined changes in environmental awareness and environmental knowledge among 3rd and 5th grade students participating in the Open Spaces as Learning Places Program (New Haven, Connecticut, US). Open Spaces as Learning Places is a neighborhood-based environmental program affording students the opportunity to gain awareness of the ecological patterns and processes within their neighborhood. Knowledge questionnaires and a cognitive mapping exercise were used to measure changes before and after participating in the program. The average awareness score before participating in the program was 6.53 and the average knowledge score was 6.38. After participating in the program the average awareness score was 9.94 ($p < .01$) and the average knowledge score was 6.89 ($p = .08$).

Even though these two studies are different in their approach, they both show positive outcomes when using the local environment to improve student achievement and knowledge of the environment.

Environment as an Integrating Context for Learning (EIC). An integral part of place-based education is using the Environment as an Integrating Context for learning (EIC). EIC is a term created by the State Education and Environment Roundtable (SEER, 2000). EIC does not focus primarily on learning about the environment or developing environmental awareness. Instead, EIC is a framework for interdisciplinary, collaborative, student-centered, hands-on and engaged learning. It uses a school's surroundings and community as a framework where students can construct their own learning. Typically, the environment is used as a comprehensive focus and framework for learning in all areas, such as general and disciplinary knowledge, thinking and problem-solving skills and basic life skills. EIC programs attempt to provide students with opportunities to connect and integrate what they are learning to their surroundings (Lieberman & Hoody, 1998). According to SEER (2000), using the environment as an integrating context for learning has the following benefits:

- better performance on standardized measures of academic achievement in reading, writing, math, science and social studies;
- reduced discipline and classroom management problems;
- increased engagement and enthusiasm for learning and greater pride and ownership in

accomplishments (Preface, para. 6).

In 2005, SEER conducted a study on behalf of the California Department of Education. The data analyzed in this study compared standardized test scores from the California Standard Testing and Reporting (STAR) assessment program representing five school years of scores from second through fourth grades in reading, writing, math, language and spelling. The State Education and Environment Roundtable used four pairs of schools, one being the treatment group and one being the control group in each pair. The treatment group participated in EIC programs and the control group participated in traditional classroom instruction. The results of the study are as follows:

- In 100% of the reading assessments, students in the treatment groups scored as well or better then students in the control groups.
- In 92.5% of the math assessments, students in the treatment groups scored as well or significantly higher than students in the control groups.
- In 95% of the language assessments, students in the treatment groups scored as well or significantly higher than students in the control group.
- In 97.5% of the spelling assessments, students in the treatment groups scored as well or significantly higher than students in the control group.
- In over 96% of all cases, students in the treatment groups scored as well or significantly higher than students in the control groups.
- In only 4% of the cases, students in the control groups scored significantly higher than students in the treatment groups.
- In 42% of the cases, students in the treatment groups scored significantly higher than students in the control groups in reading, math, language and spelling (SEER, 2005,

Results, para. 3).

Summary

The ultimate goal of environmental education is to help individuals develop an appreciation for nature (Saylan & Blumstein, 2011), as well as raise awareness about environmental protection, ethics, values and responsibility (Xuehua, 2004). In the absence of an overarching theory, that encompasses environmental education, experiential learning and place-based education are two widely utilized frameworks. While limited in scope, research conducted using the schoolyard as an outdoor classroom shows that providing students with hands-on, exploratory activities in their local environment significantly improves students' knowledge and behaviors toward the environment (Ballantyne & Packer, 2009; Malinowski & Fortner, 2011).

Chapter 3

Methodology

The purpose of this study was to examine the effectiveness of using the schoolyard as an outdoor classroom to improve environmental knowledge and attitudes in fifth grade African-American students. This chapter contains sections on the research design, the population and sampling procedures, instrumentation, data collection, data analysis and human subjects concerns.

Research Design

This study consisted of a quantitative, pre-experimental design using one group, also known as a "pretest-posttest" single group design (Salkind, 2010). This design was selected because the school district would not allow an experimental design. History, maturation, and carryover affects are all threats to this particular design. In addition, the validity of this design is a threat because there is inadequate control during implementation (Salkind, 2010).

The focus group for this study was fifth grade African-American students in a Midwestern, urban school district in the US. The students in this study were African-Americans from low socio-economic families. The students' reading and math abilities ranged from below grade level to above grade level. The study consisted of 11 classrooms (N=248). The treatment group fully participated in the program, i.e. using the schoolyard as an outdoor classroom and completing all of the hands-on, interactive activities over a six-week period.

Sampling

The sample procedure was a convenience sample. Each student was issued a random identification number that was unknown to the researcher. For each pre- and post-assessment, the students wrote their number on the assessment. To ensure that students remembered their number they wrote it on the inside cover of their science textbook or in the science notebook that was provided to them through the “Nature Unleashed” curriculum. Since the researcher taught in the school, a convenience sample was utilized and students were able to participate in the study in intact classroom settings with their teachers.

The students selected were from four elementary schools in a Midwestern, urban school district. The students within the school district tend to be rather transient, therefore, a larger sample size assisted in accounting for possible attrition (Gall et al., 2007).

Instrumentation

Two data collection instruments were utilized in this study. One instrument measured the gains in environmental knowledge and the other measured changes in attitudes. Each instrument is discussed below.

The “Nature Unleashed” curriculum, produced by the Missouri Department of Conservation, is designed for elementary students. The primary target is fourth grade ecology; however, it also targets matter and energy, living organisms and inquiry. Communication arts is also incorporated into the program. Appendix A offers a description of each Grade Level Expectation addressed in the curriculum. There are eight lessons in the unit with at least one activity per lesson. Appendix B highlights the content of each lesson. The lessons provide students with field-tested, inquiry-based, hands-on activities to promote understanding of the concepts taught. All of the materials are free of charge from the Missouri Department of Conservation. The materials include a detailed teacher’s guide, a colorful student book for each student and a science notebook for each student. The curriculum includes the assessment administered as a pre- and post-assessment to measure knowledge gains. The assessment consisted of nine selected response questions and 10 constructed response questions. The constructed response questions consisted of underlining specific information, writing words to match their definitions, creating charts, labeling and written responses from the students in their own words. Appendix C provides the Nature Unleashed assessment, which was administered to the whole group. Upon the completion of the pre-assessments, the teachers participating in the study returned them to the researcher for scoring. The same process was followed upon the completion of the post-assessments. The researcher utilized the scoring guide that accompanied the curriculum to score the assessments.

The assessment that accompanied the "Nature Unleashed" curriculum had not been tested for validity and reliability. The researcher conducted a pilot study in April 2014 with seven fourth grade students to measure the validity and reliability of the assessment. Content validity was addressed by ensuring the assessment matched the objectives of the curriculum. The questions on the assessment were compared to the grade-level expectations to ensure they were aligned. To test for the reliability of the assessment, two different tests were conducted: test-retest reliability and internal consistency reliability. Test-retest reliability entails administering the assessment at one point in time and then readministering the assessment at a later time. Salkind (2008) stated, "test-retest reliability is a must when you are examining differences or changes over time" (p. 104). The one critical issue with the test-retest reliability is to ensure enough time has passed before administering the test a second time (Gall et al., 2007). The students who participated in the pilot study took the assessment four weeks after they took the assessment the first time. The Pearson correlation coefficient was utilized to determine the test-retest reliability. Internal consistency reliability was utilized to ensure the individual items on the assessment measured only one dimension of the content. Cronbach's alpha coefficient (α) was utilized because the assessment consisted of selected response and constructed response questions, which had different point scales (Gall et al., 2007).

The other instrument utilized in this study was the Children's Environmental Attitude and Knowledge Scale (CHEAKS). This instrument consisted of two sub-scales: attitude and knowledge. For the purpose of this study, only the attitude scale was utilized because the "Nature Unleashed" assessment measured knowledge. The attitude scale consisted of 36 multiple-choice questions that measured students' attitudes toward environmental issues (12 items each focused on verbal commitment, actual commitment, and affect). The items in the attitude scale consisted of a 5-point Likert-type scale, i.e., 1 = very true, 2 = mostly true, 3 = not sure, 4 = mostly false or 5 = very false. The attitudinal items focused on six content areas: animals, energy, pollution, recycling, water and general issues. The most pro-environmental responses were scored five points and the least pro-environmental responses were given one point. The scores on the attitude scale range from 36 to 180. The reliability of the attitude sub-scale was .89 to .91 using Cronbach's alpha. This measured the internal consistency of the attitude scale. Factor analysis showed correlations among the attitude scales, which showed this section measured independent constructs. It also indicated the intention of the attitude scale held true, to measure a single global factor. These analyses provide evidence that the CHEAKS attitude sub-scale is valid (Leeming & Dwyer, 1995). Appendix D contains the CHEAKS attitude assessment. .

