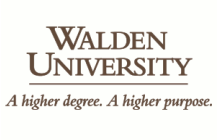

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The Effects of an Integrated Health and Physical Education Program on Student Achievement

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Walden University

COLLEGE OF EDUCATION

This is to certify that the doctoral study by

Myralynn Billingsley Catchings

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

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Walden University
2011

Abstract

The Effects of an Integrated Health and Physical Education Program on Student Achievement

by

Myralynn B. Catchings

M.A., Mississippi State University, 1981

B.S., Alcorn State University, 1974

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Education

Teacher Leadership

Walden University

December 2011

Abstract

In recent years, several schools have addressed the No Child Left Behind (NCLB) Act of 2001 by focusing on promoting skill acquisition in reading and math, often overlooking physical education (PE) as a significant part of a child's education. The purpose of this causal-comparative study was to evaluate the effectiveness of an integrated health and physical education (HPE) program on student achievement. This study was grounded in action-based learning theories. The research question examined differences in posttest scores, adjusted for pretest differences, from 204 freshman students enrolled in a Biology-1 class at an urban high school. Students in Group A were enrolled in Biology-1 and an HPE class that incorporates Biology-1 content. Students in Group B were enrolled in Biology-1 but were not in a HPE class; thus, they did not participate in the integrated HPE program. An analysis of covariance (ANCOVA) was used to determine whether the integrated PE program increased student achievement in Biology-1. The findings showed that there was a significant difference between the two groups ($p < .05$). The Biology-1 students who participated in the integrated HPE program scored significantly higher on the Biology-1 state test than the Biology-1 students who did not participate in the integrated HPE program. These results may influence educational decisions regarding the use of HPE by encouraging serious consideration of an integrated HPE program, which could enhance student achievement, thus promoting positive social change.

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Dedication

Effectively integrating core subject content into the physical education curriculum can provide students with valuable information that they will need to know in order to succeed academically and to compete in our global society. With integration, students are getting the physical activity they need to enhance the development of their minds and their bodies. Integration could be the medium for closing the achievement gap that has plagued the success of educators for decades. Understanding the process by which students learn, the various learning strategies that enhance learning and the need for effective professional development can facilitate the success of an effective integrated health and physical education program in the schools. Therefore, this study is dedicated to physical educators and educational leaders who want to do their part in increasing student learning and be a catalyst for positive global change.

Acknowledgments

I would like to express my gratitude to the advisors at Walden University for giving me the opportunity to grow professionally. With this opportunity, I thank God for giving me the strength, the ability, and the will to persevere. Special thanks go out to my committee chair (Brenda Kennedy, Ed.D.) and committee member (Kerry Burner, Ed.D.) for all they have done to make this possible. The leadership, guidance, assistance, and patience they bestowed upon me during this doctoral journey were greatly appreciated and will be very useful for the rest of my life. Especially Dr. Kennedy, who far exceeded my expectations; I will never forget her.

Meeting timelines as I progressed through the doctoral program called for many adjustments in my daily schedule and the need for family members to be supportive and understanding. Therefore, I would like to thank my wonderful daughter (Myrian) for reading everything I wrote and listening to my concerns when I was stressed. I must thank my son-in-law (Michael) for his support to me and my daughter as we both pursued our goal to become Doctors of Education at Walden University. I want to thank my grandson (Ariest) and darling granddaughter (Brianna) who willingly increased their learning by allowing me to practice integrating core subject content in their summer activities while they were on vacation with me. Most of all, I would like to give special thanks to my sister (Patricia), my niece (Dr. McCleon), and my sons (Billy and Trey) for encouraging me to take on this doctoral endeavor and assisting me along the way.

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Without God and all of you, this dream would have always been a dream; but this success has proven that with the help of God, hard work, and dedication; dreams can become realities. Thank you all for being there for me.

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Section 1: Introduction to the Study

In recent years, several states have reorganized their accountability for public school education to address the No Child Left Behind (NCLB) Act of 2001 (2002) by concentrating on school programs that promote skill acquisition in reading and math, often overlooking physical education (PE) as a significant part of a child's education (Shirvani, 2009; Siegel, 2007b). In an effort to reduce the pressure placed on schools and teachers to increase student academic performance, many educational systems have resorted to reducing the number of quality PE programs (Hall, 2007; Siegel, 2006; Smith & Lounsbery, 2009). Houston (2007) stated that schools are "issuing heavier doses of a narrowed curriculum that sacrifices physical activity by labeling it a frivolous component" (p. 123). As schools work to meet the adequate yearly progress (AYP) mandates of NCLB (2002), time for PE in the daily curriculum has been reduced and, in some cases, eliminated (Hall, 2007). The practice of replacing PE time with additional course work time is becoming a national norm. In some school districts, students are pulled from PE classes to participate in tutorial services designed to increase scores on state testing.

Traditionally, health and physical education (HPE) teachers have been concerned with encouraging students to participate in structured physical activities provided through HPE classes (Mississippi Department of Education [MDOE], 2006). Past researchers

have found that there is a relationship between physical activity and academic achievement; however, they found no evidence that justified the inclusion of a PE curriculum in the schools (Coe et al., 2006; Martin & Chalmers, 2007; Scheuer, 2004; Scheuer & Mitchell, 2003; Stevens et al., 2008). Recent researchers found that students can receive the same physical benefits from participating in physical activities other than PE in the schools (Coe et al., 2006; Stevens et al., 2008). More recent researchers found similar results, indicating that there is a relationship between physical fitness and academic achievement, but they did not indicate whether PE should or should not be included in the schools to help students achieve academically (Castelli et al., 2007; Ferris, Williams, & Shen, 2007; Houston, 2007; Siegel, 2007a).

Castelli et al. (2007) measured students' aerobic capacity, flexibility, and muscle fitness in their study. They found that children who were physically fit scored higher on standardized academic performance tests (the Illinois Standard Achievement Test) than students who were not physically fit. In another study, they also looked at the relationship between physical fitness on attention and working memory among groups of active and inactive children. When brain activation was measured, "they found that fit children allocated more resources towards identifying stimuli, and also processed stimuli faster" (para. 13).

Ferris, Williams, and Shen (2007) found that brain-derived neurotrophic factor (BDNF) levels increased significantly with exercise. A BDNF is a chemical that is active

in the hippocampus, which is responsible for long-term memory in humans and aids in learning (Manabe, 2002). In the brain, BDNF is also active in the cortex and basal forebrain, which are areas essential to learning, long-term memory, and higher order thinking. When there is an increased level of BDNF active in the brain, more neurons are produced. More neurons means more information can be processed and retained, thereby allowing students to understand, grasp, retain, and recover more information and at a faster pace (Blaydes-Madigan & Hess, 2004). Houston (2007) examined test scores of students who were passing and students who were failing and then looked at their time allotments for physical activity. Houston found that failing students spent little or no time participating in physical activity, whereas passing students spent more than 30 minutes a day participating in vigorous physical activities. The results of Siegel's (2007a) study showed that students who were involved in regular physical activity outside of school have higher academic achievement scores than students who were not. Siegel also concluded that there was a favorable connection between students' scores on physical fitness tests and their reading and mathematics achievement scores. This study will contribute to this body of research by formally evaluating the effectiveness of an HPE program which integrates core subject matter into the Physical Education curriculum. Specifically, this study will evaluate the effectiveness of an integrated HPE program on student achievement in Biology-1. A more detailed discussion is presented in Section 2.

Problem Statement

Since 2002, many schools in Mississippi have struggled to meet the adequate yearly progress (AYP) mandates of NCLB (2001), which states:

> Not later than 12 years after the end of the 2001–2002 school year, all students in each group described in subparagraph (C) (v) will meet or exceed the State's proficient level of academic achievement on the State assessments under paragraph (3). (United States Code: Title 20, 6311; See Appendix A)

Although the school district in this study has not resorted to allotting less time for HPE in the daily curriculum, as other districts have done (Lewis & Shaha, 2003), it has resorted to pulling particular students out of high school HPE classes to receive small group and one-on-one tutoring in the tested areas to prepare them for quarterly tests, which replicates the practice of replacing HPE time with additional course work time identified by Lewis and Shaha (2003). Despite these efforts, ninth grade students' test scores in Biology-1 are not progressively improving at the rates set by the district. Table 1 indicates the rates set and achieved in Biology-1 over the past 3 years, since the district implemented the practice of pulling students out of HPE classes for tutoring and remediation (MDOE, 2009).

Table 1

Results of the Biology-1 Subject Area Testing Program (SATP) for 2007-2010

School Year	Number Tested	Mean Scale Score	District Expectations of % Passing	% Passing
2007-2008	221	331.2	95	82.8
2008-2009	227	328.4	95	79.7
2009-2010	210	367.2	98	92.4

Students in Biology-1 have missed the 95% pass rate set by the district for the past 3 years. For the 2007-2008 school year, students missed the expected passing rate by 12.2%. The following school year, students declined even more to a 15.3% deficit below the expected district rate. But for the 2009-2010 school year, students in Biology-1 increased to a 92.4% pass rate, which may be credited to the integrated HPE program; however, this rate is still 5.6% below the expected rate set by the district.

As required by the school district, core subjects have been integrated into the HPE curriculum in an effort to assist students in understanding the relevancy and interconnectedness of the material taught in core and noncore subjects, as well as the connection of the information that is taught to their lives. Integrating core subject matter into the HPE curriculum may provide the students with a deeper understanding and critical application of the information they learn. However, in spite of this integration, a

formal evaluation of its effectiveness has not been done to see if the program improved student achievement in the core subject areas. Based on the results shown in Table 1, a noticeable improvement was made in the last year. This could be due to the integrated HPE program. Although the table shows some noticeable evidence that students were learning, Buchanan et al. (2002) suggested that some type of assessment needs to be put in place to determine the level of student achievement as a result of the integrated program.

Currently, there is no concrete evidence that there is a relationship between an integrated HPE program and academic achievement. Buchanan et al. (2002) described an integrated curriculum project called Fit Newton's Great Adventure with at-risk fifth graders at a rural elementary school. After collaborating with the fifth grade teachers and analyzing progress reports from the state Department of Education, they decided to integrate reading, writing, and science into the PE curriculum, along with the components of critical thinking, problem-solving, and cooperation. Buchanan et al. defined Fit Newton's Great Adventure as a "student-oriented project that places physical education and science outcomes in the foreground, while using writing, cooperative work, and problem-solving to facilitate achievement of these outcomes" (para. 8). The Fit Newton's Great Adventure project was never formally evaluated; therefore, Buchanan et al. assessed the success of their project by the reactions and participation of the students. Buchanan et al. said:

> They [the students who participated in the project] enjoyed the activities and correctly answered questions pertaining to the concepts covered. The days leading to the culminating event helped prepare them for working cooperatively in their assigned groups. All students contributed to their group's success by discharging the duties of their responsibility role. They had to read, think critically, and solve problems in order to perform each task. Writing was successfully incorporated into the program through journal assignments. As an added bonus, all of the activities were designed and implemented using the school's existing (and limited) physical education equipment and playground facilities. (para. 27)

Buchanan et al. (2002) stated that "by using an integrated approach, physical educators can provide creative opportunities to accommodate diverse learning styles and to unify concepts from various disciplines" (p. 33). This project would position HPE and science as a major concentration, using cooperative learning, and problem-solving to promote achievement of these areas (Buchannan et al., 2002; Kalyn, 2005; McCarthy, 2007). They concluded that conducting four prep workshops helped the students to become familiar with the process, thus promoting understanding and enhanced student achievement.

Since recent studies have indicated that higher grades may be related to physical activity (Blaydes- Madigan & Hess, 2004; Coe et al., 2006; Martin & Chalmers, 2007; Scheuer, 2004; Scheuer & Mitchell, 2003; Stevens et al., 2008), the value of a *structured*

PE program integrated with Biology-1content matter may be useful, especially as the pressure for students to increase performance on high stakes tests continues to increase (Houston, 2007; Siegel, 2007b; Smith & Lounsbery, 2009). This study will contribute to the body of knowledge needed to address this void in the literature. The results from this study could also assist school districts in central Mississippi in making critical decisions related to improving the academic achievement of students and meeting the mandates of NCLB (2002).

Nature of the Study

It is important to evaluate the effectiveness of the integrated HPE program that is already in place in the school district on student achievement in Biology-1 to examine whether there is a relationship between integrated HPE and academic achievement. The causal-comparative design used in this study yields results that would benefit all teachers, administrators, and students, and may affect decisions made by school districts to reduce or eliminate HPE from the curriculum to better prepare students to enhance their performance in core classes. In order to validate this claim, this study was conducted in an urban high school in central Mississippi. The school's enrollment was 488 students in the ninth grade. Of these 488 students, 125 students were enrolled in Biology-1, but were not enrolled in a HPE class and 79 students were enrolled in a Biology-1 class and also enrolled in a girls' HPE class. Students not taking HPE either took band, Junior Reserve Officers' Training Corps (JROTC), or advanced athletics. It is important to note that core subject content has been integrated into the structured HPE program to provide cross-

curricular instruction in Biology-1 to enhance academic achievement in the area of science. Specific Biology-1 content that was addressed includes (a) molecules, (b) stages of cell division, (c) phases of mitosis, (d) photosynthesis, (e) classifications of species, (f) food chain, (g) body systems, (h) genetics, and (i) graphs. A more detailed description of the integrated program is presented in Section 3.

This study used a causal-comparative design and ex post facto data to determine the effectiveness of the integrated HPE program on student achievement in Biology-1. Researchers have shown that male and female students taught using games, fun activities, and simulations do not differ significantly in achievement or in interest (Achor, Imoko, & Ajai, 2010; Akinsola, & Animasahun, 2007; de Freitas, 2006; Konstantopoulos, 2009). Therefore, Group *A* will include all female ninth grade students who are enrolled in both, a Biology-1 class and a girls' HPE class. This group participated in the integrated HPE program. Group *B* will include both male and female ninth grade students who are enrolled in Biology-1 but are not enrolled in a girls' HPE class and, therefore, did not participate in the integrated HPE program.