Data Collection

In order for this study to be undertaken, it was important to have the teachers participate in the study and understand the essence of the program being implemented. The eleven fifth grade teachers who participated in the study were required to teach the "Nature Unleashed" curriculum as part of the district's science curriculum. In March 2014, the fifth grade teachers attended a one-day professional development workshop to acclimate them to the "Nature

Unleashed" curriculum. The teachers received their curriculum guides and walked through the components of a lesson. They also conducted several hands-on, inquiry-based lessons, such as examining animal skulls to determine the type of consumer. Another activity investigated how cold-blooded animals survive in cold weather by finding ways to keep their animal's body temperature within a comfortable range. This afforded teachers the opportunity to experience the activities before implementing them in their classroom. The education consultant from the Missouri Department of Conservation was present during the professional development to answer questions.

In early April 2014, the participating teachers began teaching the curriculum. They administered the pre-assessment for the "Nature Unleashed" curriculum and the Children's Environmental Attitudes and Knowledge Scale (CHEAKS), which were returned to the researcher for scoring. Upon the completion of the final lesson, the teachers administered the post-assessment for the "Nature Unleashed" curriculum and CHEAKS and returned the post assessments to the researcher for scoring. The entire curriculum, including the pre/post assessments, lasted a duration of approximately six weeks.

During the implementation of the curriculum, the researcher visited each fifth grade classroom or group at least once. During these visits, the researcher conducted observations and kept a journal describing each classroom or group of students. The researcher observed the instructional delivery of the curriculum, noting if the teacher was following the curriculum provided as well as the implementation of the schoolyard investigations. The researcher also went outdoors with the students to observe and note their participation and engagement in the activities. During the outdoor investigations, the researcher checked for understanding by asking students probing questions about their investigation and data collection.

Data Analysis

Descriptive statistics were utilized to describe the sample of the population that participated in the study, i.e., gender and ethnicity. The data are presented in Table 1 of Chapter 4 and discussed briefly.

Inferential statistics were utilized in order to make an inference from the sample to the population. This may pose a threat to the population validity of the study. Since this study focused on African-American students, it may be difficult to generalize the outcomes to other populations of students of different ethnicities with similar socio-economic backgrounds (Gall et al., 2007).

The purpose of this study was to examine the effectiveness of using the schoolyard as an outdoor classroom to improve African-American students' environmental knowledge and attitudes. The following research questions guided the study's methodology, design and analysis strategies:

Research Question One

Does utilizing the schoolyard as an outdoor classroom improve environmental knowledge in 5^{th} grade African-American students?

Research Question Two

Does utilizing the schoolyard as an outdoor classroom improve environmental attitudes in 5^{th} grade African-American students?

In order to investigate the research questions, the following hypotheses were developed. The null hypotheses are as follows:

H_o1 – There is no significant change in environmental knowledge after participating in schoolyard activities in 5^{th} grade African-American students.

H_o2 – There is no significant change in environmental attitudes after participating in schoolyard activities in 5th grade African-American students.

All statistical analyses were conducted using the *Statistical Package for the Social Sciences* (SPSS) program. All levels of statistical significance were set at .05 ($p = .05$). If $p < .05$ the null hypothesis was rejected but if $p > .05$ the null hypothesis was not rejected. An analysis of each output is discussed herein.

Null Hypothesis One

The participants in the treatment group took a pre and post assessment. Each of the assessments were analyzed to identify the mean and standard deviation of each group. Then, a t-test for dependent means was conducted. This compared the differences in pretest scores and posttest scores to determine if there was a statistically significant change (Trochim, 2006).

Null Hypothesis Two

The participants in the treatment group took the CHEAKS as a pre and post assessment. Each of the assessments were analyzed to identify the mean and standard deviation of each group. A t-test for dependent means was conducted. This compared the differences in pretest scores and posttest scores to determine if there was a statistically significant change. In addition, each attitude sub-group was analyzed by finding the mean and standard deviation. Then, t-tests for dependent means were conducted to determine if there was a statistically significant positive change in verbal commitment, actual commitment and affect.

Ethics and Human Relations

The only known threats this study posed for the research participants were potential outdoor hazards. Some students may have had spring allergies or allergies to living things found in the environment, so proper precautions were taken to ensure that every student was safe when exploring outdoors.

The superintendent of the school district in which the researcher works, provided approval for the research to take place within the district.

Summary

This chapter has discussed and justified the research design, data collection and data analysis procedures. The intent of the study was to determine if utilizing the schoolyard as an outdoor classroom increases environmental knowledge and attitudes in 5^{th} grade African-American students. The findings from this study contribute to the limited research regarding the use of the schoolyard to teach environmental concepts.

Chapter 4

Results

The purpose of this study was to examine the effectiveness of using the schoolyard as an outdoor classroom to improve environmental knowledge and attitudes in African-American students. This chapter provides the pilot study findings, as well as descriptive statistics of the participants, an explanation for missing data, the data analysis procedures and the data analysis for each of the hypotheses for the study.

Pilot Study

Due to the lack of data pertaining to the reliability and validity of the Nature Unleashed assessment, a pilot study was conducted with a group of fourth grade students (N = 7) participated in the pilot study. They were administered the post assessment four weeks after taking the pre-assessment.

In order to determine the reliability of the scores, the test-retest reliability correlation coefficient was determined by conducting a bivariate correlation. The Pearson Correlation Coefficient was .45 ($r_{\text{pre-post}} = .45$) and a coefficient of determination of .20 ($r^2_{\text{pre-post}} = .20$). A correlation coefficient of .45 represents a moderate relationship between the pre-assessment and the post assessment. The coefficient of determination provides a more accurate way to interpret the correlation coefficient. A coefficient of determination of .20 shows that the pre-assessment and post assessment share about 20% of the variance, which means that 80% of the variance cannot be explained (Salkind, 2008).

Two internal consistency estimates of reliability were derived for the Nature Unleashed assessment: coefficient alpha and a split-half coefficient expressed as a Spearman-Brown corrected correlation. For the split-half coefficient, the assessment was split into two halves making the two halves as equivalent as possible. Questions 1 – 10 were in the first half and questions 11 – 19 were in the second half. Questions 13 and 18 were removed from the scale because they had zero variance. Values for both the coefficient alpha and the split-half coefficient were the same, .59, which is too low to be considered internally consistent and reliable.

To ensure the content of the Nature Unleashed assessment was valid, the researcher compared the items on the assessment to the objectives of the curriculum. Each item on the assessment aligned with the objectives and the lessons addressed the objectives thoroughly. The researcher also compared the items on the assessment to the grade-level expectations to ensure alignment. A science grade-level expectations alignment matrix accompanied the curriculum, which correlated the assessment item to the grade-level expectation it addressed. All of the assessment items aligned with at least one grade-level expectation.

Descriptive Statistics of the Participants

The participants in this study were representative of the larger population of 5^{th} grade students in an urban district. Table 1 shows 212 students participated in the Nature Unleashed pre and post assessments, 49.5% female participants (N = 105) and 50.5% male participants (N = 107). All of the students were African-American.

Table 1

Demographic Information for Participant Population for the Nature Unleashed Assessment

Variable	f	%
Gender		
Female	105	49.5
Male	107	50.5
Total N	212	100.0
Race/Ethnicity		
African-American	212	100.0
Total N	212	100.0

Fewer students participated in the CHEAKS assessment (N = 182); 48.9% were female (N = 89) and 51.1% were male (N = 93), as shown in Table 2. This was due to students being absent the day the CHEAKS assessment was administered. All of the students were African-American.

Table 2

Demographic Information for Participant Population for the CHEAKS Assessment

Variable	f	%
Gender		
Female	89	48.9
Male	93	51.1
Total N	182	100.0
Race/Ethnicity		
African-American	182	100.0
Total N	182	100.0

Table 3 shows the demographic information for the entire population of 5th grade students (N = 250). The female (N = 124) to male (N = 126) ratio was almost equal. There were 248 African-American students and 2 Hispanic students.

Table 3

Demographic Information for Total Population

Variable	f	%
Gender		
Female	123	49.6
Male	125	50.4
Total N	248	100.0
Race/Ethnicity		
African-American	248	
Total N	248	100.0

Eliminated Data

The two Hispanic students (1 female, 1 male) were eliminated from the study since this study focused on African-American students. One entire class (N = 20) did not participate in the study. This was due to the teacher misplacing the Nature Unleashed assessments and the CHEAKS assessments. This class included 10 females and 10 males.

Sixteen students did not take the Nature Unleashed pre-assessment and post-assessment. Out of the total participant population (N = 212) for the Nature Unleashed assessment, 14 females and 24 males were eliminated from the study because they did not take the pre-assessment or the post-assessment. This was due to students being absent for either the pre-assessment or the post-assessment.

Another class (N = 23) did not participate in the CHEAKS assessment. This was due to the teacher not administering the pre-assessment. This class included 12 females and 11 males.

Another 23 students did not take the CHEAKS pre-assessment and post assessment. This was due to the teacher misplacing the pre-assessments. Out of the total participants (N = 182), 19 females and 27 males were eliminated from the study because they did not take the pre-assessment or the post assessment.