The data collected for this study were scores from the Biology-1practice tests and the MSATP test of students enrolled in Biology-1 and HPE courses. This study consisted of 204 scores, with 79 scores in the Group *A* and 125 scores in Group *B*. Of the 125 scores in Group B, 86 were scores from male students and 39 were scores from female students. Consent or assent forms were not necessary since students had already

participated in the integrated program and had taken the Biology-1 practice tests as well as the state test as required by the school district. Only deidentified test data were collected to conduct the study. The scores for both groups came from the Biology-1 practice test in October which was used as the pretest. The Biology-1 practice test in April as well as the Biology-1 state test in May were used as the posttests.

The integrated Biology-1 content was developed at the school site in collaboration with the Biology-1 teachers, who helped to establish a connection with the content that is taught in Biology-1. Then, this information was transitioned from one HPE lesson to the other, emphasizing the importance of learning and its relevance to life (Kalyn, 2005; McCullagh & Wilson, 2007; Yaussi, 2005). The integrated HPE program is aligned with the components of the pre- and posttests that are administered in Biology-1. The integrated HPE program was carried out in the regular HPE class (i.e. inside the regular classroom as well as on various playing areas). The pre- and posttest scores of both groups were compared to determine the effectiveness of the integrated HPE program on improving student achievement on Biology-1 content. An analysis of covariance (ANCOVA) was the inferential statistical analysis used to examine whether the integrated PE program increased student achievement in Biology-1 because of the "categorical information on the independent variable and the continuous information on the dependent variable" (Creswell, 2003, p. 172). The ANCOVA was used because this study compared nonequivalent groups that were not randomly assigned to control or

experimental groups and the ANCOVA adjusted for preexisting differences (Creswell, 2003). The dependent variables were the posttest scores and the pretest scores represented the covariate. The independent variable was the integrated HPE program.

Research Question and Hypotheses

This study sought to answer the following research question: Will an integrated HPE program improve students' scores in Biology-1?

Null Hypothesis

The null hypothesis states that an integrated HPE curriculum will not improve students' scores in Biology-1.

Alternate Hypothesis

The alternative hypothesis states that an integrated HPE curriculum will improve students' scores in Biology-1.

A more detailed discussion is included in Section 3.

Purpose of the Study

Researchers have confirmed that student learning can be enhanced with cross-curricular integration (Ballinger & Deeney, 2006; Clocksin, 2006; Coe et al., 2006; Gatzke & LeDrew, 2008; Hall, 2007; Hatch & Smith, 2004; Kalyn, 2005; Yaussi, 2005). Kalyn (2005) indicated that "subjects generally taught in isolation become more enriched when connected to other areas" (p. 31). The effectiveness of integrated learning for both teachers and students is not an unusual concept; however, the manner in which core

subjects are integrated into the HPE curriculum is unique (Hall, 2007; Hatch & Smith, 2004; Kalyn, 2005). English, reading, science, math, art, music, and social studies can be easily integrated into HPE classes by giving students assignments in sports, health, and fitness that would (a) enhance their reading and writing skills, (b) employ the scientific process, (c) utilize math concepts, (d) display their art skills, (e) cultivate music appreciation, and (f) promote awareness of the world around them. Physical educators do not have to desert their own curricula to support core subject concepts (Hall, 2007; Maeda & Murata, 2004; Nye, 2008; Pica, 2006a; Stork & Sanders, 2008; Tappe & Burgeson, 2004; Yaussi, 2005); they need to teach the HPE curriculum while integrating core subject matter as a reinforcer (Maeda & Murata, 2004; Yaussi, 2005). Therefore, the purpose of this causal-comparative study was to evaluate the effectiveness of the standard integrated HPE program on the academic achievement of ninth grade students in Biology-1 at an urban high school in central Mississippi to further validate the claim that *kinetic movement* enhances student achievement and to justify the need for quality HPE programs in the schools.

Theoretical Framework

The theoretical framework that guided this study is the action-based learning theory, which maintains the belief that movement builds the framework for learning (McGill & Beaty, 1995; Ratey, 2001; Revans, 1982). The action-based learning theory is based on the results of brain-based research and presumes that when the brain carries out

its normal processes (e.g. physical movement, emotional, social, moral, and cognitive learning systems), learning will take place (Caine & Caine, 1995; Jackson, 1999; Jensen, 2000; Sousa, 1998). Recent brain-based researchers suggested that educators focus on the learning process and teach to the whole child (Blaydes-Madigan & Hess, 2004; Pica, 2006b; Schiller & Willis, 2008; Sousa, 1998) because students have many systems that educators strive to stabilize so that students can perform at maximum levels (Blaydes-Madigan & Hess, 2004). Students' physical movement, emotional, social, moral, and cognitive learning systems work together and are interdependent (Blaydes-Madigan & Hess, 2004; Pica, 2006b; Schiller & Willis, 2008), and the brain is only as healthy as the body that carries it (Blaydes-Madigan, 2009; Ratey, 2008; Sousa, 2007), which points to the need for a structured PE program in the school. A successful educational program considers all these systems and teaches to elevate all these systems so that students can understand how they learn, how to be healthy and physically fit, how to manage their emotions (both negative and positive), how to work well with others, and how to set goals for success in life (Blaydes-Madigan & Hess, 2004; Pica, 2006b; Schiller & Willis, 2008). As educators increase their knowledge of how the brain works and how to work together for the benefit of all students, more students may experience success.

Movement is vital to learning because it activates the manufacture and flow of a brain-derived neurotrophic factor (BDNF) (Ferris et al., 2007; Levinger et al., 2008; Manabe, 2002). BDNF is a chemical that is active in the hippocampus, which is

responsible for long-term memory in humans and aids in learning (Manabe, 2002; Ratey, 2008). It also helps neurons to exchange information with one another (Manabe, 2002). Students may not be ready to learn because of insufficient developmental issues such as physical and emotional needs, balance, motor skills, eye fitness, crossing the midlines, and rhythm. Through movement and physical activity, many of these issues can be tackled and eliminated.

Tomporowski et al. (2008) asserted that, when students learn new information while moving, the learning is more engrossed in the brain. The cerebellum is the part of the brain that processes movement and learning; therefore, when the cerebellum is stimulated, so is the learning part of the brain (Hall, 2007; Pica, 2006b; Tomporowski et al., 2008). Researchers found that students who are physically active experience an increase in the flow of BDNF (Blaydes-Madigan, 2009; Levinger et al., 2008; Ratey, 2008); therefore, kinetic movement may help enhance learning by producing more BDNF within the student's brain (Blaydes-Madigan, 2009; Ferris et al., 2007; Pica, 2006b). Kinetic movement also sends more blood and oxygen to the brain and muscles, thus increasing mental functioning (Pica, 2006b; Tomporowski et al., 2008). Other researchers have found that kinetic movement can reduce stress and anxiety by deterring the production of a chemical called cortisol, which causes individuals to be less capable of planning, making decisions, and solving problems, and other higher-order thinking skills (Blaydes-Madigan, 2009; Covelli, 2007; Nieuwenhuys, Pijpers, Oudejans, &

Bakker, 2008). Kinetic movement increases brain function and produces more neurons; thus, the ability to learn and make better grades increases (Blaydes-Madigan, 2009; Nieuwenhuys et al.; Pica, 2006b; Ratey, 2008). Higher grades may be related to kinetic movement, and a structured PE program may be helpful since the pressure for students to increase performance on high stakes tests continues to increase (Houston, 2007; Siegel, 2007b; Smith & Lounsbery, 2009).

Definition of Terms

Cooperative learning: A learning method where students combine in small mixed groups and help each other for a common academic aim, boost each other's self-esteem, develop communication abilities, increase problem solving and critical thinking abilities, and take an active part in learning (Doymus, Simsek, & Karacop, 2009).

Criterion-referenced tests (CRTs): "CRTs compare each student's performance to some pre-established criteria, often in the form of specific learning objectives. Students' scores are determined by the degree of their mastery on these objectives, regardless of how other students performed on the same objective" (Kim, Lee, Chung, & Bong, 2010, p. 141).

Disciplines: Branches of knowledge or school subjects which are formally taught, either at a school, a university, or some other such method (Parpala, Lindblom-Ylänne, Komulainen, Litmanen, & Hirsto, 2010).

Ergometer: An instrument for measuring muscle power or work done by muscles, e.g. when exercising (Ferris et al., 2007).

Kinetic movement: Movement that involves motion of the muscles such as running, walking, swimming, or lifting weights (Yaussi, 2005).

Leisure time activities: Physical activities done during nonworking hours for recreation or enjoyment (Kalyn, 2005).

Rote Learning: Memorization or the process of putting information in your memory through sheer repetition. This involves learning facts without developing a deep understanding of them which makes it impossible to grasp meaning and to apply and transfer the knowledge to other areas (Pica, 2006b).

Sedentary lifestyles: Types of lifestyle that consist of little or no physical exercise such as sitting, watching television, playing video games, long periods of time on the computer, and reading (Patterson & Van Der Mars, 2008).

Structured PE program: A school-based program that provides students with a variety of physical activities designed to improve fitness levels under the direction of a certified PE instructor (Schiller & Willis, 2008).

Twenty-first Century Skills: Skills compiled from contemporary literature, emerging research, and the voice of representatives from education, business and industry, intended to serve as a bridge across public, business, industry, and education

sectors through common definitions, and contexts for the skills most needed by students and workers in the emerging digital age (Salpeter, 2003).

Assumptions

The following assumptions were made in this study:

1. All the data, materials, and resources needed to conduct this study would be provided to me stripped of identifying information.

2. All Biology-1 students would do their best to perform well on the Biology-1 assessments.

3. Biology-1 teachers would work cooperatively in the study to administer tests and provide accurate documentations.

4. The Office of Assessment would provide accurate test data to the chairperson of the science department who would, in turn, provide accurate test data free of identifiers from these assessments.

Limitations

There are severe limitations to causal-comparative research. The main weakness is that there is no control of the independent and dependent variables because they have already taken place. A noticeable cause and effect relationship may not exist the way it appears; it may be inverted. Additionally, some other factor may, in fact, cause the effect of the hypothesized relationship. The integrated HPE curriculum that is already in place was designed by me to enhance academic achievement and increase state test scores in

Biology-1 of the students whom I teach. All strategies and learning theories used in this study were obtained from the work of other researchers in the field of education. Another limitation to this study was that one of the groups consisted of both male and female students (Group *B*) while the other group (Group *A*) consisted of all female students. Research has shown that male and female students taught using games, fun activities, and simulations do not differ significantly either in achievement or in interest; therefore, the gender differences should not matter (Achor, Imoko, & Ajai, 2010; Akinsola, & Animasahun, 2007; de Freitas, 2006; Konstantopoulos, 2009).

Another potential weakness of the study is that some of the scores may already show high levels of achievement; therefore, the academic achievement may predict a very small percentage of improvement. The school in this study practiced pulling students out of their HPE class to provide tutorial services in an effort to help students excel on state tests. Although the female students in Group A were not pulled from their HPE class because they were participating in the integrated HPE program that incorporated Biology-1 content into the HPE curriculum, the male students in Group B were pulled from their HPE classes. The boys' HPE classes did not offer an integrated program in which Biology-1 content was incorporated into the HPE curriculum; therefore, the male students in Group B were pulled from their HPE class 3 days each week to receive tutorial services in Biology-1. Since the female students in Group B did not take HPE, they were not pulled from other classes to receive tutoring in Biology-1.

The extra assistance that the male students received may have influenced their test scores. The scores of students with excessive absenteeism may influence the results of statistical testing and outcomes. Some of the students in the Group *B* may participate in other forms of physical activity that is unknown to me which may also affect the study's outcome.

The Scope and Delimitations of the Study

The scope of this study was to evaluate the effectiveness of the integrated HPE program on the academic achievement in Biology-1 of approximately 204 ninth grade HPE students at an urban high school in central Mississippi. Eighty-two percent of the students are Black, 15% are White, 2% are Hispanic, 1% is Asian, and less than 1% is Native American. Of the 488 students at the school, 61% receive free or reduced lunch indicating low socio-economic status. Since this causal-comparative research study was confined to ninth grade students enrolled in the 2010-2011 school year at an urban high school in central Mississippi, the results of this study can possibly be generalized to the entire ninth grade population in Mississippi and beyond its borders. However, without randomly selected samples from the population, the generalizability could be hindered.

Significance of the Study

A study concerning the integration of core subjects into the HPE curriculum to increase student achievement in Biology-1 was significant for a number of reasons which

are identified as the application to the local problem, the professional application, and the application for positive social change.

Application to the Local Problem

This study was significant in that its results addressed a local problem. Ninth grade students in the district have struggled with meeting the state's minimum requirements in the area of Biology-1. Since the implementation of NCLB, this school had struggled to meet adequate yearly progress (AYP) as well as reach the growth status. The school was in its second year of improvement status (MDOE, 2009). Scores on the Biology-1 state test had not reached state requirements of 100% passing rate. Administrators had set an expectation for at least 98% of the Biology-1 students to perform at or above minimum requirements for the 2010-2011 school year. This study should help physical educators to assess the role they are playing in doing their part in increasing student achievement in Biology-1 by enhancing student learning as well as physical fitness (Lynn, 2007; Pica, 2006a; Siegel, 2006; Smith & Lounsbery, 2009; Stevens-Smith et al., 2006). Teachers must effectively integrate core subject content of science into the HPE curriculum to meet the unique needs of the disciplines, the students, and classroom situations. This will expose students to the materials they will need to master in order to increase student learning and perform at or above the state's minimum requirements.

Professional Application

Currently, students are pulled out of HPE classes to get tutorial services in order to increase scores on state tests. The results of this study may impact administrative decisions to reduce HPE or eliminate it in an effort to enhance students' performance in core subjects. This study may encourage administrators to consider the important benefits of HPE to today's students and the advantages of cross-curricular integration in enhancing student learning ("Action for Healthy Kids," 2004; Castelli et al., 2007; Coe et al., 2006; Greer & Gilbert, 2006; Hall, 2007; "PE Central," n. d.; Siegel, 2007a). This study may also encourage other physical educators to integrate core subject content into their HPE curriculum in order to enhance student learning, increase students' concentration levels, and make it easier for students to learn (Pica, 2006b; Tappe & Burgeson, 2004; Tomporowski et al., 2008; Yaussi, 2005).