Results

A t-test for dependent means was performed on the data to determine if there was an increase in students' knowledge from the pre-assessment to the post-assessment. The data utilized were percentage scores on the assessments. A t-test for dependent means was performed on the CHEAKS data to determine if there was a positive change in students' attitudes toward the environment. In addition, t-tests for dependent means were performed on each of the subgroups (i.e., actual commitment, verbal commitment and affect) to determine if there was a positive change. Several of the Likert-scale responses for specific items were recoded because the most pro-environmental responses on the CHEAKS assessment were given five points. To address this issue the Likert-scales for items 1, 3, 5, 7, 8, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 23, 25, 26, 27, 28, 29, 33, 34, 35, 36 were recoded (i.e., 5 = very true, 4 = mostly true, 3 = not sure, 2 = mostly false, 1 = very false).

Below are the results for the two hypotheses for this study. The overall data analysis for the Nature Unleashed assessment is presented, followed by observation data of the implementation of the Nature Unleashed curriculum. Individual class data analysis for the Nature Unleashed assessment, along with individual classroom observation data, are found in Appendix F. In addition, the CHEAKS overall data analysis are presented, along with the overall data analysis of the subgroups. Appendix G provides individual class data analysis for the CHEAKS assessment. Appendix H provides individual class data analysis for the subgroups.

Null Hypothesis # 1.

The first null hypothesis posited there would not be a significant change in environmental knowledge after students participated in schoolyard activities. This null hypothesis was rejected. The results from the t-test for dependent means indicated there was a significant change or gain in knowledge from the Nature Unleashed pre-assessment to the post-assessment. The mean for the post-assessment (M = 30.44, SD = 11.47) was significantly greater than the mean for the pre-assessment (M = 21.57, SD = 8.87), $t(173) = -12.25$, $p < .01$. Since the obtained value ($p = .000$) is less than the critical value ($p = .05$), the null hypothesis was not accepted. Table 4 provides the overall statistical analysis.

Table 4

Nature Unleashed Assessment

	N	M	SD	t(173)	p
pretest	174	21.57	8.62		
posttest	174	30.44	11.47		
paired test	174	-8.87	9.55	-12.25	.000

Note: *(p < .05, 2-tailed)*

Observations. The researcher visited each classroom at least twice during the study. Out of the ten classrooms, the researcher observed six of the classrooms participating in schoolyard activities. The other four classrooms were either reading the book aloud that accompanied the Nature Unleashed curriculum or were not having science at all during their science period. Since everyone was working at their own pace, the researcher observed the same schoolyard activity multiple times in multiple classrooms. While observing the schoolyard activities, the students were engaged and on-task. The teachers did not provide students with answers regarding their observations, but asked probing questions to help students clarify their thinking. For example, while gathering data about living and non-living things in the schoolyard, teachers would ask students how they know the difference. One student explained the difference as “a living thing grows and reproduces and it needs food and water.” Another student explained, “Non-living things do not grow.” On another occasion, a group of five girls discovered small holes in a tree that appeared to be filled with sap. After the researcher provided them with tree identification books, they identified the tree and then conducted research on the internet to determine what caused the holes in the tree.

Null Hypothesis # 2.

The second null hypothesis posited there would not be a significant change in environmental attitudes after students participated in schoolyard activities. This null hypothesis cannot be rejected. The results from the t-test for dependent means indicated that there was not a significant or positive change in environmental attitudes from the CHEAKS pre-assessment to the post-assessment. The mean for the CHEAKS post-assessment (M = 113.11, SD = 21.91) was not significantly greater than the CHEAKS pre-assessment (M = 112.37, SD = 24.39), $t(135) = -.352$, $p > .05$. Since the obtained value ($p = .725$) is greater than critical value ($p = .05$), the null hypothesis cannot be rejected. Table 5 provides the overall statistical analysis.

Table 5

Overall CHEAKS Assessment

	N	M	SD	t(135)	p
pretest	136	112.37	24.39		
posttest	136	113.11	21.91		
paired test	136	-.743	24.60	-.352	.725

Note: *($p < .05^*$)*

Subgroup Analysis

Verbal Commitment. The mean on the post-assessment for verbal commitment (M = 38.90, SD = 8.88) was not significantly greater than the mean on the pre-assessment for verbal commitment (M = 38.11, SD = 8.55), $t(135) = -.971$, $p > .05$. Table 6 provides the statistical analysis for the subgroup verbal commitment.

Table 6

Overall Verbal Commitment

	N	M	SD	t(135)	p
preverbal	136	38.11	8.55		
postverbal	136	38.90	8.88		
preverbal – postverbal	136	-.794	9.54	-.971	.334

Note: *($p < .05^*$)*

Actual Commitment. The mean on the post-assessment for actual commitment (M = 35.91, SD = 7.97) was not significantly greater than the mean on the pre-assessment for actual commitment (M = 35.71, SD = 8.71), $t(135) = -.246$, $p > .05$. Table 7 provides the statistical analysis for the subgroup actual commitment.

Table 7

Overall Actual Commitment

	N	M	SD	t(135)	p
preactual	136	35.71	8.71		
postactual	136	35.91	7.98		
preactual - postactual	136	-.206	9.74	-.246	.806

Note: $(p < .05^{*})$

Affect. The mean on the post assessment for affect (M = 38.29, SD = 9.10) was not significantly greater than the mean on the pre-assessment for affect (M = 38.55, SD = 10.68), $t(135) = .272$, $p > .05$. Table 8 provides the statistical analysis for the subgroup affect.

Table 8

Overall Affect

	N	Mean	SD	t(135)	p
Pre-affect	136	38.55	10.68		
postaffect	136	38.29	9.10		
preaffect – postaffect	136	.257	11.02	.272	.786

Note: *($p < .05^*$)*

Conclusion

This chapter presented the results of the analyses that were conducted on the two hypotheses for this study. One of the null hypotheses was rejected and one of the null hypotheses was accepted. The concluding chapter will provide a summary and overview of the study, a discussion of the research findings, conclusions, implications of the findings and recommendations for future research.

Chapter 5

Summary and Discussion

This chapter offers a summary of the findings of the study and describes how the study contributes to the existing literature. The implications and limitations of the study, as well as recommendations for further research, are discussed.

Study Overview

There is a growing concern that children spend less time outdoors due to the advancements in technology. Since they spend less time outdoors, they tend to lack knowledge about the environment and often have a disinterest in the environment (d'Alessio, 2012). These issues shaped the purpose of this study, which was to investigate if getting students outside to participate in environmental activities would improve their knowledge about the environment and their attitudes toward the environment. The following questions guided the study:

1. Does utilizing the schoolyard as an outdoor classroom improve environmental knowledge in 5th grade African-American students?
2. Does utilizing the schoolyard as an outdoor classroom improve environmental attitudes in 5th grade African-American students?

Kolb's (1984) experiential learning theory provided the framework for the study. The premise underpinning this theory is that learning is a continuous process grounded in experiencing the environment to create knowledge (Kolb, 1984). The experiential learning theory is related to place-based education. Place-based education provides learners the opportunity to experience local phenomena and teaches them how they can sustain their local community (Jennings, Swidler & Koliba, 2005). In addition to learning about local phenomena, place-based education also affords learners the opportunity to learn about the history, culture, social issues and economics of their community (Sobel, 2006). Through these experiences, learners are able to develop a sense of place by making meaningful personal connections to their surroundings and their community (Karrow & Fazio, 2010; Knapp, 2005; Sobel, 2006; van Eijck, 2010). Meaningful connections enhance a learner’s identity, improves their well-being and transforms their commitment to the community (Ault, 2008).

Major Findings

The first null hypothesis stated there would be no change in environmental knowledge after participating in schoolyard activities. This hypothesis was rejected after data analysis revealed there was a significant change in environmental knowledge from the pre-assessment to the post assessment. Each question that showed a significant gain in knowledge is discussed below.

The first four concepts assessed were all presented as multiple-choice questions. The first question asked students to identify the ecosystem where a beaver would be found. Pond, forest and prairie ecosystems were discussed in detail in Chapter 2 of the student book that accompanied the “Nature Unleashed” curriculum, but did not provide the beaver as an example of an animal that lives in a pond ecosystem. The second question asked students to identify an example of camouflage. This concept was discussed in the student book with examples. The answer choices provided, except for the correct answer, were easy to eliminate due to the context of the answer. The third question entailed identifying the primary source of energy for plants. Chapter 4 specifically stated this. The final multiple-choice question discussed the fact that a bright pink insect’s ability to hide among flowers. The students were to identify which ecosystem the insect would most likely be able to survive. In Chapter 3 of the student book, camouflage was discussed and the bright pink insect was used as an example. The student book even provided a picture of the bright pink insect.

Another question asked students to list the six needs of most plants, i.e. air, water, light, nutrients, space and temperature. These six items were stated explicitly in the first chapter of the student book. Community, ecosystem, organism and population were assessed by providing examples of each one and asking the students to label each description correctly. These concepts were discussed in-depth in Chapter 1 and examples were provided.