Addressing Positive Social Change

Walden University's (2006) definition of positive social change is "a deliberate process of creating and applying ideas, strategies, and actions to promote the worth, dignity, and development of individuals, communities, organizations, institutions, cultures, and societies. Positive social change results in the improvement of human and social conditions" (para. 1). Since recent studies indicate that many parents and educators are not aware that poor nutrition, inactivity, and obesity problems among students in the United States are negatively affecting their academic achievement (Maeda

& Murata, 2004; Pica, 2006b), the results of this study may promote positive social change by helping parents, educators, and all constituents across the world to recognize the importance of encouraging students to participate in vigorous physical activities. Maeda and Murata (2004) had this to say about physical activity and student achievement:

> Although some classroom teachers view physical activity and physical education as unimportant, committed physical education specialists, contrary to the myth, can succeed in helping them recognize the crucial role that physical activity and movement play in maintaining good health and boosting learning. (para. 5)

It is acknowledged from previous research that poor nutrition, inactivity, and obesity problems have had a negative effect on the academic success of students in the United States and abroad (Maeda & Murata, 2004; Pica, 2006b). The problem is that the main goals in education have been to develop the mind and not the body when in fact; non-core subjects such as art, PE, and music contribute to students' overall achievement by stimulating various parts of the brain that will positively affect academic achievement (Blaydes- Madigan & Hess, 2004; Houston, 2007; Maeda & Murata, 2004; Siegel, 2006, 2007b). Students may more likely sustain physical activities throughout their lives to reduce the dangers of obesity, help lower health costs, and improve student achievement (Blaydes- Madigan & Hess, 2004; Maeda & Murata, 2004; Preisser, 2004; Stork & Sanders, 2008), as a result of this study.

Summary and Transition

The purpose of this quantitative, causal-comparative study was to evaluate the effectiveness of an integrated HPE program on the academic achievement of ninth grade students in Biology-1 at an urban high school in central Mississippi to justify the need for quality HPE programs in the schools. Physical activity and academic achievement are integral parts of education that should be designed to teach the whole child (Rothstein & Jacobsen, 2006; Schiller & Willis, 2008). Previous research supports the notion that these components are matched perfectly and can be effectively integrated to improve student learning. It is also conceived that one without the other would cause a deficiency and in order for schools to benefit from the advantages of an effective, integrated HPE program, policy makers and educational leaders must provide for and support such programs to prepare students to compete in our global society.

Section 1 of this study offers information about integration and student achievement. Section 2 grounds the study in theory and current research by presenting a review of the literature that discusses in detail the benefits of an effective, integrated HPE program. Due to our ever-changing society, this groundwork is mingled with the urgency for preparing students to meet the needs of the 21st century so they are prepared to successfully compete in the work world. A thorough explanation of how learning theories works in integrating core subjects in the HPE curriculum is provided in Section 2. Additionally, an extensive review of the literature about helping students acquire 21st

century skills is discussed in Section 2 as well as details concerning the positive social changes that will result from this study.

Educational systems are bound by federal mandates that hold schools responsible for the success of students. Details of these federal requirements are discussed. Section 2 sets the tone for the research methodology presented in Section 3. A detailed description of the research design, the rationale for the research design, population, sample, variables, and materials that were used is presented.

Section 4 reports research findings relative to the research question and hypothesis. Additionally, a description of data collection and the statistical procedures used to make decisions about the hypothesis are presented. This study evaluated the effectiveness of an integrated HPE program on the academic achievement and a report of those findings is presented, interpreted, and explained thoroughly which will be relative to the underlying theoretical framework of this study. Section 5 presents an overview of the study, as well as conclusions, interpretations, study recommendations, and implications for social change.

Section 2: Literature Review

The purpose of this causal-comparative study was to evaluate the effectiveness of an integrated Health and Physical Education (HPE) curriculum to improve ninth grade students' achievement in Biology-1 at an urban high school in central Mississippi. Therefore, I begin the literature review with a discussion of the traditional role of HPE programs to give a background of what a quality HPE program entails. Then I present different views on how students gain knowledge through action-based learning. This discussion is important because it sets groundwork for understanding the role that a structured Physical Education (PE) curriculum play in schools that seek positive reform. Next, I explain how the results from recent brain research have impacted student learning. I also discuss the connection between physical activity and student achievement. It is important to know why students need physical movement, so I included the benefits of physical activity to show how it affects student learning, as well as addressing the effects that obesity have on student achievement. A discussion of the impact of cross-curricular integration on student achievement is presented. The impact of No Child Left Behind on HPE programs follows this section and includes the use of *21st century skills* to enhance student achievement. Such skills are essential to improving student achievement and preparing students for success in the global society. The theoretical framework is presented, including a description of how an eclectic blend of learning strategies and theories were used to evaluate the effectiveness of integrating

science content into the HPE curriculum to increase student learning in the area of Biology-1. The research methodologies that were used are explained, including a justification for the chosen methodology. This section ends with a conclusion and a summary describing how the research literature guides this study.

The literature in this review was selected because of its connection to the dependent variable of academic achievement as measured by pre- and posttest scores in Biology-1 and its contributions to evaluating the effectiveness of an integrated HPE program. The dependent variables were the Biology-1 posttest scores and the pretest scores represented the covariate. The independent variable was the integrated HPE program. An analysis of covariance (ANCOVA) was the inferential statistical analysis used to examine whether the integrated PE program increased student achievement in Biology-1 (Creswell, 2003). More details of the research methodology are discussed in Section 3.

To facilitate this study, a search of the literature was conducted in an organized manner. First, a keyword search from Education Research Complete, the Educational Resource Information Center (ERIC), Academic Search Premier, and ProQuest databases was conducted to gather the information from scholarly, peer-reviewed journals. It is important to note that the research published by Blaydes-Madigan on action-based learning is not peer reviewed but is used widely in education throughout the United States. The search was further narrowed to retrieve articles within the last 5 years so that

the literature review would consist of the most recent information on student achievement. Keywords included: *student achievement* and *health and physical education*. Other related words that emerged from the search and were used to narrow the search were *cross-curricular integration, adolescents-junior high school students, brain research and student learning, technology and student learning, research and student achievement, obesity and student achievement, 21st century skills, action-based learning, movement and student learning, physical activity and student learning,* and *learning theories*. I printed the information from the selected articles and sorted them in files for later retrieval. After gathering the needed information from the search of the literature, I categorized articles according to main topics that inform the research questions. I reviewed each article for relevance to the topics, sorting them based on their similarities and differences.

Traditional Roles of Health and Physical Education Programs

Traditionally, students are taught physical fitness, team sports, individual *leisure time activities*, and healthy lifestyles in HPE classes (MDOE, 2006). One of the main goals of HPE is to provide adequate physical activities to all HPE students. This goal is important because students can change their current health as well as their future health by controlling certain risk factors associated with disease, disability, or premature death (Blaydes-Madigan & Hess, 2004; Lengel & Kuczala, 2010; Yassi, 2005). This change helps to decrease the incidence of obesity, which is a growing problem in children and

adolescents today due to sedentary lifestyles (Cavallini et al., 2007; Crosnoe, 2007; Greer & Gilbert, 2006; Lynn, 2007; Preisser, 2004; Stork & Sanders, 2008; Yaussi, 2005). Based on the statistics from the Center for Disease Control (CDC, 2010), "the percentage of overweight children aged 6-11 years has increased from 6.5 percent to 19.6 percent since the early 1980s and among adolescents aged 12–19, obesity increased from 5.0% to 18.1% during the same period" (para. 3). Surveys show that overweight and obese children and adolescents are more likely to have at least one risk factor for heart disease or type 2 diabetes and this trend is increasing (CNN, 2009; CDC, 2010). The CDC recommended that teachers educate students about the importance of good nutrition and exercise as well as change schedules to increase the amount of physical activity students experience in a day.

Researchers have claimed that adequate physical activities are beneficial to the health of the body (Blaydes-Madigan & Hess, 2004; Covelli, 2007; Pica, 2006b; Schiller & Willis, 2008; Yassi, 2005). These benefits include improved appearance, better developed muscle strength and endurance, improved body image, a feeling of personal self-control, more enjoyment in life, improved health, increased levels of energy, enhanced physical performance, greater success in school work, reduced stress and tension, healthier sleep, and longevity (Blaydes-Madigan & Hess, 2004; Covelli, 2007; Lengel & Kuczala, 2010; Yassi, 2005). Because students seldom exercise voluntarily, it is vital to explain to parents, administrators, policy makers, government agencies, and all

educational constituents why schools should provide students with structured HPE programs in order to bring about physiological changes in students (Blaydes-Madigan, 2005; Greer & Gilbert, 2006; Lynn, 2007; Yaussi, 2005).

A second important goal of HPE is to evaluate students' physical fitness levels (MDOE, 2006). Physical education teachers in Mississippi are required to administer a physical fitness test to all HPE students. According to the President's Council on Fitness, Sports & Nutrition (2010a), "the physical fitness test recognizes students for their level of physical fitness in five events: (a) curl-ups or partial curl-ups, (b) shuttle run, (c) endurance run-walk, (d) pull-ups or right angle push-ups, and (e) V-sit or sit and reach" (para. 3). Students are eligible to qualify for three awards: (a) The Presidential Physical Fitness Award, (b) The National Physical Fitness Award, and (c) The Participant Physical Fitness Award (PCFSN, 2010b). Awards are earned by the following standards set by the President's Council on Fitness, Sports & Nutrition, (2010b):

> To earn the Presidential Physical Fitness Award, students must score at or above the 85th percentile on all five activities. To earn the National Physical Fitness Award, students must score above the 50th percentile on all five activities. To earn the Participant Physical Fitness Award, students must participate in all five activities, but one or more of their scores fall below the 50th percentile. (para. 1)

The final goal of HPE is to promote healthy lifestyles (MDOE, 2006). People who are active have fewer heart problems and other diseases than those who are inactive

(Covelli, 2007; Crosnoe, 2007; Pica, 2006b; Preisser, 2004; Yaussi, 2005). It is vital that HPE teachers, as well as all educators, stress to students the importance of maintaining an active lifestyle throughout their futures. Teaching leisure time activities helps students learn a variety of physical activities that can be enjoyed throughout their lives, increasing longevity.

Viewpoints on How Students Gain Knowledge

Pica (2006b), as well as Leppo and Davis (2005), found that educational systems are eliminating physical education because people believe that the mind and body are two different units and developing the mind is more important than developing the body. Pica contended that many believe that learning takes place when students see and hear information which involves *rote learning* (memorization). Students today are not participating in "active, sensory experiences… instead, they are passively interacting with educational products" (Pica, 2006b, p. 52). It was further stated that "active, authentic learning…-the process of exploration and discovery, of acquiring knowledge, of knowing how to acquire it-…will serve a child endlessly" which would almost certainly promote a permanent love for learning (Pica, 2006b, p. 52). When students assume responsibility for their learning, they are more likely to have academic success. Therefore, in order to enhance student achievement, teachers must educate the whole child (the child's body as well as the mind).

Brain researchers have recently confirmed that the mind and body work as one unit, meaning that active learning will stimulate the brain much more than rote learning (Blaydes- Madigan & Hess, 2004; Pica, 2006b; Schiller & Willis, 2008). "Sitting increases fatigue and reduces concentration, [while] movement feeds oxygen, water, and glucose to the brain, optimizing its performance" (Pica, 2006b, p. 52). Therefore, when students engage in hands-on learning or action-based learning, "more neural networks in the brain and throughout the body" are produced, making the entire body an instrument for learning (Pica, 2006b, p.52). Additionally, students learn when learning is fun and meaningful to them (Buchanan et al., 2002; Rothstein & Jacobsen, 2006). It motivates them to learn more and increases their understanding (Buchanan et al., 2002; Rothstein & Jacobsen, 2006; Siegel, 2007a). This method of instruction teaches to the whole child using all three domains (cognitive, affective, and psychomotor) (Pica, 2006b). Pica concluded that in spite of the recent findings from brain research that students need to increase their physical activities, there are still many parents and educators who believe that developing the mind should take priority over developing the body. This study highlights the connection between kinetic movement and student achievement and seeks to show how educating both the mind and body enhances achievement.

Brain Research and Student Learning

Instructional leaders are constantly searching for and implementing an eclectic blend of learning strategies and techniques to meet the needs of today's students because

of the diversity in the classroom. Bruer (1999) contended that educators should consider what psychologists and cognitive scientists have found to be true about teaching and learning and not be concerned with new brain research. Bruer (1997) asserted that it would be 2 decades before brain research could be used in education. It was less than 1 decade since Bruer claimed that brain research would be useless in education that neuroscience discovered new information about the brain and how it processes, interprets, and stores new information that is beneficial to educational institutions. The brain-based learning theory assumes that, when the brain carries out its normal processes, learning will take place (Caine & Caine, 1995; Jackson, 1999; Jensen, 2000; Sousa, 1998). Recent brain-based learning theorists have suggested that educators focus on the learning process and teach to the whole child (Blaydes-Madigan & Hess, 2004; Pica, 2006b; Schiller & Willis, 2008; Sousa, 1998) because it is important that students' learning systems work together to enhance the health conditions of the body (Blaydes-Madigan & Hess, 2004; Pica, 2006b; Schiller & Willis, 2008). When the body is healthy, the brain is healthy (Blaydes-Madigan, 2005; Ratey, 2008; Sousa, 2007).