Two questions entailed students contrasting specific concepts. One question asked the students to contrast producers and consumers by writing an explanation. Producers and consumers were discussed in Chapter 4 and examples were provided. The other question asked the students to contrast herbivores, omnivores and carnivores by writing and explanation of each. These three types of consumers were discussed and examples were provided in Chapter 5.

Four questions dealt with the concept food chains. One question entailed students sharing their knowledge of the flow of energy in a food chain. They were provided with four pictures and were asked to use arrows and numbers to show the flow of energy in the particular food chain. Food chains were discussed in Chapter 4 and the example provided in the student book was the same food chain that was on the assessment. In the second question, students were given a scenario of a food chain explaining who eats whom. They had to list each organism as a predator or prey from the food chain under the correct heading. Chapter 6 discussed predator and prey relationships. The next question provided students with a food chain. Using their knowledge of producers, consumers, decomposers, prey, predators, herbivores, carnivores and omnivores, the students had to categorize each organism within the food chain next to all of the concepts that applied to each organism. The last question provided students with a food chain. They were asked to explain what might happen to the food chain if the population of a specific organism within that food chain died off. Chapter 4 discussed, in depth, what would happen in a food chain if the population of a specific organism died off.

The final question that showed a significant gain in knowledge pertained to harmful and beneficial actions on the environment. Students were provided with a list of actions and then put a check in the correct column to show if the action would have a harmful or beneficial effect on the environment. Harmful and beneficial actions were discussed in Chapters 7 and 8. The actions listed on the assessment were similar to the examples in the student book.

The second null hypothesis speculated that there would be no change in environmental attitudes after participating in schoolyard activities. This hypothesis was not rejected after data analysis revealed that there was no significant change in environmental attitudes.

Discussion

Despite the significant gain in environmental knowledge, the enhanced environmental knowledge is not attributed solely to participating in schoolyard activities. Out of the ten classes participating in the study, only six of the classes utilized the schoolyard as an outdoor classroom. Unfortunately, the classes that did participate in the schoolyard activities only participated in one to three activities. One particular class only used the schoolyard to identify living and non-living things. In this activity, the students conducted observations in the schoolyard and listed examples of living and non-living things in their science notebook. Another class participated in identifying living and non-living things and observed the interaction between living and non-living things as well as the interaction between living things. The students then made notes of their observations of the interactions they observed in their science notebook. A third class participated in one additional activity by collecting data about living organisms, noting populations of organisms as well as differentiating between a community and an ecosystem. This class was able to transfer their knowledge of organisms, populations and communities while tending their school garden. The other four classes strictly read the book that accompanied the Nature Unleashed curriculum and had class discussions about what they read. Those classes that did go out to the schoolyard only participated in one to three activities before taking the post assessment. The two classes that had the greatest gains from the pre-assessment to the post assessment only participated in one outdoor activity but read the entire book that accompanied the curriculum as well as watched the videos that accompanied the curriculum. The focus of these videos were about animals of Missouri. These findings contradict other studies by Carrier (2007, 2009), who showed significant changes in knowledge after students participated in schoolyard activities. It seems that the students in this study were able to increase their knowledge about the environment by just reading about the environment, which was not the purpose of the study since the focus was upon outdoor activities.

During the study, the teachers were given the directive by the science coordinator to strictly focus on predator and prey relationships and food chains, because these were the only ecology concepts that were being assessed on the state assessment. Based on the observations discussed above and the concepts that were enhanced, it is obvious that the teachers followed this directive. Over half of the concepts that had a significant gain from pre-test to posttest were the questions pertaining to predator and prey relationships and food chains.

On many occasions, when the researcher arrived to classrooms to conduct observations, the class was in the middle of a math lesson or the students were working on a math assignment. Of course, the teacher always had an explanation, which usually was they were just finishing their math assignment. Unfortunately, in underperforming schools, the primary focus is English/language arts and mathematics, with teachers often fitting in science when they can

(McPhail, 2011). English/language arts and mathematics are the two subjects that are assessed on the state standardized tests starting in third grade through the eighth grade. Students are expected to make substantial gains in both subject areas.

The results regarding changes in attitudes toward the environment were not significant. However, one class showed a significant change in attitudes based on the analysis of the CHEAKS data. The overall results contradict the findings of studies conducted by Carrier (2007, 2009), who found a significant positive change in attitudes after students participated in schoolyard activities. The lack of getting the students outside to experience nature may have contributed to no significant change in attitudes. Had the students participated in all of the schoolyard activities, then there may have been a significant change in attitudes.

The analysis of the subgroups of the CHEAKS assessment, by class, yielded no significant change in verbal commitment, actual commitment or affect except in two cases. Two classes had significant changes in actual commitment, which showed their attitudes changed regarding the things the students would do to help improve the environment. This result was surprising because one class did not participate in the schoolyard activities and did very little reading from the Nature Unleashed book however, they did read the ecology material in their science textbook. The other class that had significant changes in actual commitment read the entire book that accompanied the Nature Unleashed curriculum.

The most profound finding in this study was the fact that the 5th grade teachers who participated in the study did not actively participate in the study. The teachers did not implement the Nature Unleashed curriculum as instructed, which was a tremendous disservice to the students. Students of low socio-economic families come to school with fewer life-world experiences than their counterparts. This reason alone should encourage teachers to expose their students to as many learning opportunities as possible.

The curriculum consisted of 28 experiential activities, 23 of those activities affording students the opportunity to go outdoors to explore, investigate and ask questions about the immediate areas around the school. The teachers truly limited their students learning opportunities by not providing them with authentic, experiential and inquiry based experiences. By affording students the opportunity to experience learning, they are able to create their own knowledge and reflect on these concrete experiences in order to clarify abstract concepts (Broda, 2007; Kolb, 1984). Immersing students in environmental studies also stimulates cooperation and enhances problem-solving and critical thinking skills (Cleaver, 2007; Dillon, 2006; Louv, 2005).

Implications and Limitations

In many urban districts, the focus is on the achievement gap, causing teachers to focus more on English/language arts and mathematics. These students lack achievement because they lack opportunities (Milner, 2010). African-Americans are disengaged in science and are under-represented in the science fields (McPhail, 2011); therefore, urban educators must provide more opportunities for African-American students to engage in science. Providing African-American students with more cooperative learning opportunities, kinesthetic and tactile strategies and real-life experiences will promote authentic learning, increasing African-American students' science literacy and assist them in understanding the more abstract concepts in science (Atwater, Lance, Woodard, & Johnson, 2013; Boykin, Tyler & Miller, 2005; Emdin, 2010).

In this particular study, the teachers did not provide their students the opportunity to learn from their experiences in the environment. These experiences would have enhanced their understanding of the concepts being taught and may have shown a change in their verbal commitment, actual commitment and affect toward the environment. They had multiple opportunities within the Nature Unleased curriculum to expose students to the local environment and to assist students in changing their attitudes toward the environment but instead chose to limit their students' learning opportunities by only reading about environmental concepts. Preparation for the state standardized assessments in English/language arts and math prevented teachers from immersing their students in the Nature Unleashed curriculum. The instructional focus for the entire school year was on English/language arts and math in order to increase students' achievement levels on the state standardized assessment.

Educators have the opportunity to influence students' formation of positive attitudes toward the environment if they provide them the opportunity to increase their knowledge about the environment (Chawla & Flanders-Cushing, 2007). It is very important to engage urban students in learning about the environment. The schoolyard assists in making a connection between classroom learning and the real world (Eyler, 2009) and students must be afforded the opportunity to make those connections. It is very important that educators continue to provide urban students with multiple opportunities to learn about the environment. We must continue to immerse students in learning activities that provide them with direct experiences in well-known natural areas (Chawla & Flanders-Cushing, 2007). These experiences will not only assist African-American students with increasing their critical thinking and problem-solving skills but will also help African-American students develop bonds with nature, which can ultimately change their attitudes toward the environment. By developing bonds with nature and creating more positive attitudes toward the environment will encourage African-American students to have more pride in their community.

The experimental learning theory (Kolb, 1984) was the theoretical basis for this study. From the classroom observations conducted, it was evident there was more reading about the environment than there was experiencing the environment. Even though the students did not experience the environment through outdoor schoolyard activities, a significant growth in environmental knowledge occurred. The students in this study did not participate in enough experiential activities in the schoolyard to conclude that experiential learning is not effective for African-American students.

There were several limitations to this study, including teacher participation, time of year, lack of curriculum coverage and the Children's Environmental and Knowledge Scale. As noted in the observations section in Chapter 4, many of the teachers did not afford their students the opportunity to participate in the schoolyard activities. They chose to read the book that accompanied the curriculum. Some teachers were not fond of being outdoors and others felt they needed to cover the content before the state assessment, which was another limitation to the study. The study was started at the beginning of April and the state assessments were administered beginning the last week of April. Many of the teachers were concerned about increasing state assessment scores therefore; they believed they needed to devote more of their time to English/language arts and mathematics. This caused the teachers to neglect teaching the science curriculum set forth by the school district. The teachers then fell behind in their Nature Unleashed lessons, preventing the students from participating in all the schoolyard activities and completing the curriculum. It is recommended that extensive environmental education curriculums, such as the Nature Unleashed curriculum, be utilized in the fall. This will ensure that students participate in all of the outdoor experiential activities, affording teachers the opportunity to teach the curriculum in its entirety and with fidelity.

One major limitation in this study was the teachers were receiving conflicting information regarding the implementation of the Nature Unleashed curriculum. When the teachers attended the professional development for the curriculum, they were told to teach the lessons verbatim. They were also aware that they were participating in this study. After the second week of implementing the curriculum, the science coordinator for the district told the teachers to focus on teaching predator/prey relationships and food chains. The reason being was those were the only two concepts out of the entire Nature Unleashed curriculum that would be assessed on the state standardized assessment. This directive was not surprising. After teaching in two urban district over an 18-year period, the primary focus has always been covering what is on the state assessment. This is a disservice to our African-American students because we are only preparing them to be test takers instead of preparing them for a world of critical thinking and problem solving.

Finally, after a critical review of the Children's Environmental and Attitude Scale, it was discovered that this assessment needed to be revised to be more culturally relevant. Out of the 36 statements on the CHEAKS assessment, 15 of them are culturally biased and socio-economically biased. For example, in several statements the noun "parents" was used instead of parent. Many African-American students and low socio-economic students come from single parent homes therefore these statements were irrelevant to them. Another example of cultural bias and low socio-economic bias were statements pertaining to going door to door in their neighborhood to discuss environmental issues or pass out information. This statement is irrelevant to most African-American students and low socio-economic students because often times they live in neighborhoods that are unsafe therefore their parents do not allow them to go outdoors. Finally, many areas require residents to pay for recycling pickup. This alone would deter African-American families and low socio-economic families from recycling.

Another issue with the CHEAKS assessment was the way they were worded. For example, in two statements sorting recycled items was discussed. This is no longer necessary if your recycled items are picked up at your home or recycle containers are provided for you. In addition, statements regarding using too much water, building houses where animals live and animal testing may not be a concern for African-American students and low socio-economic students. In fact, they may not even be aware of these issues.

Recommendations for Further Research

This study focused on African-American fifth grade students utilizing only an experimental group. Since it was difficult to conclude that outdoor experiential activities contributed to students' gains in environmental knowledge, it is recommended that teachers provide multiple opportunities for African-American students to be exposed to learning opportunities that will enhance their understanding of what is being learned. Experiential learning not only allows students to experience what they are learning but also provides multiple opportunities for students to improve their critical thinking and problem-solving skills. African-American students are the ones who need multiple opportunities to experience what they are learning and need more opportunities to learn in authentic settings. Unfortunately, many African-American students, especially those from low-socioeconomic families, are not provided with authentic experiences like those that are more fortunate therefore, African-American students must be provided with every opportunity to enhance their understanding and achieve at higher levels. It is also recommended that teachers utilize provided curriculums with fidelity instead of strictly teaching what is on a state assessment. If teachers are only teaching African-American students what is on a state assessment they are truly providing their students a disservice. Many learning opportunities are missed due to teachers only focusing on the content on an assessment. Measuring changes in attitudes toward the environment among African-American students also needs to be studied further to determine if exposing them to their local environment is beneficial. If this study is undertaken, a new attitudinal survey needs to be created that is suitable for African-American students and low socio-economic students. Finally, research ought to be undertaken to determine if outdoor experiential activities improve African-American students' scores on standardized science assessments.

Conclusion

The results of this study provide insight into the importance of engaging African-American students in meaningful learning experiences by utilizing the schoolyard to learn about the environment. The findings are promising, but further research is needed in order to add to the limited research on this particular topic, especially with respect to African-American students. Educators must continue to provide meaningful science instruction to African-American students, since they are less engaged in science and are underrepresented in science careers.

In order to improve environmental knowledge and attitudes, educators must provide elementary students with opportunities to learn about local places instead of far away spaces. If we provide multiple opportunities to learn about the environment at an early age, educators can assist students in developing positive attitudes toward the environment. By developing positive attitudes toward the environment, children today may be more willing to take care of their local environment, which will improve their communities. The young people of today are the future stewards of the environment, thus the educational process must assist them in developing pro-environmental attitudes, actions and beliefs.

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Appendix A

Grade Level Expectations

Science Concepts

Ecology

EC.1.A – All populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem.

EC.1.D – The diversity of species within an ecosystem is affected by changes in the environment, which can be caused by other organisms or outside processes.

EC.2.A – As energy flows through the ecosystem, all organisms capture a portion of that energy and transform it to a form they can use.

EC3.C – Natural selection is the process of sorting individuals based on their ability to survive and reproduce within their ecosystem.

Living Organisms

L.O.1.A – Organisms have basic needs for survival.

L.O.1.E – Biological classifications are based on how organisms are related.

Matter and Energy

M.E.2.C – Electromagnetic energy from the sun (solar radiation) is a major source of energy on Earth.

Communication Arts Standards

Writing.2.D.5.a – Compose text using words that are specific, accurate, and suited to the topic.

Writing.2 – Compose well-developed text – paper.

Writing.3.A.5 – Compose a variety of text including a summary (narrative or informational).

The program is also aligned to the Missouri Show-Me Process Standards. They are as follows:

1.8 – Organize data, information and ideas into useful forms (including charts, graphs, outlines) for analysis and presentation.

2.1 – Plan and make written, oral and visual presentations for a variety of purposes and audiences (Missouri Department of Conservation, 2009, p. 16).

Appendix B

Objectives for Each Lesson

Lesson 1 – Describe the basic needs of most plants and animals. Identify the living and non-living components of an ecosystem. Explain why non-living components of an ecosystem are important for the living components. Demonstrate how organisms, populations, community and ecosystems are connected (Missouri Department of Conservation, 2009, p. 23).

Lesson 2 – Identify examples of different plants and animals found in pond, prairie and forest ecosystems. Explain why different plants and animals live together in an ecosystem (Missouri Department of Conservation, 2009, p. 41).

Lesson 3 – Identify specialized structures of plants and describe how they help animals survive within forest and prairie ecosystems. Identify specialized structures and senses and describe how they help animals survive within pond, forest and prairie ecosystems. Explain how camouflage is a survival tool. Recognize internal cues and external cues that cause organisms to behave in certain ways. Predict which plant or animal will be able to survive in a specific ecosystem based on its structures or behaviors. Identify the ways a specific organism may interact with other organisms with other organisms or the environment (Missouri Department of Conservation, 2009, p. 61).

Lesson 4 – Identify the primary source of energy plants use to produce their own food. Explain the difference between a producer and a consumer and classify populations of organisms as producers or consumers by the role they serve in the ecosystem. Sequence the flow of energy through a food chain beginning with the sun and predict the possible effects of removing a population of organisms from a food chain (Missouri Department of Conservation, 2009, p. 101).

Lesson 5 – Explain how herbivores, carnivores and omnivores are different and categorize consumers by what they eat. Define the role of decomposers in an ecosystem and classify organisms as producers, consumers or decomposers by the role they play in pond, forest and prairie ecosystems. Explain how the teeth of an animal's skull can help identify the type of consumer it is (Missouri Department of Conservation, 2009, p. 135).

Lesson 6 – Define predator and prey and categorize organisms as predator and/or prey in a given ecosystem. Identify the roles of predators and prey in an ecosystem. Explain why predators and prey are important to energy flow in a food chain. Predict the possible effects of removing an organism from a food chain. Give examples of how humans as predators affect an ecosystem (Missouri Department of Conservation, 2009, p. 209).

Lesson 7 – Explain why organisms need to interact with other organisms and their environment. Identify ways specific organisms interact with other organisms and the environment. List human interactions with their environments and explain how these human interactions may affect the environment and the organisms in the environment/ecosystem (Missouri Department of Conservation, 2009, p. 223).

Lesson 8 – Explain how humans are just one of the organisms interacting with plants and animals in Missouri. Identify examples in Missouri where human activity has had a beneficial or harmful effect on other organisms (Missouri Department of Conservation, 2009, p. 233).

Appendix C

Nature Unleashed Unit Assessment

test

Directions: Read each item carefully. Circle the letter of the best answer.

1. A beaver builds its home out of mud and sticks. In which ecosystem is it most likely found?

a. Forest c. Prairie
b. Pond d. All of the above

2. Which of the following is an example of camouflage?

a. Prairie racerunners use rocks as shelter or to warm up or cool down.
b. Big brown bats use hollow trees, deep rock crevices, buildings, caves and other places to roost.
c. Venomous snakes and spiders use venom to protect themselves and to make their live food hold still.
d. Newborn deer have white spots on their brown fur that allow them to blend into their forest surroundings.

3. What is the primary source of energy plants use to make food?

a. Nutrients c. Sun
b. Soil d. Water

4. A redbud is a shade-loving tree. In which ecosystem is it most likely found?

a. Forest c. Prairie
b. Pond d. All of the above

5. What external cues, or something outside the body, cause ducks to migrate?

a. Cooler temperatures and shorter days c. Hot, humid and windy days
b. High heat and dryness d. Sudden movement or sudden sound

6. Butterflies and bees visit one flower, then the next and the next, and so on. How are they interacting or living with the flowers?

a. Escaping c. Migrating
b. Hibernating d. Pollinating

7. An insect that is bright pink and is able to hide among blooming flowers is most likely able to survive in which environment?

a. Forest c. Prairie
b. Pond d. Stream

Directions: Read each item carefully. Follow the directions provided.