According to several researchers, physical activity stimulates the brain so that learning can take place (Coe et al., 2006; Pica, 2006a; Stork & Sanders, 2008). However, it was noted in the research that this physical activity did not have to come from HPE in the schools (Martin & Chalmers, 2007). Researchers have suggested that kinetic movement should be integrated with other subject matter to provide important benefits to

the students (Siegel, 2006; Houston, 2007; Tomporowski et al., 2008). Through kinetic movement, new information is embedded within a student's neural systems (Ferris et al., 2007; Tomporowski et al., 2008). The sensory strands are employed during movement and "carry impulses from the muscles to the brain" which allows embedding (Hall, 2007, para. 5). "The more muscles activated while learning new information with subject matter concepts,… the stronger and more concrete the learning" (Hall, 2007, para. 5). The part of the brain responsible for movement and learning is the cerebellum. Hall contended that when students move, the cerebellum is stimulated; thus, stimulating the learning part of the brain. Therefore, exercise can provide many benefits to the brain (Hall, 2007; Houston, 2007; Siegel, 2006).

Exercise triggers the production and flow of a brain-derived neurotrophic factor (BDNF) (Blaydes-Madigan, 2009; Ferris et al., 2007; Hall, 2007; Levinger et al., 2008; Manabe, 2002; Ratey, 2008). A BDNF is a chemical that is active in the hippocampus, which is responsible for long-term memory in humans and helps neurons to exchange information with one another (Manabe, 2002). Researchers also found that students who are physically active experience an increase in the flow of BDNF (Blaydes-Madigan, 2009; Levinger et al., 2008; Ratey, 2008). Ferris et al. (2007) studied the effect of acute exercise on serum "BDNF levels in humans and to determine the relationship between exercise intensity and BDNF responses [as well as] the changes in BDNF and cognitive function" (para. 1). Fifteen participants (11 males and four females) took a graded

exercise test (GXT) on a cycle *ergometer*. Each participant performed the test at 20% below the ventilatory threshold (VTh) (VTh – 20) and at 10% above the VTh (VTh + 10). Serum BDNF and cognitive function were established before and after the GXT. The BDNF did not change from baseline after the VTh-20. It was further noted that "cognitive function scores improved after all exercise conditions, but did not correlate with BDNF changes" (para. 5). It was concluded that increased levels of BDNF were significant in human response to exercise and the size of the increase was contingent on the intensity of the exercise. Therefore, if this is so, kinetic movement provided in this study's integrated program may help enhance learning by producing more BDNF within the student's brain (Blaydes-Madigan, 2009; Ferris et al., 2007; Pica, 2006b).

Researchers found that "students who sit for longer than 20 minutes experience a decrease in the flow of BDNF" (Blaydes-Madigan, 2009; Ferris et al., 2007). After about 17 to 20 minutes of sitting, melatonin sets in the hamstrings and the calf muscles of the legs and the brain lets the body know that it is at rest. This draws needed oxygen and glucose away from the brain. A change occurs in the brain and body because of gravity (Blaydes-Madigan, 2009; Ferris et al., 2007; Levinger et al., 2008; Manabe, 2002; Ratey, 2008). During this sitting time, the blood flow is cut off at the hips, the knees, and the ankles; and since the lower limbs are not moving, the flow of BDNF is deterred and hinders learning (Blaydes-Madigan, 2009; Ferris et al., 2007; Levinger et al., 2008; Manabe, 2002). Students become sluggish and sleepy and they struggle to be attentive

and to concentrate on the materials to be learned; thus learning is decreased. Movement balances the body physically, chemically, electrically, and emotionally (Blaydes-Madigan, 2010). Physical activity puts the brain and the body into bio-balance, producing an ideal learning situation for the students.

When information enters the brain, it is assigned to the nucleus of a neuron. This produces an electrical response that is propelled down the axon and release chemicals called neurotransmitters (Blaydes-Madigan, 2009; Ratey, 2008). These neurotransmitters leap across "a space called the synapse and lock into receptors on finger-like projections called dendrites" (Blaydes-Madigan, 2009, para. 5). These neurotransmitters continue on to make a neural pathway which promotes learning (Blaydes-Madigan, 2009; Levinger et al., 2008; Ratey, 2008). These neural pathways are employed "during movement and carry impulses from the muscles to the brain" which allows embedding (Hall, 2007, para. 5). This means more learning takes place when there is movement present.

Blaydes-Madigan (2009) asserted that information travels in the brain up and down, front to back, and side to side. The information that is traveling left to right crosses the Corpus Callosum and the information that is traveling front to back cross the Motor Cortex. Information that travels up and down goes from the bottom of the brain to the top of the brain. The three basic human motor movements that correspond with how information travels are (a) crawling or walking, (b) jumping, and (c) rolling (Blaydes-Madigan, 2009). Blaydes-Madigan (2009) asserted that students may not be prepared to

learn because of insufficient development, including physical and emotional needs, balance, motor skills, eye fitness, crossing the midlines, and rhythm. Students may not receive adequate nutrition, exercise, water, and sleep. They may not have social competence and trust. Their spatial awareness and vestibular system could be lacking. They may not have adequate motor skills. Some students may have trouble with vision such as tracking, far and near focusing, and eye dominance which may be the result of the effects of television and computers. Another deficiency that students have is organizing, integrating, and energizing the brain. They may have poor beat awareness, beat competency, and fail to use the brain as a pattern seeking device. Many of these concerns can be dealt with and possibly eradicated with physical activities. It is important to make sure that these processes are in place, especially when students learn differently (Blaydes-Madigan, 2009; Ratey, 2008).

Connections Between Physical Activity and Student Achievement

Researchers found that field tests of physical fitness were positively related to academic achievement (Castelli et al., 2007; Siegel, 2007a, 2007b). Students who had high scores on physical fitness tests also scored higher on achievement tests. Houston (2007) concluded that there was a relationship between failing student tests scores and reduced time allotments for physical activity. Students who had higher grades participated in daily HPE and students who had lower grades did not take part in daily HPE. Smith and Lounsbery (2009) asserted that every effort should be made to support

physical education programs in schools because researchers have confirmed a positive link between physical movement and academic achievement. Teachers must build effective movement experiences that would support cognitive development (Leppo & Davis, 2005) because active learning enhances student achievement much more than seat work (Maeda & Murata, 2004). According to Pica (2006a, 2006b), physical activity increases student learning. Tomporowski et al. (2008) noted that physical exercise is an effective means of improving those characteristics of children's mental performance essential for cognitive development. Ferris et al. (2007) discovered that BDNF levels in humans were significantly increased after exercise.

Scheuer and Mitchell (2003) concluded from their study that there were many positive connections between physical activity and academic performance; however, they found no concrete evidence that suggests that HPE enhanced academic performance. They recommended that schools should enhance their HPE programs instead of decreasing them. They felt that this may be a way to decrease the incidence of obesity as well as enhance student achievement, thus, justifying HPE programs in schools.

Individuals who exercise regularly were found to have higher levels of BDNF than those who did not exercise (Blaydes-Madigan, 2009; Ferris et al., 2007; Levinger et al., 2008); thus improving their mental functioning. Yaussi (2005) declared that movement promotes achievement and that students should be given opportunities to move around during core subject classrooms to stimulate brain functioning. Yet, other

researchers, particularly Martin and Chalmers (2007), have shown that this relationship was not significant enough to validate the inclusion of HPE programs in schools (Coe et al., 2006; Martin & Chalmers, 2007; Scheuer, 2004; Scheuer & Mitchell, 2003; Stevens et al, 2008). Martin and Chalmers (2007) noted that over the past 5 decades, there was no concrete evidence that there was a relationship between academic achievement and physical fitness. They asserted that any positive relationships that may have been found has caused schools to believe that "healthy children learn better" and uses this concept to justify HPE programs in the school. They contended that the “conclusions of previous studies have been based on the statistical significance of the results, and have not incorporated the practical significance” (p. 214). Therefore, they investigated this relationship using scores on the Iowa Tests of Basic Skills and physical fitness scores as measured by performance on the President's Challenge. The 5847 participants from Seattle School District were in the third, fifth, sixth, and eighth grade. “The correlation between mean physical and academic percentile scores was 0.19, $p <. 05$” (p. 214). They concluded from their study that there was a statistical significant relationship between academic achievement and physical fitness; however, they felt “that only 3.6% of the variance in academic performance could be explained by physical fitness” (p. 214). This small percentage suggests that the relationship between academic achievement and physical fitness is not sufficient enough to conclude that PE programs promote academic achievement in students. The kinetic movement in the current study guides the

evaluation of the integrated HPE program design. If Martin and Chalmers is correct, students' academic achievement is not contingent on PE, but students' participation in any type of physical activity, structured or unstructured. If this was true, then parents would have to ensure that students engaged in some type of physical activity and the responsibility of enhancing mental functioning is taken from the school. On the contrary, the statistics from the CDC (2010) showed an increase in overweight children 6-11 years of age since the early 1980s and "among adolescents aged 12–19, obesity increased from 5.0% to 18.1% during the same period" (para. 3). The CDC recommended that teachers educate students about the importance of good nutrition and exercise as well as change schedules to increase the amount of physical activity students experience in a day because not all parents are doing their part in ensuring that children are physically active. Pica (2006b) contended that today's students are passively interacting with educational products, which further leans to a sedentary lifestyle.

Stevens et al. (2008) conducted a study to find out if there was a relationship between physical activity and academic achievement. They also wanted to know if school-based HPE participation was related to academic achievement in children. They selected participants from "the Early Childhood Longitudinal Study-Kindergarten database" (p. 3680). "Structural equation models were constructed for both mathematics (boys, n = 3,226; girls, n = 3,256) and reading achievement (boys, n = 3,167; girls, n = 3,226)" (p. 368). The outcome of the study showed that physical activity was related to

mathematics as well as reading achievement in both male and female students; however, they found that school-based HPE participation was not related to academic achievement in children. They felt that these results may be linked to HPE programs that fail to provide students with quality instructions. The integrated HPE program in this study provides structure, motivation, and instructions that are effective in increasing student achievement.

Clocksin (2006) stated that learning should be fun. For this study, incorporating Biology-1 content in the HPE curriculum can provide students with valuable learning while they are having fun. Clocksin reported that teachers view learning core content as a means of increasing students' knowledge as well as improving students' communication and problem solving skills, while students view it as fun. Music, games, movement, dance, videos, and hands-on manipulative can be used to teach diverse subjects such as nutrition, music appreciation, and fitness (Blaydes-Madigan & Hess, 2004; Buchanan et al., 2002), as well as grammar, mathematics, social studies, and science through collaborative teaching across the curriculum (Kalyn, 2005). Researchers found that students can actually learn while they are having fun (Clocksin, 2006; Kalyn, 2005). Although several studies found that there was some noticeable evidence that students were learning, Buchanan et al. (2002) suggested that some type of assessment needs to be put in place to determine the level of student achievement as a result of an integrated program.

Benefits of Physical Activity to Learning

Physical activity, as little as stretching every 20 minutes during instructions in the classroom, can increase the amount of BDNF produced in the brain and help enhance student learning (Blaydes-Madigan, 2009; Ferris et al., 2007; Levinger et al., 2008; Manabe, 2002). Structured HPE provides students with physical activities that can help enhance learning by stimulating the flow of BDNF in the student's brain, which can further provide support for integration (Blaydes-Madigan, 2009; Ferris et al., 2007; Levinger et al., 2008; Manabe, 2002; Pica, 2006b; Ratey, 2008).

Blaydes-Madigan (2009) pointed out that another benefit of physical activity is an increased supply of blood to the brain. This increased blood flow helps provide more nutrients to the brain (Blaydes-Madigan, 2009; Tomporowski et al., 2008; Ratey, 2008). Exercise expands capillaries in the brain which allows more blood and oxygen to flow to the brain (Ratey, 2008). Walking is particularly good for the brain because it is not strenuous, so the leg muscles do not take up extra oxygen and glucose like they do during other forms of exercise, such as playing basketball or swimming (Blaydes-Madigan, 2009; Pica, 2006b; Ratey, 2008). As an individual walks, his or her brain is effectively oxygenated; enhancing the way one thinks. This may help sustain the life of new neurons and help them to fire more efficiently (Blaydes-Madigan, 2009). Structured HPE provides physical movement that increases blood flow and oxygen delivery to the brain

which increases mental operation (Blaydes-Madigan, 2009; Pica, 2006b; Tomporowski et al., 2008; Ratey, 2008).

Yet another benefit of physical activity for the brain and body is its ability to reduce stress. Covelli (2007) and Nieuwenhuys, Pijpers, Oudejans, and Bakker (2008) asserted that stress and anxiety activate the adrenal glands which produce chemicals called cortisol. When cortisol gets into the brain, an individual's ability to solve problems, make decisions, make plans, and make judgments as well as completing other higher-order skills is hindered. When there are high levels of cortisol for extended time periods, brain cells die and the number of brain cells that are produced is decreased (Blaydes-Madigan, 2009; Covelli, 2007; Nieuwenhuys et al., 2008; Ratey, 2008). Covelli contended that the amount of cortisol produced in the brain can be adjusted through physical activity; thus, decreasing the number of brain cells that are dislocated and diminished. This allows for increased brain function and when there are more neurons present, the ability to learn increases (Blaydes-Madigan, 2009; Covelli, 2007; Nieuwenhuys et al., 2008; Pica, 2006b; Ratey, 2008).

Connections Between Obesity and Student Achievement

Obesity is a growing problem in children and adolescents today due to the consequences of a *sedentary lifestyle*, the most common cause of obesity (Cavallini et al.,2007; Crosnoe, 2007; Greer & Gilbert, 2006; Lynn, 2007; Preisser, 2004; Stork & Sanders, 2008; Yaussi, 2005). Obese students generally have low self esteem and lack

motivation to be assertive in class (Blaydes-Madigan & Hess, 2004; Crosnoe, 2007; Greer & Gilbert, 2006; Preisser, 2004). Therefore, the way to overcome this problem is to engage students in physical activities and encourage good nutrition (Cavallini et al., 2007; Preisser, 2004; Yaussi, 2005). Students need physical activity in order to provide adequate stimulation to the brain so that learning can take place (Coe et al., 2006; Pica, 2006a; Stork & Sanders, 2008). Physical educators can integrate other subjects into their classes, and non-PE teachers can incorporate movement into their classes (Hall, 2007; Leppo & Davis, 2005; Maeda & Murata, 2004). Providing hands-on learning would be an ideal way to get students to moving (Hall, 2007; Maeda & Murata, 2004; Nye, 2008; Pica, 2006a; Stork & Sanders, 2008; Tappe & Burgeson, 2004; Yaussi, 2005). It is very important that educators stress to students the significance of developing an active, healthy lifestyle for lifelong learning (Castelli et al., 2007; Stork & Sanders, 2008; Yaussi, 2005).