8. Describe the 6 basic needs of most plants.

9. Read the list of things below. Underline the non-living things.

Bluebird	Cloud	Frog	Rabbit	Tree
Building	Coneflower	Grass	Sun	Wind
Butterfly	Dirt	Human	Rock	Worm

10. Read the descriptions below. Place the name (community, ecosystem, organism, population) on the line by the description that is an example of what the word means.

_________________ 3 round-winged katydids, 2 hummingbirds, 3 big bluestem

_________________ small section of prairie that shows some living things and non-living things

_________________ 1 round-winged katydid

_________________ 3 round-winged katydids

11. Duckweed plants live in a watery environment. Which specialized structure helps them survive? Explain how it helps duckweed plants survive in their environment.

a. Large leaves
b. Thin stripes on leaves
c. Long strong roots
d. Thread-like roots

12. Which of the following must tadpoles have to survive in a watery environment? Explain how your selected answer helps tadpoles survive.

a. Ribs
b. Eyes
c. Gills
d. Mouth

13. How are producers and consumers different?

14. Show the flow of energy through a food chain using the things listed below. Use numbers and arrows to show the flow of energy.


Decaying plants


Sowbug

Sun


Ovenbird

15. How are herbivores, carnivores and omnivores different?

16. A snail is eaten by a crayfish and the crayfish is eaten by a bluegill and the bluegill is eaten by a green heron. Who are predators and who are prey in this scenario? List them under appropriate columns. An animal may be listed more than once.

Predators	Prey

17. In the food chain shown below, list which things fit in which category. Things may fit in more than one category.

Sun ➲ Coneflower ➲ Leaf beetle ➲ Grasshopper sparrow ➲ Bullsnake

Producer(s):
Consumers(s):
Decomposer(s):
Prey:
Predator(s):
Herbivore(s):
Omnivore(s):
Carnivore(s):

18. In the food chain shown below, predict what might happen if the entire population of bullsnakes died? List one possible effect.

Sun ➲ Coneflower ➲ Leaf beetle ➲ Grasshopper sparrow ➲ Bullsnake

19. For the list of actions below, put an X in the appropriate column to indicate which ones could have a beneficial or harmful effect on other organisms or an ecosystem.

Action	Beneficial effect	Harmful effect
Spilling gas on the ground when fueling up the lawn mower		
Dropping a gum wrapper on the ground		
Picking up trash on the school grounds		
Hunting and killing deer outside of deer hunting season		
Trapping nuisance otters		
Riding your bike on marked trails		
Recycling newspapers		
Setting up your tent in a no-camping area		

Appendix D

CHEAKS Assessment

Verbal Commitment

1. I would be willing to stop buying some products to save animals' lives.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

2. I would not be willing to save energy by using less air conditioning.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

3. To save water, I would be willing to use less water when I bathe.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

4. I would not give $15 of my own money to help the environment.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

5. I would be willing to ride the bus to more places in order to reduce air pollution.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

6. I would not be willing to separate family's trash for recycling.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

7. I would give $15 of my own money to help protect wild animals.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

8. To save energy, I would be willing to use dimmer lights.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

9. To save water, I would be willing to turn off the water while I wash my hands.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

10. I would go from house to house to pass our environmental information.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

11. I would be willing to write letters asking people to help reduce pollution.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

12. I would be willing to go from house to house asking people to recycle.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

Actual Commitment
13. I have not written someone about a pollution problem.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

14. I have talked with my parents about how to help with environmental problems.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

15. I turn off the water in the sink while I brush my teeth to conserve water.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

16. To save energy, I turn off lights at home when they are not in use.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

17. I have asked my parents not to buy products made from animal fur.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

18. I have asked my parents to recycle some of the things we use.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

19. I have asked others what I can do to help reduce pollution.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

20. I have often read stories that are mostly about the environment.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

21. I do not let a water faucet run when it is not necessary.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

22. I leave the refrigerator open while I decide what to get out.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

23. I have put up a birdhouse near my house.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

24. I do not separate things at home for recycling.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

Affect
25. I am frightened to think people don't care about the environment.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

26. I get angry about the damage pollution does to the environment.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

27. It makes me happy when people recycle used bottles, cans, and paper.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

28. I get angry when I think about companies testing products on animals.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

29. It makes me happy to see people trying to save energy.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

30. I am not worried about running out of water.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

31. I do not worry about environmental problems.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

32. I am not frightened about the effects of pollution on my family.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

33. I get upset when I think of the things people throw away that could be recycled.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

34. It makes me sad to see houses being built where animals used to live.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

35. It frightens me to think how much energy is wasted.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

36. It upsets me when I see people use too much water.
(1) very true
(2) mostly true
(3) not sure
(4) mostly false
(5) very false

Appendix E

Studies Matrix

Hypotheses	Populations	Findings
Utilizing an environmental theme across the curriculum will improve academic achievement (Haines & Kilpatrick, 2007).	Elementary Students (K-5)	Iowa Test of Basic Skills • 1999 – 26 points below state average. • 2007 – score of 89 points. • 48.6 point improvement. Surpassed the state average points.
Regular schoolyard experiences would have a positive impact on students' environmental knowledge, attitude personal behaviors toward the environment and would affect comfort levels in outdoor settings. Gender would influence the changes (Carrier, 2007).	Treatment Group • 4th grade students = 23 • 5th grade students = 27 Control Group • 4th grade students = 33 • 5th grade students = 26 Gender 4th grade students • 28 males, 28 females 5th grade students • 24 males, 29 females	Environmental Attitude • No significance by grade level. • Significant effect of treatment group ($p=.0066$). • Gender – Significant effect in treatment group ($p=.0017$). • Overall attitudes increased after intervention ($p=.0276$). Environmental Knowledge • No significant differences in gender. • No gender differences of self-reported environmental behaviors or comfort levels.
Schoolyard activities would enhance achievement across both genders; however, boys in the treatment group (schoolyard activities) would demonstrate levels of achievement comparable to the girls' levels in either condition. Compared the impact on students' environmental knowledge, attitude personal behaviors toward the environment and would affect comfort levels in outdoor settings (Carrier, 2009).	Treatment and Control Groups • 4th and 5th grade students Gender • Girls – 50 – 55% • Boys – 45 – 50 % Ethnicity • White – 60 – 80% • Black (AA) – 16 – 21% • Hispanic or Asian – 4 – 17%	• Boys had statistically significant greater score gains in treatment group than in the traditional group for knowledge, attitudes, behaviors and comfort levels. Knowledge Scores • Both boys and girls increased knowledge scores in the treatment group than in the traditional group. • Boys in the schoolyard group increased learning more when compared to the control group.

		Attitudes • Boys increased environmental attitudes more in the treatment group than in the traditional group. • Girls' scores were not statistically significant. Behaviors • Both groups increased behavior scores in the treatment group and the traditional group. • Boys had a greater increase that girls in the treatment group. Comfort Level • Boys increased their comfort level more in the treatment group than in the traditional group. • Differences for girls were not statistically significant.
Using the environment and a context for learning (EIC) will improve student achievement (SEER, 2005).	Compared second through fourth grade scores on the California Standard Testing and Reporting assessment in reading, writing, math, language and spelling over five years. Treatment Group • Participated in EIC activities Control Group • No treatment/Direct Instruction	Treatment Group • 100% of students scored as well or better in reading compared to the control group. • 92.5% of students scored as well or higher in math compared to the control group. • 95% of students scored as well or higher in language compared to the control group. • 97.5% of students scored as well or higher in spelling compared to the control group.

Utilizing the schoolyard will improve environmental knowledge and attitudes in 5th grade African-American students (Spray, 2015).	Treatment Group Population • 248 5th grade African-American students (N = 248) Knowledge Assessment • 212 5th grade African-American students (n = 212) Attitude Assessment • 136 5th grade African-American students (n = 136)	Knowledge Scores • Significant gains in environmental knowledge ($p = .000$). Attitude Scores • No significant change in attitudes toward the environment ($p = .725$).

Appendix F

Individual Class Data Analysis for the Nature Unleashed Assessment

Class 1 Results

There were 24 students (N = 24) in the class and 22 students (n = 22) took both the Nature Unleashed pre-assessment and post assessment to measure gains in knowledge about the environment. The mean for the post assessment (M = 33.73, SD = 9.80) was significantly greater that the pre-assessment (M = 23.05, SD = 6.65), $t(21) = -5.85$, $p < .05$. Table 6 provides the statistical data analysis for this class.

The researcher visited this class on several occasions during the study. Each time the students were reading from the book that accompanied the Nature Unleashed curriculum as a whole class. During the reading, the teacher would stop periodically to discuss what was read. Not once did the researcher observe the class participating in the outdoor activities. In fact, the researcher spoke with the teacher about the outdoor activities and the researcher was told that the students never went outside.