Educators continue to concentrate on the improvement of the mind, ignoring the physical needs of the body ("Action for Healthy Kids," 2004; Blaydes-Madigan, 2009; Maeda & Murata, 2004; Pica, 2006b; Rothstein & Jacobsen, 2006). A balance between the physical and mental needs of students seem like a reasonable target, since both are needed and used for an entire lifetime. Leppo and Davis (2005) stated that "when learning experiences incorporate movement, learning is more efficient, comprehension is clearer, thought processes are better connected, obesity problems are addressed, and

learning is fun" (p. 16). This is why integrative teaching methods should be used. "Classroom teachers should integrate their lessons with the structured physical education curriculum and vice versa" (Hall, 2007, para. 13). This is more crucial when the school does not offer a structured HPE program with PE specialists readily available to make sure students are getting the benefits of daily physical activity that can combat obesity ("Action for Healthy Kids," 2004; Kalyn, 2005; Maeda & Murata, 2004).

Impact of Cross-Curricular Integration on Student Achievement

Despite the fact that researchers of the National Association for Sport and Physical Education (NASPE) (2010) had recommended that elementary school children should receive quality HPE instruction for a minimum of 150 minutes in a week and that children should not be sedentary for more than 60 minutes at a time, except when they are asleep, schools' administrators are reducing or eliminating HPE, leaving teachers with the burden of spending more class time preparing students to perform better in math and reading on state tests (Rothstein & Jacobsen, 2006).

Due to the escalating pressure that is placed on teachers and administrators to increase students' academic achievement, educational systems are reducing or eliminating subjects that are not considered core subjects, such as art, PE, and music (Hall, 2007; Houston, 2007; Maeda & Murata, 2004; Siegel, 2006). Those very subjects (art, physical education, and music) are subjects that contribute to students' overall achievement by stimulating various parts of the brain that will positively affect academic

achievement (Houston, 2007; Maeda & Murata, 2004; Siegel, 2006, 2007b). Maeda and Murata (2004) stated that "an education in this sense is balanced because all three domains-cognitive, affective, and psychomotor-are promoted, and one domain does not take precedence at the expense of another" (para. 5). Therefore, the main concerns in education should be to concentrate on the improvement of the mind and the body (Blaydes-Madigan, 2009; Maeda & Murata, 2004).

Pica (2006b) stated that there are many factors, other than HPE and being physically active, that may have an effect on academic achievement. Recent findings from research present strong support for integrating other subject matter with HPE to increase student learning. Physical educators can emphasize classroom subject matter concepts while working with students to improve their fitness level (Hall, 2007; Maeda & Murata, 2004; Nye, 2008; Pica, 2006a; Stork & Sanders, 2008; Tappe & Burgeson, 2004; Yaussi, 2005). Physical educators must provide students with physical activity that is interesting while incorporating skills and knowledge that students need to compete in our global society (Buchannan et al., 2002; Kalyn, 2005; McCullagh & Wilson, 2007). According to several researchers, integration across the curriculum is an important issue to educators who expect and demand students to perform at their highest level (Buchannan et al., 2002; Kalyn, 2005; McCullagh & Wilson, 2007; Yaussi, 2005). Researchers contended that core subject content, especially Biology, can be easily integrated into the HPE curriculum with science teachers across *disciplines* by

establishing connections with the content that is taught and transition that information effectively from one lesson to the other, emphasizing the importance of learning and its relevance to life (Kalyn, 2005; McCullagh & Wilson, 2007; Yaussi, 2005). Kalyn (2005) asserted that integrated HPE programs may even justify the need for quality HPE programs in the schools which may improve students' physical fitness and increase achievement. Therefore, a district requirement of integrating core subject content into the HPE curriculum may be the ideal way to promote student learning in the area of science; thus, raising Biology-1 state test scores.

Researchers of previous studies have suggested that cross-curricular integration increases student learning (Ballinger & Deeney, 2006; Clocksin, 2006; Coe et al., 2006; Gatzke & LeDrew, 2008; Hall, 2007; Hatch & Smith, 2004; Kalyn, 2005; Yaussi, 2005). Students benefit from overall cross-curricula integration because the mind and body works together which contributes significantly to increased student achievement (Hatch & Smith, 2004; Kalyn, 2005; Pica, 2006b; Siegel, 2006, 2007). In spite of the possible impact of physical activity on student achievement, many schools are faced with administrative decisions to decrease the time spent in HPE to allow more time for instruction in core subject area content (Locke & Graber, 2008; Nye, 2008; Durant et al., 2009). Sacrificing HPE for more time in the core classroom does not improve academic achievement; in fact, researchers have proved that by reducing the time spent in the classroom for academics and increasing time in HPE helped to raise mathematics scores

("Active Education," 2009; Castelli et al., 2007; Houston, 2007; Siegel, 2007a, 2007b).

Buchanan et al. (2002) asserted that students are often asked to link information they learn in school with the real-world experiences everyday such as calculating purchases, planting flowers, or measuring ingredients for recipes. Rose and Meyer (2002) asserted that brain research informs educators that learning involves relating thoughts and creating significant associations and interconnections between the information that is just learned and the information that is previously known. Students would need to have knowledge of math as well as other subjects in order to make these real-world connections (Hatch & Smith, 2004; Pica, 2006b). Students can use this knowledge outside the classroom if the curriculum is significant and made applicable. Teachers across disciplines should establish connections with the content that is taught and should transition effectively from one lesson to the other, emphasizing the importance of learning and its relevance to life (Buchannan et al., 2002; Kalyn, 2005; McCullagh & Wilson, 2007; Yaussi, 2005) which enhances student learning. The goal of education is to educate the whole child (Buchanan et al., 2002; Rothstein & Jacobsen, 2006). Quality PE programs can provide students with cognitive skills of critical-thinking, problem solving, and writing skills as well as promoting health, fitness, and motor skills (Rothstein & Jacobsen, 2006; Stork & Sanders, 2008; Smith & Lounsbery, 2009).

Buchanan et al. (2002) stated that “by using an integrated approach, physical educators can provide creative opportunities to accommodate diverse learning styles and to unify concepts from various disciplines” (p. 33). They successfully implemented a program called "Fit Newton's Great Adventure" which combined science, reading, writing, and PE in cooperative problem-solving tasks. The components of critical thinking, problem-solving, and cooperation were integrated with HPE. The content areas that were integrated were contingent upon the needs of the students, the main concern of the school, and the teacher’s point of references (Kalyn, 2005; McCarthy, 2007). This program positioned HPE and science as major concentration; using writing, cooperative learning, and problem-solving to promote achievement of these areas (Buchannan et al., 2002; Kalyn, 2005; McCarthy, 2007). Buchannan et al. concluded that the Fit Newton’s Great Adventure program successfully promoted understanding and enhanced student achievement. While reading and writing are ideal components to integrate in HPE, as well as all subjects, very few, if any, physical educators do this (Gammill, 2006). McCarthy (2007) and Bintz (2004) asserted that the curriculum must match the writing with HPE topics and the unit should include lessons on poetry, journal writing, fictional stories, and interview skills. Researchers from the recent studies that were reviewed have suggested that cross curricula integration and action-based learning were excellent means of transferring information from one classroom to another, allowing students to receive the same information in multiple ways in order to meet the needs of all learners and the

importance of assessment to track progress. The integrated HPE program in this study connects Biology-1 content to students' lives so that a better understanding can be gained through participation in action-based learning.

Impact of No Child Left Behind on Physical Education Programs

Increasing student learning is the goal of every educational institution and all educational systems are affected by the implementation of the No Child Left Behind (NCLB) (2002) legislation which mandates that all children should be educated to their highest abilities. Based on the philosophy that all children can learn (Chubbuck, 2010; Dessoye, 2007; Lalley & Gentile, 2009; Popkewitz, 2009), instructional practices as well as assessment practices must be profitable for all children. According to Houston (2007) and Shirvani (2009), the problems of the NCLB legislation are the pretentious belief that the education system needs to be repaired, the misunderstanding between testing and teaching to the test in education, the damage bestowed upon low-income children by ignoring the conditions and environments in which they live, being confused, disregarding results reported by the experts, and preventing the United States from competing globally.

Rothstein and Jacobsen (2006) asserted that NCLB holds students accountable for achieving proficient scores in reading and math, and eradicates time spent on other curricular goals. Houston (2007) stated that a heavier dose of a narrowed curriculum that sacrifices physical activity was justified by labeling it as a frivolous component. This

presents a problem which affects students who are spending most of the school day doing large amounts of reading and mathematics at the expense of other subjects, including PE (Houston, 2007; Rothstein & Jacobsen, 2006; Siegel, 2006, 2007b). According to researchers (Houston, 2007; Shirvani, 2009), heavy testing in education encouraged by the NCLB has led schools to teach what is tested rather than promote critical-thinking skills that students need for success in society. As schools work to meet the adequate yearly progress (AYP) mandates of the NCLB (Shirvani, 2009), time for PE in the daily curriculum has been reduced and, in some cases, eliminated. This increased focus on reading and mathematics is believed to strengthen any insufficiencies in student achievement scores (Houston, 2007).

Many school districts are so concerned about the NCLB requirements and possible monetary cut-backs for not meeting the terms that many of them are going back to the basics; concentrating only on the 20th century skills and ignoring the 21st century skills (Silva, 2009). Many of them are allotting less time for or eliminating HPE and other noncore subjects to allow more time learning core content (Durant et al., 2009; Locke & Graber, 2008; Nye, 2008; Zascavage & Winterman, 2009). Salpeter (2003) of the Partnership for 21st Century Skills (P21) stated that “standardized tests can measure only a few of the critical skills that we hope our students will learn" (para. 4). Schools worldwide are constantly researching ways to address the educational needs of students. Lemke et al. (2003) stated the following about the enGauge 21st Century Skills:

> The enGauge 21st Century Skills were developed through a process that included literature reviews, research on emerging characteristics of the Net-Generation, a review of current reports on workforce trends from business and industry, analysis of nationally recognized skill sets, input from educators, data from educator surveys, and reactions from constituent groups. Many of these important works…are cross-matched to the enGauge 21st Century Skills. (p. 4)

Lemke et al. (2003) also asserted that "as society changes, the skills needed to negotiate the complexities of life also change" (p. 2). What was considered literate in the early 1900s (simple reading, writing, and arithmetic) is now considered illiterate without developing a broader range of literacy skills (proficiency in science, technology, and culture) needed to succeed in the 21st century (Bell, 2010; Burkhardt et al., 2003; Lemke et al., 2002, 2003; Loertscher, Trilling, & Fadel, 2010; Salpeter, 2003; Silva, 2009). Lemke et al. (2002) suggested that educators reconstruct curricula to include digital age proficiencies in order to prepare students for the world after graduation and the enGauge 21st century skills are a good start.

The enGauge 21st century skills consist of four main categories. They are: (a) Digital-Age Literacy Skills, (b) Inventive Thinking, (c) Effective Communication, and (d) High Productivity (Lemke et al., 2003). Salpeter presented a report from the P21 that communicated the big picture of how educational systems can help develop students to be successful and productive members of society in the 21st century. Researchers of the

P21 have made recommendations that schools focus on the following six key elements of 21st century learning (Burkhardt et al., 2003; Lemke et al., 2002, 2003; Salpeter, 2003):

1. Core Subjects
2. Learning Skills
3. 21st century Tools
4. 21st Century Context
5. 21st Century Content
6. New Assessments that Measure 21st Century Skills

The NCLB program is tantamount with high-stakes testing and a mental picture of what student achievement really is. Zascavage and Winterman (2009) stated that both, the Individuals with Disabilities Education Improvement Act (IDEIA) (2004) and the NCLB Act (2001), mandate high quality standards for all students, yet neither law addresses implementation. Smith and Lounsbery (2009) noted that there are several national organizations and leaders in the profession that endorses quality PE and are aware of its potential to help students achieve national health goals. Quality PE is widely supported by the American Academy of Pediatrics (2000, 2006); American Heart Association (1996); American Medical Association (2007); and the United States Department of Health and Human Services (2000, 2004a, 2004b). However, Smith and Lounsbery (2009) felt that "due to the unfunded mandates of NCLB, most schools are under extraordinary pressure to demonstrate their effectiveness by meeting student

achievement criteria in core subjects" (p. 42). Even though physical inactivity is believed to be a growing health issue and public health organizations have endorsed their support, Smith and Lounsbery felt that schools have not responded positively; mainly because schools do not feel that health is their responsibility, and unless the federal government intercedes with a policy intervention, nothing is likely to change (Smith & Lounsbery, 2009).

Theoretical Framework

This study was based on the action-based learning theories. As a result of brain-research, action-based learning theories posit that physical movement promotes learning. The integrated HPE program is designed to teach the whole child. Students have many systems (intellectual, physical, emotional, social, and moral) that must work together so that students can perform at maximum levels (Blaydes-Madigan, 2009; Ratey, 2008). A successful integrated program helps students understand "how they learn, how to be healthy and physically fit, how to control their emotions, how to work well with others, and how to set goals for success in life" (Blaydes-Madigan & Hess, 2004, para. 1). This teaches the whole child and not just the mind.

Hall (2007) stated that "PE is a unique subject matter [to integrate core subjects into] in that it allows us to teach using verbal instruction, visual demonstrations and kinesthetic movement" (para. 4). "Information travels in the brain up and down, front to back, and side to side. Information travels left to right across the Corpus Callosum and

front to back across the Motor Cortex" (Blaydes-Madigan, 2009, para. 4). The three "basic human motor movements that correspond with how information travels are (a) walking, (b) jumping, and (c) rolling" (Blaydes-Madigan, 2009, para. 4; Ratey, 2008, p 47). If students are not ready to learn, it may be due to insufficient developmental issues. "Through movement and physical activity, many of these issues can be addressed and eradicated" (Blaydes-Madigan, 2009, para. 3). It is important to note whether these developmental issues are in place, especially when students began to learn differently.

When information enters the brain and is assigned to the nucleus of a neuron, "an electrical response is emitted which propels this signal down the axon and release chemicals called neurotransmitters. These neurotransmitters leap across a space called the synapse and lock into receptors on finger-like projections called dendrites" (Blaydes-Madigan, 2009, para. 4). These neurotransmitters continue on to make a neural pathway which promotes learning.

The integrated HPE program that was evaluated in this study incorporates physical activities that involve all the senses in order to improve whole brain learning, especially the parts of the brain that are not fully developed (Blaydes-Madigan & Hess, 2004). This integrated HPE program teaches to the whole child because "each child has interactive interdependent intellectual, physical, emotional, social, and moral systems" that must be developed so that each child reaches high levels of achievement (Blaydes-Madigan & Hess, 2004, para 1). Each child's abilities are evaluated and various learning

strategies are used to reach the different learners (Askell-Williams, Murray-Harvey, & Lawson, 2007; Orland-Barak & Yinon, 2007; Roekel, 2009). The action-based learning program, as well as other learning theories, in this study offer useful means of presenting knowledge in a variety of ways to increase student learning (Askell-Williams et al., 2007; Blaydes- Madigan & Hess, 2004; Orland-Barak & Yinon, 2007). An action-based, integrated HPE program is an ideal means of providing students with motor learning for increased cognition.

The cerebellum works with the body's vestibular system to control balance, provide coordination, and develop spatial awareness. Hypothetically, when ideas are turned into action, it helps students to read and write better and there are visual fields that students need in order to reinforce their eye tracking. They must plot a course through space and cross the brain and body midlines. The senses that are used to improve balance, coordination, spatial awareness, directionality, and visual literacy are developed when students roll, creep, crawl, spin, twirl, bounce, balance, walk, jump, juggle, and support his or her own weight in space (Blaydes-Madigan, 2009, para. 1). Movement in space crosses the brain and body's midlines which helps to assimilate and organize the hemispheres of the brain. Cross lateral activities provide more blood flow to the brain which helps students to be more alert and eager to learn. The integrated HPE program in this study provided these functions.

Brain researchers contend that the mental development of children is contingent on his or her early progress in motor development (Lengel & Kuczala, 2010; Ratey, 2008). The brain increases "its ability to process information by developing the body's systems of balance, coordination, vestibular, and motor movement" because the very things that make an individual move are the things that make that individual think (Blaydes- Madigan & Hess, 2004, para 5). As the brain and body work together to process motor sequences and patterns, the brain generates corridors for understanding reading and math (Blaydes- Madigan, 2009; Ratey, 2008). When students roll, walk, and jump while participating in the integrated HPE program; they replicate the same pattern that information travel through the brain. "If a child did not crawl or crawl enough, for example, the brain may have missed a step in developing or practicing processing information and struggles to learn" (Blaydes-Madigan & Hess, 2004, para. 6). Therefore, movement in the integrated HPE program will offer students the opportunity to give their brains the required practice to process Biology-1 information.

In this study, Biology-1 content was integrated into the HPE curriculum as a requirement of the school district in order to help students make science connections relevant to everyday living while participating in daily physical activities. For instance, ways for students to use this knowledge in everyday situations were created and students were required to review Biology-1 content while working out in HPE class. According to researchers, integrating physical movement during the school day has been shown to

enhance academic performance (Buchanan et al., 2002; Castelli et al., 2007; Ferris et al., 2007; Hall, 2007; Houston, 2007; Leppo & Davis, 2005; Maeda & Murata, 2004; Pica, 2006a, 2006b; Siegel, 2006, 2007a, 2007b; Smith & Lounsbery, 2009; Tomporowski et al., 2008; Yaussi, 2005). Tomporowski et al. (2008) asserted that the more muscles one activates while learning new information with core subject content, the greater and more concrete the learning. Kinetic movement activates the manufacture and flow of a chemical called BDNF (Ferris et al., 2007; Levinger et al., 2008; Manabe, 2002) which helps neurons correspond with one another (Manabe, 2002). When more BDNF passes through the brain, more neurons are fired. This allows the neurons to communicate information with each other; helping to increase students' understanding, comprehension, long-term memory, and recovery of more information at a faster pace (Ferris et al., 2007; Manabe, 2002). Researchers found that students who are physically active experience an increase in the flow of BDNF (Levinger et al., 2008); therefore, kinetic movement can help stimulate learning by increasing the flow of BDNF within the student's brain (Ferris et al., 2007; Pica, 2006b). Kinetic movement also increases blood flow and oxygen delivery to the brain and muscles, thus increasing mental functioning (Pica, 2006b; Tomporowski et al., 2008). Other researchers have found that kinetic movement can reduce stress and anxiety by deterring the production of a chemical called cortisol which causes individuals to be less capable of planning, judging, and problem solving, as well as completing other higher-order skills (Covelli, 2007; Nieuwenhuys et al., 2008).

Kinetic movement increases brain function and produces more neurons; thus, the ability to learn and make better grades increases (Nieuwenhuys et al., 2008; Pica, 2006b). Since higher grades may be related to kinetic movement, a structured PE program may be helpful, especially when the pressure for students to increase performance on high stakes tests continues to increase (Houston, 2007; Siegel, 2007b; Smith & Lounsbery, 2009).

Research Methodologies

Three types of research designs that were considered when planning this study: qualitative, quantitative, and mixed methods. Since this study did not use words, open-ended questions, or case studies to answer the research question, a qualitative research approach was inappropriate for this study. This study did not use a mixed method approach because all data that was collected was quantitative in nature, consisting of only scores from pre- and posttests. Therefore, a quantitative research approach was chosen for this study. This study used a causal-comparative design because the effect and the alleged cause have already transpired and had to be studied to determine if the integrated HPE program made the difference in scores. This design was selected because both groups (Group *A* and Group *B*) were selected without random assignment. The purpose of this study was to evaluate the effectiveness of an integrated HPE program on student achievement in Biology-1. The causal-comparative design represented the best methodology to evaluate this relationship because both groups had already taken a pretest

and posttest as standard operating procedure with Group *A* participating in the integrated HPE program (Creswell, 2003).

The research question played a vital role in determining which research methodology would be selected. This study assigned groups based on intact classroom groupings because the students had already been assigned to these class settings. This nonrandom group assignment made the causal-comparative methodology design the best choice for this study in order to answer the question, "Will an integrated HPE program improve students' scores in Biology-1?" This methodology and design allowed me to compare scores from the Biology-1practice tests and state test between the two groups to assess the effectiveness of the required integrated HPE program.

Conclusion

Since the implementation of NCLB Act in 2002, educators have continued to teach to state-mandated tests rather than focus on research-based strategies that would teach students concepts with deeper meaning. It is vital that educators understand how children learn (Gardner, 2006). Brain research theory maintains the connections between physical movement and increased academic achievement (Ratey, 2001). Physical activities that involve all the senses are essential in improving whole brain learning (Blaydes- Madigan & Hess, 2004). Based on the results from brain research, it is important that educators teach to the whole child because each child has many systems that must be developed so that each child can achieve high levels of academic

performance (Blaydes- Madigan & Hess, 2004, Ratey, 2001). A review of the literature of 21st century skills recommended that educators must come to the realization that the skills taught in the past are no longer sufficient for today's learner (Lemke et al., 2003; Silva, 2009). To effectively prepare students, educational leaders must provide instructions within the context of 21st century skills. Transforming these skills in digital age places of learning and providing the appropriate assessment of these skills using several different types of evaluations will eventually inform society if today's students will be prepared to live, learn, work, and serve successfully in a digital, global society (Burkhardt et al., 2003; Lemke et al., 2002, 2003; Salpeter, 2003).

The theoretical framework was justified in this section with recent brain research which stated that a child's early motor development sets the stage for their future mental development (Ratey, 2001). Action-based learning helps a child develops his or her body's systems (balance, coordination, vestibular, and motor movement) which allows their brain to process information efficiently (Blaydes- Madigan & Hess, 2004; Ratey, 2001). When students perform motor movements such as rolling, walking, and jumping; they replicate the same pattern that information travel through the brain. The brain uses these motor patterns as the means for learning. If the body's motor, balance, and vestibular systems are not developed properly, the brain will not be able to process information efficiently (Blaydes-Madigan & Hess, 2004).

The information presented in this section highlighted the effectiveness of the integrated HPE program to increase student achievement. An integrated HPE program gives students the opportunity to exercise their brains while learning new knowledge so that information can be processed more proficiently (Ratey, 2001). If this is so, it is crucial that a formal evaluation be done to determine if the integrated HPE program will increase student achievement in Biology-1.

Summary

As previously stated in this section, an integrated HPE program has been implemented with freshman students enrolled in an urban high school in central Mississippi for the past 3 years as a requirement set by the school district in which core subject content is integrated into the HPE curriculum. This integrated HPE program has never been formally evaluated to determine its effectiveness on student achievement. This study concentrated on the area of Biology-1 because students' ninth grade year is when the students take the Biology-1 state test. The results of this study may impact educational decisions of reducing HPE in order to enhance students' performance on state tests to a serious consideration of an integrated HPE curriculum. This study answers the question: "Will an integrated HPE program improve students' scores in Biology-1?"

This literature review reported that action-based learning (which makes up the integrated HPE program that is used to evaluate its effectiveness) can enhance student learning. This study will inform administrators and constituents of ways to provide

students with needed physical activity, while at the same time, promoting learning in Biology-1. The integrated HPE program used in this study is described in detail in Section 3.

Section 4 reports research findings relative to the research question and hypothesis. Additionally, a description of data collection and the statistical procedures used to make decisions about the hypothesis is presented. This study evaluated the effectiveness of an integrated HPE program on the academic achievement and a report of the findings is presented, interpreted, and explained thoroughly which will be relative to the underlying theoretical framework of this study. Section 5 presents an overview of the study, as well as conclusions, interpretations, study recommendations, and implications for social change.

Section 3: Research Method

This section explains the research method that was used to evaluate the effectiveness of the integrated HPE curriculum on the academic achievement of ninth grade Biology-1students at an urban high school in central Mississippi. In this study, I sought to answer the following research question: Will an integrated HPE program improve students' scores in Biology-1?

Although the school in this study has not eliminated PE from the school curriculum, it is a common practice for students to be pulled out of the HPE classes to receive tutorial services in order to increase scores on state testing. The data collected in this study helped to determine whether or not an integrated HPE program would improve students' scores in Biology-1. Additionally, this study will add to the body of knowledge in the field as to whether physical movement is related to student achievement or not.

Section 3 begins with a description of the research design and approach that was used in this study and a justification for using the design and approach selected. Then, a description of the research setting and sample is presented, which includes information about the population, sampling method, sample size, eligibility of participants, and the characteristics of the selected sample. A detailed description of the integrated HPE program is included. Next, the instrumentation and materials used to collect data are discussed. The data collection process and data analysis are explained. This section

concludes with the ethical treatment of the study participants and the role of the researcher in the data collection.

Research Design and Approach

The quantitative research approach for this study was an ex post facto nonexperimental study of nonequivalent groups. This design was selected because archival data was used and the treatment had already taken place. The purpose of this study was to examine whether or not an integrated HPE program would increase students' scores in Biology-1. The nonequivalent control group design represented the best methodology to evaluate this relationship because both groups had taken the same pre- and posttests but only one group participated in the integrated HPE program (Creswell, 2003). For this study, a pretest and posttest had already been given to both groups in Biology-1. Group *A* participated in the integrated HPE program. The notation of this design is:

Group *A* O —— X —— O

Group *B* O ———————— O

The study is considered nonexperimental because archival data was used and the treatment had already taken place. The causal-comparative nonequivalent control group design was best suited to this study because archival data were used and the groups were

intact groups, such as classrooms, that were readily available to the researcher (Creswell, 2003).

This quantitative, causal-comparative design addressed the following research question: Will an integrated HPE program improve students' scores in Biology-1? The null hypothesis states that in the population of students, an integrated HPE curriculum will not improve students' scores in Biology-1. The alternative hypothesis states that in the population of students, an integrated HPE curriculum will improve students' scores in Biology-1.

The inferential statistical analysis that was used to examine the hypotheses in this study was an analysis of covariance (ANCOVA) because this study compared the difference between the scores of the two groups (Creswell, 2003). The dependent variables were the posttest scores; the pretest scores were the covariate. The independent variable was the integrated HPE program. The integrated HPE program took place in the regular HPE classroom settings (gymnasium, playing field, health classroom, and track field) with students who were enrolled in both a Biology-1 class and an HPE class.

Setting and Sample

Setting

The school in this study has an enrollment of 488 students in the ninth grade. Of these 488 students, 204 are enrolled in Biology-1, and 79 are enrolled in both a Biology-1 class and a girls' HPE class. Students not taking HPE either took band, Junior Reserve

Officers' Training Corps (JROTC), or advanced athletics. It is important to note for this study that over the past 3 years, Biology-1 content has been integrated into a structured HPE program to provide cross-curricular instructions in Biology-1 to enhance academic achievement in this science area. The sample for this study consisted of 204 student scores, with 79 scores in Group *A* and 125 scores in Group *B*. These numbers were based on the total number of students who were enrolled in Biology-1 and HPE as well as the students who were enrolled in Biology-1 class but not enrolled in HPE at an urban high school in central Mississippi.