Table 1F

Class 1-Paired Samples T-Test

	N	M	SD	t(21)	p
pretest	22	23.05	6.65		
posttest	22	33.73	9.80		
paired test	22	-10.68	8.56	-5.85	$.000^{*}$

Note: $(p < .05^{*})$

Class 2 Results

There were 27 students (N = 27) in the class and 19 students (n = 19) took both the Nature Unleashed pre-assessment and post assessment to measure gains in knowledge about the environment. The mean for the post assessment (M = 24.68, SD = 14.21) was significantly greater that the pre-assessment (M = 19.74, SD = 9.21), $t(18) = -2.53$, $p < .05$. Table 7 provides the statistical data analysis for this class.

While visiting this class on several occasions, the researcher observed the students participating in several outdoor activities. The students identified living and non-living things in the environment and created lists in their notebooks. They also identified and listed ways that living and non-living things interacted with each other as well as living things interacting with each other. In addition, the students identified and listed examples of organisms, populations, communities and ecosystems within the schoolyard. During these activities, students were engaged and on-task and the teacher used probing questions to assist students in their explanations of what they were observing. This particular class also participated in growing vegetables. Every time they visited their gardens, they were applying their knowledge of organisms, populations and communities to what they were observing in the garden.

Table 2F

Class 2-Paired Samples T-Test

	N	M	SD	t(18)	p
pretest	19	19.74	9.21		
posttest	19	24.68	14.21		
paired test	19	-4.95	8.53	-2.53	.021*

Note: *(p < .05*)*

Class 3 Results

There were 25 students (N = 25) in the class and 15 students (n = 15) took both the Nature Unleashed pre-assessment and post assessment to measure gains in knowledge about the environment. The mean for the post assessment (M = 27.87, SD = 9.36) was significantly greater that the pre-assessment (M = 21.13, SD = 6.84), $t(14) = -2.93$, $p < .05$. Table 8 provides the statistical data analysis for this class.

The researcher observed this class on several occasions. The students were in the schoolyard identifying and listing living and non-living things. As a follow up activity, the students were in the schoolyard observing the interaction between living and non-living things as well as the interaction between living things. They were taking notes about these interactions so they could write about them when they returned to the classroom. The students were engaged in discussions with one another during their observations. The teacher used probing questions to assist students in clarifying their thinking and reasoning.

Table 3F

Class 3-Paired Samples T-Test

	N	M	SD	t(14)	p
pretest	15	21.13	6.84		
posttest	15	27.87	9.36		
paired test	15	-6.73	8.89	- 2.93	.011*

Note: *($p < .05^{*}$)*

Class 4 Results

There were 15 students (N = 15) in the class and 13 students (n = 13) took both the Nature Unleashed pre-assessment and post assessment to measure gains in knowledge about the environment. The mean for the post assessment (M = 37.46, SD = 8.18) was significantly greater that the pre-assessment (M = 17.62, SD = 6.87), $t(12) = -13.95$, $p < .05$. Table 9 provides the statistical data analysis for this class.

While observing this class, the students were writing definitions in their notebooks that would aid them in their observations in the schoolyard. Once they finished their definitions, they moved to the schoolyard to identify living and non-living things. Most of the students were engaged in discussions with each other. The teacher had students clarify how they knew things were living or non-living. On other occasions, the researcher only observed the students reading from the book that accompanied the Nature Unleashed curriculum and participating in class discussions.

Table 4F

Class 4-Paired Samples T-Test

	N	M	SD	t(12)	p
pretest	13	17.62	6.87		
posttest	13	37.46	8.18		
paired test	13	-19.85	5.13	-13.95	.000*

Note: *(p < .05*)*

Class 5 Results

There were 23 students (N = 23) in the class and 15 students (n = 15) took both the Nature Unleashed pre-assessment and post assessment to measure gains in knowledge about the environment. The mean for the post assessment (M = 27.87, SD = 9.36) was significantly greater that the pre-assessment (M = 21.13, SD = 6.84), $t(14) = -2.93$, $p < .05$. Table 10 provides the statistical data analysis for this class.

During several visits to this class, the researcher only observed the students reading from the book that accompanied the Nature Unleashed curriculum. The researcher never observed the students participating in schoolyard activities.

Table 5F

Class 5-Paired Samples T-Test

	N	M	SD	t(14)	p
pretest	15	21.13	6.84		
posttest	15	27.87	9.36		
paired test	15	-6.73	8.89	-2.93	.011*

Note: *(p < .05*)*

Class 6 Results

There were 24 students (N = 24) in the class and 20 students (n = 20) took both the Nature Unleashed pre-assessment and post assessment to measure gains in knowledge about the environment. The mean for the post assessment (M = 22.95, SD = 10.23) was significantly greater that the pre-assessment (M = 17.15, SD = 8.52), $t(19) = -2.76$, $p < .05$. Table 11 provides the statistical data analysis for this class.

While visiting this classroom, the researcher never once observed the teacher utilizing the Nature Unleashed curriculum. The teacher was always teaching math during her science period.

Table 6F

Class 6-Paired Samples T-Test

	N	M	SD	t(19)	p
pretest	20	17.15	8.52		
posttest	20	22.95	10.23		
paired test	20	-5.80	9.39	-2.76	.012*

Note: *(p < .05*)*

Class 7 Results

There were 25 students (N = 25) in the class and 16 students (n = 16) took both the Nature Unleashed pre-assessment and post assessment to measure gains in knowledge about the environment. The mean for the post assessment (M = 30.19, SD = 13.05) was significantly greater that the pre-assessment (M = 22.69, SD = 11.25), $t(15) = -4.14$, $p < .05$. Table 12 provides the statistical data analysis for this class.

The teacher of this class utilized the book that accompanied the Nature Unleashed curriculum as well as the schoolyard activities. The researcher observed the students in the schoolyard observing and identifying living and non-living things as well as the interaction between living and non-living things as well as the interaction between living things. While observing the students in the schoolyard, groups of five girls were interested in holes in a tree. The researcher talked with the students and had them make predictions as to why the holes were in the tree. The following day the researcher brought the students books to identify the tree. Once they determined the type of tree, the students researched the tree to determine why the holes were in the tree. The students in this class were always engaged while participating in the activities in the schoolyard.

Table 7F

Class 7-Paired Samples T-Test

	N	M	SD	t(15)	p
pretest	16	22.69	11.25		
posttest	16	30.19	13.05		
paired test	16	-7.50	7.24	-4.14	.001*

Note: *(p < .05*)*

Class 8 Results

There were 26 students (N = 26) in the class and 16 students (n = 16) took both the Nature Unleashed pre-assessment and post assessment to measure gains in knowledge about the environment. The mean for the post assessment (M = 31.13, SD = 10.67) was significantly greater that the pre-assessment (M = 17.94, SD = 7.07), $t(15) = -5.22$, $p < .05$. Table 13 provides the statistical data analysis for this class.

The researcher observed this class participating in schoolyard activities on two occasions. During the first observation, the students were identifying living and non-living things. They were listing them in their notebooks. During the second observation, the students were observing the interaction between living and non-living things and the interaction between living things in the schoolyard. They were taking notes in their notebooks for further discussion in the classroom. This class was participating in schoolyard activities at the same time as another class so some of them were not engaged in their observations. The teacher was primarily an observer and did not interact with the students.

Table 8F

Class 8-Paired Samples T-Test

	N	M	SD	t(15)	p
pretest	16	17.94	7.07		
posttest	16	31.13	10.67		
paired test	16	-13.19	10.10	-5.22	.000*

Note: *(p < .05*)*

Class 9 Results

There were 16 students (N = 16) in the class and 12 students (n = 12) took both the Nature Unleashed pre-assessment and post assessment to measure gains in knowledge about the environment. The mean for the post assessment (M = 39.08, SD = 11.80) was significantly greater that the pre-assessment (M = 21.17, SD = 5.86), $t(11) = -7.00$, $p < .05$. Table 14 provides the statistical data analysis for this class.

While observing this class, the students were writing definitions in their notebooks that would aid them in their observations in the schoolyard. Once they finished their definitions, they moved to the schoolyard to identify living and non-living things. Most of the students were engaged in discussions with each other. The teacher had students clarify how they knew things were living or non-living. On other occasions, the researcher only observed the students reading from the book that accompanied the Nature Unleashed curriculum and participating in class discussions. When the researcher talked with the teacher about the schoolyard activities, the teacher expressed that the students read the entire book that accompanied the Nature Unleashed curriculum but did not do any more schoolyard activities. It is important to note that the same teacher taught classes four and nine because they were departmentalized.

Table 9F

Class 9-Paired Samples T-Test

	N	M	SD	t(11)	p
pretest	12	21.17	5.86		
posttest	12	39.08	11.80		
paired test	12	-17.92	8.87	-7.00	.000*

Note: *(p < .05*)*

Class 10 Results

There were 25 students (N = 25) in the class and 23 students (n = 23) took both the Nature Unleashed pre-assessment and post assessment to measure gains in knowledge about the environment. The mean for the post assessment (M = 29.30, SD = 9.63) was significantly greater that the pre-assessment (M = 26.22, SD = 6.88), $t(22) = -2.24$, $p < .05$. Table 15 provides the statistical data analysis for this class.

On several occasions, the researcher observed this class only reading the book that accompanied the Nature Unleashed curriculum. The researcher never observed the students participating in activities in the schoolyard.

Table 10F

Class 10-Paired Samples T-Test

	N	M	SD	t(22)	p
pretest	23	26.22	6.88		
posttest	23	29.30	9.63		
paired test	23	-3.09	6.61	-2.24	.035*

Note: *(p < .05*)*

Appendix G

Individual Class Data Analysis for the CHEAKS Assessment

Table 1G

Paired Samples T-Test per Class

Class	n	M	SD	t	df	p
1	20	-2.10	30.08	-3.12	19	.758
2	16	-7.13	18.84	-1.51	15	.151
3	12	-2.17	16.41	-.457	11	.656
4	13	5.31	16.01	1.20	12	.255
5	15	-3.80	18.39	-.800	14	.437
6	16	-4.63	20.06	-.922	15	.371
7	16	10.69	33.37	1.28	15	.220
8	9	15.44	20.06	2.31	8	.050
9	19	1.842	30.36	.264	18	.794
Overall	136	.743	24.60	.352	135	.725

Note: $(p < .05^{*})$

Table 2G

Class 1-Paired Samples T-Test

	N	Mean	SD	t(19)	p
pretest	20	111.30	29.39		
posttest	20	109.20	23.33		
paired test	20	-2.10	30.08	-3.12	.758

Note: $(p < .05^{*})$

Table 3G

Class 2-Paired Samples T-Test

	N	Mean	SD	t(15)	p
pretest	16	118.63	22.72		
posttest	16	111.50	9.03		
paired test	16	-7.13	18.84	-1.51	.151

Note: *($p < .05^*$)*

Table 4G

Class 3-Paired Samples T-Test

	N	Mean	SD	t(11)	p
pretest	12	107.92	18.35		
posttest	12	105.75	23.72		
paired test	12	-2.17	16.41	-.457	.656

Note: *($p < .05^*$)*

Table 5G

Class 4-Paired Samples T-Test

	N	Mean	SD	t(12)	p
pretest	13	117.15	21.89		
posttest	13	122.46	26.29		
paired test	13	5.31	16.01	1.20	.255

Note: *($p < .05^*$)*

Table 6G

Class 5-Paired Samples T-Test

	N	Mean	SD	t(14)	p
pretest	15	114.07	18.96		
posttest	15	110.27	25.90		
paired test	15	-3.80	18.39	-.800	.437

Note: $(p < .05^{*})$

Table 7G

Class 6-Paired Samples T-Test

	N	Mean	SD	t(15)	p
pretest	16	124.56	22.75		
posttest	16	119.94	25.26		
paired test	16	-4.63	20.06	-.922	.371

Note: $(p < .05^{*})$

Table 8G

Class 7-Paired Samples T-Test

	N	Mean	SD	(15)	p
pretest	16	98.44	22.97		
posttest	16	109.13	17.69		
paired test	16	10.69	33.37	1.28	.220

Note: $(p < .05^{*})$

Table 9G

Class 8-Paired Samples T-Test

	N	Mean	SD	t(8)	p
pretest	9	112.78	31.80		
posttest	9	128.22	21.46		
paired test	9	15.44	20.06	2.31	.050

Note: $(p < .05^{*})$

Table 10G

Class 9-Paired Samples T-Test

	N	Mean	SD	t(18)	p
pretest	19	107.68	24.43		
posttest	19	109.53	18.01		
paired test	19	1.842	30.36	.264	.794

Note: $(p < .05^{*})$

Appendix H

Individual Class Data Analysis for the CHEAKS Subgroups

Table 1H

Class 1 Subgroups Paired Samples T-Test

	N	Mean	SD	t(19)	p
preverbal	20	37.30	9.89		
postverbal	20	35.35	9.17		
preactual	20	35.40	10.65		
postactual	20	36.05	6.49		
preaffect	20	38.60	11.24		
postaffect	20	37.80	10.34		
preverbal postverbal	20	1.95	9.98	.874	.393
preactual – postactual	20	-.650	12.12	-.240	.813
preaffect – postaffect	20	.800	12.77	.280	.782

Note: $(p < .05^{*})$

Table 2H

Class 2 Subgroups Paired Samples T-Test

	N	Mean	SD	t(15)	p
preverbal	16	39.13	6.79		
postverbal	16	39.63	10.06		
preactual	16	38.00	8.38		
postactual	16	34.88	4.82		
preaffect	16	41.50	9.47		
postaffect	16	37.00	4.21		
preverbal – postverbal	16	-.500	10.16	-.197	.847
preactual – postactual	16	3.125	8.79	1.42	.175
preaffect – postaffect	16	4.50	10.00	1.80	.092

Note: $(p < .05^{*})$

Table 3H

Class 3 Subgroups Paired Samples T-Test

	N	Mean	SD	t(11)	p
preverbal	12	38.33	6.88		
postverbal	12	36.50	8.15		
preactual	12	34.00	9.18		
postactual	12	33.42	7.63		
preaffect	12	35.58	9.91		
postaffect	12	35.83	9.91		
preverbal – postverbal	12	1.83	7.15	.889	.393
preactual – postactual	12	.583	8.59	.235	.818
preaffect – postaffect	12	-.250	4.65	-.186	.856

Note: ($p < .05^{*}$)

Table 4H

Class 4 Subgroups Paired Samples T-Test

	N	Mean	SD	t(12)	p
preverbal	13	39.23	7.45		
postverbal	13	42.69	10.20		
preactual	13	35.38	7.92		
postactual	13	36.38	9.12		
preaffect	13	42.54	9.56		
postaffect	13	43.38	10.91		
preverbal – postverbal	13	-3.462	8.22	-1.52	.155
preactual – postactual	13	-1.00	5.23	-.690	.504
preaffect – postaffect	13	-.846	8.16	-.374	.715

Note: $(p < .05^{*})$

Table 5H

Class 5 Subgroups Paired Samples T-Test

	N	Mean	SD	t(14)	p
preverbal	15	36.00	4.61		
postverbal	15	37.27	8.33		
preactual	15	38.53	9.36		
postactual	15	33.33	10.93		
preaffect	15	39.53	10.61		
postaffect	15	39.67	9.91		
preverbal – postverbal	15	-1.27	8.82	-.556	.587
preactual – postactual	15	5.20	8.70	2.31	.036*
preaffect – postaffect	15	-.133	9.41	-.055	.957

Note: *(p < .05*)*

Table 6H

Class 6 Subgroups Paired Samples T-Test

	N	Mean	SD	t(15)	p
preverbal	16	44.06	8.26		
postverbal	16	42.00	9.19		
preactual	16	39.94	7.64		
postactual	16	38.69	10.64		
preaffect	16	40.56	10.24		
postaffect	16	39.25	9.34		
preverbal – postverbal	16	2.06	6.23	1.32	.206
preactual – postactual	16	1.25	8.42	.594	.561
preaffect – postaffect	16	1.31	10.37	.507	.620

Note: $(p < .05^{*})$

Table 7H

Class 7 Subgroups Paired Samples T-Test

	N	Mean	SD	t(15)	p
preverbal	16	32.56	7.62		
postverbal	16	36.69	6.77		
preactual	16	32.63	7.61		
postactual	16	38.06	6.58		
preaffect	16	33.25	10.33		
postaffect	16	34.38	7.23		
preverbal – postverbal	16	-4.13	11.29	-1.46	.164
preactual – postactual	16	-5.44	11.04	-1.97	.068
preaffect – postaffect	16	-1.13	14.67	-.307	.763

Note: ($p < .05^*$)

Table 8H

Class 8 Subgroups Paired Samples T-Test

	N	Mean	SD	t(8)	p
preverbal	9	43.11	12.25		
postverbal	9	44.00	8.76		
preactual	9	30.89	7.82		
postactual	9	39.78	6.16		
preaffect	9	38.78	14.92		
postaffect	9	44.44	10.76		
preverbal – postverbal	9	-.889	9.39	-.284	.784
preactual – postactual	9	-.89	7.37	-3.62	.007*
preaffect – postaffect	9	-5.67	7.73	-2.20	.059

Table 9H

Class 9 Subgroups Paired Samples T-Test

	N	Mean	SD	t(18)	p
preverbal	19	26.16	8.40		
postverbal	19	39.11	7.41		
preactual	19	34.47	7.36		
postactual	19	33.95	6.99		
preaffect	19	37.05	11.72		
postaffect	19	36.47	6.88		
preverbal – postverbal	19	-2.95	11.70	-1.10	.287
preactual – postactual	19	.526	9.27	.247	.807
preaffect – postaffect	19	.579	14.01	.180	.859

Note: ($p < .05^*$)