Sample

The sample was selected using a convenience sample with nonrandom assignment since the test scores of all students enrolled in a Biology-1 class represent the sample for the study, 204 scores. The study will not involve stratification of the population since the convenience sampling was a "nonprobability sample" (Creswell, 2003, p.156). Group *A* included all female ninth grade students who were enrolled in girls' HPE and Biology-1 and participated in the integrated HPE program. Group *B* included both male and female ninth grade students who were enrolled in Biology-1 but were not enrolled in HPE classes and who did not participate in the integrated HPE program. The participants in both groups took the same pretest and posttests in Biology-1 and scores were used to collect data on each group. The sample size was determined using the sample size calculator at Creative Research Systems (2010) for an 8.58 confidence interval, a 95%

confidence level, and a population of all 9th grade students in Mississippi, approximately 40,134 students (MDOE, 2009).

Integrated Health and Physical Education Program

Students in the Group *A* participated in an action-based learning (ABL) program as part of the integrated HPE program. Four ABL activities were incorporated into the HPE classes with the intent to train the brain to receive and process information more efficiently. The integrated program took place in a classroom setting (gymnasium, playing field, health classroom, and track field) in order to provide structured movement with the integrated Biology-1 content to be learned. With input and collaboration from the science teachers, the integrated program was designed to meet the specific needs of Biology-1 students.

Action-Based Learning

Action Based Learning (ABL) is a program created by Blaydes-Madigan and Hess (2009), who introduced it in December 2005 at the Pennsylvania Association of Health and Physical Education, Recreation, and Dance (AHPERD). The ABL Lab consists of a sequence of progressions and stations devised to train the brain to process information. "Students engaged in ABL improve memory retention, reinforce academic concepts, balance brain chemicals while experiencing whole-brain, whole-body learning" (Blaydes-Madigan & Hess, para. 2). The components of the ABL program are supported by the results of brain research that maintains that there is a relationship between physical

movement and increased academic performance. The ABL program was first implemented at Westbrook Elementary School in Pennsylvania (See Appendix B for the components of Westbrook's Action-Based Learning Lab.).

The four ABL activities that were used in the integrated program are as follows:

1. Visual-Motor Control (Aid the brain in focusing on reading for longer periods, discriminating sounds, and organizing information).
2. Visual Tracking (Aid the brain in processing thought, organizing thoughts in sequence, discriminating likeness and differences, discriminating sounds, and advancing to higher-level thinking).
3. High Level Thinking (Aid the brain in anchoring information and improved memory retrieval, preparing the brain to take a test, combining many skills for higher-level thinking).
4. Jump Rope (Used to prepare the brain for optimal learning). (Blaydes-Madigan, 2009, para. 2)

The ABL activities activate more BDNF which causes neurons to fire more efficiently, decrease anxiety, and raise one's sense of worth. It is important to note that the research published by Blaydes-Madigan on ABL is not peer reviewed. The ABL program is geared toward children that are 4-7 years old, but can enhance student performance of all students of all ages and abilities with modifications in the program. As students began to show proficiency in their performance of the current activity, more

rigorous activities were presented so that students could progress. The length of each activity was contingent upon students' specific needs and ability; therefore, all students can take part in the program with success (Blaydes-Madigan & Hess, 2009).

Implemented Integrated HPE Program

When the district required that all elective teachers integrate core subject content into their curriculum, I initially collaborated with the core subject teachers to identify the content that needed to be integrated into the HPE curriculum that would help improve student achievement. I developed the integrated program by creating various activities that would utilize the ABL concepts while teaching the core subject concepts needed to increase academic achievement. Following are the actual activities that were implemented in the integrated HPE program using ABL concepts to teach Biology-1 content under the four chosen ABL activities:

Visual-motor control. Exercises have been shown to enhance academic performance. Due to the neuronal connection between the cerebellum and the prefrontal cortex, cognitive performance is increased after short bouts of exercise. Motor development provides the framework that the brain uses to sequence the patterns needed for academic concepts. The following activities were used to develop visual-motor control:

1. Tag Facts in Fifteen was an activity used to help the brain focus on reading for long periods and organizing information.

2. Body Biology engaged students in whole brain learning by using various locomotor movements to act out a biological function such as genetic traits.

Visual tracking. Students who have trouble reading may suffer from lack of eye fitness. Eyes lock into constant distant vision and the muscles that control eye movement atrophy when students watch TV and computer screens. The HPE curriculum can provide ways to strengthen eye muscles. Tracking exercises, manipulative activities, navigation activities, and target games are exercises that help the eye muscles and aids in reading. Activities used for visual tracking are as follows:

1. Basketball-Biology Taboo was used to help the brain process thoughts, to put ideas in order, to distinguish between similarities and differences, and to progress to higher-order thinking.
2. Soccer Password was also used to aid the brain in processing thought, to strengthen eye tracking, and to advance to higher-level thinking.

High level thinking. To learn facts and be able to recall what you have learned is the simplest form of thinking skill. Education today requires students to be able to demonstrate higher order thinking skills which include critical thinking, problem solving, and critical analysis. The activities that were used to help students employ higher order thinking skills are as following:

1. Puzzle Mania was used to reinforce academic content.

2. Biology Scavenger Hunt was also used to reinforce academic content as well as to anchor information and to improve memory retrieval.
3. Frisbee Golf was used to prepare the brain to take tests by combining skills for higher-level thinking.

Jump rope. Jumping rope is an ideal exercise for cardiovascular fitness, muscular endurance, and coordination. Crossing the midline integrates the hemispheres of the brain causing the brain to organize itself. When students perform cross lateral activities, blood flow is increased in all parts of the brain making it more alert and energized for learning. Researchers are learning that jumping rope helps the brain to process information in the following ways:

1. Musical Jump Rope was used to prepare the brain for optimal learning by crossing the body's midlines.
2. Hoop Jumping was used to create spatial awareness and mental alertness.

Equipment for the Action-Based Learning Program

The equipment that was used for this study was the normal gymnasium equipment such as jump ropes, basketball goals, basketballs, gymnastic mats, balance boards, juggling scarves, paddles and bats, ribbon streamers, bean bags, hula hoops, assortment of balls, Frisbees, chin-up bars, and cones to mark targets. Other equipment that was not related to PE was used to enhance the learning experience of the participants such as CD player, teacher-made CDs, poster boards, cork boards, white board with erasable marker

and erasers, and teacher-made taboo cards. A reference area was provided to students in some activities. The reference area consisted of biology textbooks, students' notes, and other science textbooks. An array of items was available for participants to use to build puzzles and models of biological content such as cotton balls, straws, cut out letters, index cards, scotch tape, paper clips, scissors, stapler and staples, paper, Styrofoam balls and squares, rubber bands, etc.

Methodology

Instrumentation and Materials

A letter of cooperation was provided to me by the school's principal as approval to conduct this study. All test scores that were used in this study came from the results of the Biology-1 practice test that was administered in October, 2010; the Biology-1 practice test that was administered in April, 2011; and the actual Biology-1 state test (MSATP) that was administered in May, 2011.

Biology-1 Practice Tests

The practice tests used in this study were components of the MSATP and were administered by classroom teachers. The Office of Assessment of the school district in this study distributed all national, state, and district assessments which included several practice tests. The practice Biology-1 Subject Area Test (SAT) was administered by the Biology-1 teachers throughout the school year. These practice tests were developed by Harcourt Assessment, Inc. and are based on the *2010 Mississippi Science Framework*

(MDOE, 2008b). The tests assess the student's understanding of fundamental biological theories, the application of biological skills, and the relevance of biology to everyday life (MDOE, 2009). On the test, students construed facts and figures, put theories to use, and drew conclusions. There were 70 multiple choice items on the test which may included charts, diagrams, or graphs. Questions from six competencies were distributed throughout the test.

The competencies were as follows with a description of each:

1. Inquiry – Apply inquiry-based and problem solving processing and skills to scientific investigations.
2. Biochemical Basis of Life – Describe the biochemical basis of life and explain how energy flows within and between the living systems.
3. Living Organisms and Their Environment – Investigate and evaluate the interaction between living organisms and their environment.
4. Biological Organization – Analyze and explain the structures and function of the levels of biological organization.
5. Heredity – Demonstrate an understanding of the molecule basis of heredity.
6. Diversity and Biological Change - Demonstrate an understanding of principles that explain the diversity of life and biological evolution. (MDOE, 2009)

Every item on a Biology-1 practice test has been through two different Mississippi Biology-1 teacher committee reviews. Each item has been reviewed by a

committee for content and appropriateness before it was used as a field-test item. After field testing, data for each item were reviewed by a teacher committee. The committee could choose to "Accept or Reject" an item or to ask that an item be revised and re-field tested. Each test item is worth one point; therefore, there is no point difference based upon an item functioning as Basic, Proficient, or Advanced. The student's performance level was based solely upon the number of items answered correctly. There is a standard setting meeting conducted each year. At these meetings, a committee of Mississippi Biology-1 teachers will establish the pass or fail cut score and cut scores for Basic, Proficient, and Advanced performance levels. The committee makes decisions about these cut scores based upon the number of items students answer correctly. Only after a standard setting can a raw score-scale score table be created to "translate" each student's score from the number of items answered correctly to a scale score. The practice test items have been approved and field tested by Biology-1 teacher committees.

These tests were electronically scored by the Office of Assessment of the school district in this study. Scores from these tests were sent to the school and placed in the student's cumulative folder and are used to inform teachers, students, and parents of the progress students are making in Biology-1. It is hoped that the students understand their educational plans for the future as well as the progress they are making academically so that students may make wise choices and decisions. Students must pass the Biology-1 MSATP in order to graduate.

The primary purposes of the MSATP are to provide information needed for state-level decisions about the effectiveness of instructional program in local school districts and to provide districts with information to be used in improving instruction (MDOE, 2009; Vogler, 2008). It also promotes instructional improvement in classrooms because test results help to recognize strengths and weaknesses of each student and each lesson and offer means for instructional leaders to make necessary adjustments to ensure academic success (Johnstone, 2003; Snooks, 2004; Vogler, 2008).

Reliability and Validity of the Biology Practice Tests

The American Educational Research Association (AERA), American Psychological Association (APA), and National Council on Measurement in Education (NCME, 1985) defined validity as "the appropriateness, meaningfulness, and usefulness of the specific inferences made from test scores" and test validation was described as "the process of accumulating evidence to support such inferences" (p. 9). In the *Standards for Educational and Psychological Testing*, the authors also stated that:

> Validation of credentialing tests depends mainly on content-related evidence, often in the form of judgments that the test adequately represents the content domain of the occupation or specialty being considered. Such evidence may be supplemented with other forms of evidence external to the test. Criterion-related evidence is of limited applicability in licensure settings because criterion

> measures are generally not available for those who are not granted a license. (p. 157)

It is vital to ascertain validity and reliability of any existing instrument that is used in a study (Creswell, 2003). In 2003, under the State Board of Education Policy IHL-1, the MSATP became a requirement for high school graduation (MDOE, 2009). The Biology-1 practice tests are based on the *2010 Mississippi Science Framework* (MDOE, 2008b) and are end-of-course, *criterion-referenced tests*. They were designed to assess how well instructors in Mississippi were teaching the Framework (Marchette, 2003). Vogler (2008) stated that instructional practices in Mississippi were greatly influenced by high stakes testing. Bay-Borelli, Rozunick, Way, and Weisman (2010) had this to say about assessments based on curriculum standards:

> Curriculum standards alone, however, are not sufficient to define a sound and reliable large-scale assessment program; well-defined test specifications are also necessary. State policy makers must have a reasonable degree of assurance that the assessments developed measure student learning relative to the curriculum standards. (para. 3)

Therefore, ascertaining validity means gathering data that rationalize the actions taken as a result of test scores. This proof is necessary in order to support the purpose of the test and this may be different with each test.

Validity is a chief concern in assessment since it ensures that an instrument actually measures what it claims to measure (Crisp, Sweiry, Ahmed, & Pollitt, 2008). According to Liu, Hee-Sun, Hofstetter, and Linn (2008), assessments should guarantee construct validity by making sure that all items are align with the knowledge integration construct and should measure several levels of competences explained by the construct. The Biology-1 SAT practice test addresses six levels of competences. To ensure content validity, assessments should be developed to measure the usual knowledge in the content area and appraised by content experts to guarantee satisfactory representation of scientific phenomena (Liu, Hee-Sun, Hofstetter, & Linn, 2008). Students should have sufficient opportunities to demonstrate their knowledge integration inquiry thinking on the assessment. The Biology-1 SAT practice tests include specifications that measure students' learning based on the *2010 Mississippi Science Framework* (MDOE, 2008b) and also provide for assessment of critical thinking skills as well as content knowledge (see Appendix C for test specifications). The NCLB Act of 2001 mandates that all testing materials purchased with federal funding have evidence of validity and reliability. The practice Biology-1 SAT is subsidized with state funds and satisfies the requirement set by the NCLB Act of 2001 (MDOE, 2009).

Mississippi Subject Area Testing Program (MSATP) Test

The Biology-1 MSATP "has been produced under a contract with the MDOE" and the MDOE or "any other entities, public or private," do not hold copyright on the

MSATP (MDOE, 2010, p. 2). Due to the strict security issues for the MSATP, the test may not be reproduced in any form without the written permission from the MDOE. The actual Biology-1 state test is not available for viewing; however, copies of the practice tests are available at: www.mde.k12.ms.us/acad/osa/biology_i_test_1.pdf (for test 1) and www.mde.k12.ms.us/acad/osa/Biology_I_Test_2.pdf (for Test 2). The MSATP was designed and copyrighted by Pearson and "*PEARSON* is a registered trademark registered in the United States of America and-or other jurisdictions" (MDOE, 2010, p. 2).

Students enrolled in Biology-1 for the first time in 2010–2011, and thereafter, must take the tests and retests based on the new framework curriculum (*2010 Mississippi Science Framework*). These students are tested and retested during paper and pencil administrations only. Students enrolled in Biology-1 for the first time prior to 2010, must take retests based upon the old framework curriculum (*Mississippi Science Curriculum Framework 2001*). These students are retested during the online administrations only. The date for the Biology-1 MSATP is set for Tuesday, May 3, 2011.

The administration of the 2010–2011 Biology-1 MSATP is an important professional responsibility. The accuracy of the test results for each student is important to ensure the validity of the test results. Experience shows that students' performance on the test is highly contingent upon their enthusiasm and feelings toward the tests, the level of teachers' preparedness in administering the tests, the physical arrangement of the rooms, and the loyalty to following test instructions (MDOE, 2010). Individuals

responsible for administering the Biology-1 MSATP test must follow standard testing procedures to ensure accurate and reliable results. The test administrators are responsible for reading through the test directions prior to beginning the test administration. It is important to note that Biology-1 teachers do not administer the Biology-1 MSATP test. All test administrators must attend staff development training in his or her district to comply with test administration procedures.

The Biology-1MSATP test contains 69 multiple-choice items plus one 4-point open-ended item. Sometimes there will be a diagram, chart, or graph that students will have to observe carefully to answer the questions. The lighting and ventilation in the testing room should be adequate and students should be seated with enough space between them to maintain confidentiality of responses. Students will be allowed as much time as needed to complete the test as long as they are on task. The students that finish early may check over their test and make changes, if necessary. Districts have the choices of requiring all students to remain in the testing room until everyone is finished, dismissing students as a group, or releasing students as they finish the test. Students who are not finished with the test may be moved to another testing area or they may finish the test in their original location. All students are encouraged to do their best in answering each question. A "Do Not Disturb…Testing in Progress" sign is placed on the door to avoid interruptions during the test. "There must be at least one Test Administrator in each testing area and a minimum of one Proctor for every 33 students" (MDOE, 2010, p.

12). Students in Mississippi take the Biology-1 MSATP test for the first time after they complete the course at the ninth grade level. Some students may take the course later than the ninth grade because of scheduling conditions. Students who do not pass the test at the first administration will have opportunities to take the test again. Students must pass the Biology-1 MSATP test in order to graduate. All scratch paper and formula charts must be returned to the District Test Coordinator, who in turn, sends to Pearson in a non-scorable box for disposal. The MDOE (2010) requires that "the District Test Coordinator (or his or her designee) destroy all copies of the Test Administrator's Manual in July 2011" (p. 35).

Reliability and Validity of the MSATP Test

"Reliability is the consistency of the results obtained from a measurement" (MDOE, 2008a, p. 84). The most important thing about reliability is that the outcomes obtained from a measurement and the degree to which the outcomes remain constant over time or among items or subtests that constitute the test. In order to make appropriate score interpretations, it is critical to be able to measure consistently. Crisp, Sweiry, Ahmed, and Pollitt (2008) stated that "validity is, of course, a key issue in assessment and is about ensuring that an assessment really measures what it purports to" (p. 97). The information on the reliability and validity of the MSATP is "several hundred pages long and is archived in the Office of Research and Statistics and the Office of Student Assessment at the Mississippi Department of Education in Jackson, Mississippi;"

therefore, the information listed in this section is abbreviated to include the most important aspects of the MSATP (MDOE, 2007, p. 1).

MDOE (2007) stated that "curriculum frameworks are developed and revised on a periodic basis by the office of curriculum and instruction. The curriculum frameworks on which the MSATP are based were last revised in 1999-2000" (p. 2). The Ad-Hoc Committee was formed in the fall of 1998 and is made up of five State Board of Education (SBE) members plus the new State Superintendent (MDOE, 2007). The purpose of the Ad Hoc Committee was to review the recommendations of the High School Exit Exam committees and make decisions about the state's new assessment and accreditation systems (MDOE, 2007). "Harcourt Educational Measurement (HEM) was selected as the test vendor and negotiated a contract in 1999" (MDOE, 2007, p 2).

The MSATP Teacher Committees were made up of the most exemplary teacher(s) in each subject and were nominated by each district superintendents in Mississippi. A list of "specific skills and objectives was compiled into a survey including questions of whether each curriculum skill or objective was currently taught in their classrooms and the degree of emphasis they believed the new test should place on it" (MDOE, 2007, p. 2). Next, "the committees formed consensus ratings of the items on each survey. The committees then compared and discussed ratings and developed a test blueprint consistent with these ratings" (MDOE, 2007, p. 2). All Mississippi teachers in each tested area were given the same survey of that the test development committees used to

create consensus ratings. The MDOE (2007) reported that "the compiled results showed an excellent match with the committee consensus ratings" (p. 3). Technical issues, such as test design, scoring and equating, and standard setting, were handled by members (a total of six) of the Technical Advisory Committee (MDOE, 2007). In 1999, HEM began developing test items. The test development committees appraised all probable test items and the blueprint matched for suitability, emphasis, and bias.

The test items included multiple choice and open ended questions which were tried out in 2000. Item statistics and potential bias were reviewed by separate committees following the item tryout. "These committees examined the newly developed and field-tested items and eliminated or modified any items that were judged to provide unfair advantage or disadvantage based on gender, ethnic, socioeconomic, special education, geographic location, religion and other categories" (MDOE, 2007, p. 3). In the summer of 2001, a second group of teacher advisory committees was created to set the pass-fail cut scores on the test used for high school graduation. Proficiency standards were established for the Biology-1 test in 2004.

Content Validity

Liu, Hee-Sun, Hofstetter, and Linn (2008) stated the following about content validity:

> To ensure content validity, assessments are developed to measure the typical knowledge in the content domain and reviewed by content experts to guarantee

> adequate representation of scientific phenomena. In addition, the items are carefully examined by educational researchers to ensure that adequate opportunities are provided for students to demonstrate their knowledge integration inquiry thinking. (p. 44)

All MSATP items on the Biology-1 test were clearly developed to measure the precise knowledge and skills expressed in the *2001 Mississippi Science Framework* (MDOE, 2001). The item writers and the item reviewers throughout the item development stage confirmed the alignment of test items with the objectives and measurement specifications outlined the curriculum frameworks to ensure that the items are measuring appropriate content. This continuous process of reviewing the items and content presented on the MSATP assessments offers evidence of the content validity of the Mississippi subject area tests.

Construct Validity

Construct validity refers to what test scores mean and what kinds of inferences they support (MDOE, 2008a). Crisp, Sweiry, Ahmed, and Pollitt (2008) defined construct validity as "how well the assessment measures the appropriate underlying constructs" (p. 1). The construct validity is the main idea behind the MSATP test validation procedure. Verification for construct validity is inclusive and incorporates support from both content- and criterion-related validity (MDOE, 2008a). Construct-

related validity evidence (internal consistency validity evidence) can come from the following possible sources (AERA, APA, & NCME, 1999):

1. High inter-correlations among assessment items or tasks attest that the items are measuring the same trait, such as a content objective, sub-domain, or construct;
2. substantial relationships between the assessment results and other measures of the same defined construct;
3. little or no relationship between the assessment results and other measures which are clearly not of the same defined construct;
4. substantial relationships between different methods of measurement regarding the same defined construct; and
5. relationships to non-assessment measures of the same defined construct. (p. 64-65)

The compilation of construct-related proof is a constant process. Five measures of construct validity for the MSATP test are (a) alignment of MSATP with test specifications, (b) item-total point biserial correlations, (c) inter-correlation among competencies, (d) unidimensionality, and (e) Differential Item Functioning (DIF) analysis (MDOE, 2008a).

Predictive Validity

The MSATP has predictive validity. "Predictive validity can be assessed by analyzing how a test's scores or interpretations can be used to predict the performance on a future task similar in construct to the test" (MDOE, 2008a, p. 82). This can be done by completing a different, validated instrument that evaluates the same construct as the test or by completing a school course that is based on the same construct as the test.

Data Collection and Analysis

Data Collection

After receiving approval from the school's principal to conduct this study, the Office of Assessment for the school in this study explained to me that I would need to secure scores from the chairperson of the science department and have the chairperson to sign the Data Use Agreement form. Copies of test scores from the Biology-1 practice tests and the MSATP were submitted to me, free of identifying information from two different groups of students: (a) Biology-1 students who did not take girls' HPE and (b) Biology-1 students who took girls' HPE. The chairperson of the science department assured me that test scores of both groups with students' names removed and replaced with random numbers will be provided upon request. After receiving approval from Walden University's Institutional Review Board (Approval #: 08-25-11-0075486), test scores from the pre- and posttests were collected from both groups of Biology-1 students.

Pretest scores were compared to posttest scores to answer the research question: "Will an integrated HPE program improve students' scores in Biology-1?"

A number was assigned to all students' test scores to protect their identity and students' scores (scores from Group *A* and scores from Group *B*) were separated before they were submitted to me. The scores from the pre- and posttests were recorded and posttest scores were matched with pretests scores and entered into Statistical Package for the Social Sciences (SPSS) by the Colorado Stat, LLC for analysis. The SPSS is a computer software program that was used to run statistical analysis. The data entries were checked at least three times to ensure accuracy. Once data were entered in SPSS, the non-identified data were stored in a locked filing cabinet and on a flash drive stored in a locked filing cabinet for no less than 7 years and not more than 10 years.

Analysis

An ANCOVA was the inferential statistical analysis used to examine whether the integrated PE program increased student achievement in Biology-1. The ANCOVA was used to adjust or control for differences between the groups based on another variable called the covariate (Creswell, 2003). The ANCOVA is an extension of the analysis of variance (ANOVA) that usually provides a way of statistically controlling for the effects of variables that one does not want to examine in a study (Creswell, 2003). The dependent variables were the posttest scores and the pretest scores represented the covariate. The independent variable was the integrated HPE program. The total scores

were tallied for members of both groups on the pretests and posttests in Biology-1, and then entered into SPSS for analysis.

Ethical Considerations

It has been determined that any risks associated with participating in this study were minimal since only ex post facto data was being used and the integrated HPE program was one that had already taken place. The benefits that are linked to this integrated HPE program are: (a) students may be more alert and focused, (b) students may recognize, comprehend, remember, and recover more information and at a faster pace, and (c) students may receive fitness benefits from the integrated program. The students in the integrated HPE program are students of the researcher.

To protect the identity of students, numbers were used to match pretest and posttest scores. Any and all information about students that was used to match scores in this study was shredded immediately after scores were matched and checked for accuracy. No identifiers were used to report the findings of this study. The raw data are accessible to the administrators, Biology-1 teachers, and the researcher. The Office of Assessment of the school in this study distributed all national, state, and district assessments which includd several practice tests. These practice tests were designed to help prepare students for taking the Mississippi Subject Area Tests at the end of the school year. The Mississippi Department of Education (MDOE, 2009) provided these practice tests to inform instructors as well as students of the abilities and goals that

students were not executing well and to assess performance of students and teachers. The science department administers practice tests in Biology-1 each school year as a normal operating procedure for the ninth grade biology department to prepare students to take the Biology-1 state test. The results of the practice tests allow teachers, students, and administrators to point out strengths and weaknesses in the instructional program and to modify instructions that would increase student achievement before the actual state test, which is called the Mississippi Subject Area Testing Program (MSATP), is administered in May. For this study, the practice test administered in October serves as the pretest and the practice test administered in April as well as the MSATP test administered in May serve as posttests. All practice tests were scored by the Office of Assessment of the school district in this study. An independent statistics and research methodology consultant (Colorado Stat, LLC) was hired to help with the dataset and prepare it for analysis; therefore, pre- and posttests scores were entered into SPSS by the Colorado Stat, LLC.

The non-identified data that was collected will be stored in a locked filing cabinet and on a flash drive stored in a locked filing cabinet. This data will be kept for no less than 7 years and not more than 10 years. This information will be available upon request from me (the researcher).

Role of the Researcher

I am a certified HPE teacher in an urban school district where I have achieved 23 years of experience teaching ninth grade female students. Three years ago, the school district required all non-core subject teachers to integrate core subject content into their curriculum to enhance student learning and increase scores on state tests. At that time, the school district provided several opportunities for teachers to attend workshops and trainings that demonstrated an eclectic blend of research-based instructional strategies that employ action-based learning and 21st century skills needed to prepare students to compete in our global society. Students take the Biology-1 state test in the ninth grade so I designed an integrated HPE program as my way of integrating across the curriculum as required by the district to enhance academic achievement and increase state test scores in Biology-1 of the students whom I teach. I have access to students' cumulative folders that include students' records and test results from the Office of Assessment. I will follow all the rules and regulations set forth by the Walden University Institutional Review Board (IRB) and the school district. A written description of the study was presented to the school's principal and a meeting was scheduled with the principal to obtain approval to conduct the study. During this meeting, the principal signed a letter of cooperation to conduct this study. Then, I met with the Office of Assessment for the school in this study and presented the signed letter of cooperation from the school's principal to conduct my study and explained that I would need copies of test scores from

the Biology-1 practice tests that was administered in October, 2010 and April, 2011 as well as the Biology-1 state test that was administered in May, 2011; free of identifying information, of two different groups of students: (a) Biology-1 students who did not take girls' HPE and (b) Biology-1 students who took girls' HPE. The office of Assessment informed me that test scores will be submitted to the school's principal and the chairperson of the Science department. I was instructed to obtain data from the chairperson of the science department. I met with the chairperson of the science department and was assured that test scores of both groups with students' names represented as numbers will be provided to me upon request. During this meeting, the Data Use Agreement was signed by the chairperson of the science department. After IRB approval, a formal request for copies of the Biology-1 practice tests scores and the Biology-1 MSATP test scores with identifiers removed were made with the chairperson of the science department.

Parental consent and student assent were not necessary for this study because the integrated HPE program had been a standard of procedure for the past 3 years and the scores from the Biology-1 practice tests and the Biology-1 MSATP test were ex post facto archival test data that were readily available to teachers, parents, students, and administrators. The chairperson of the science department separated students' scores (scores from Group *A* and scores from Group *B*) and assigned a code before the scores were submitted to me. The scores from the pre- and posttests were recorded with

identification codes. All scores from the posttests were matched with pretest scores. An independent statistics and research methodology consultant was hired to run the analysis in SPSS. Data entries were checked at least three times to ensure accuracy. Since consent and assent forms were not needed, a request for a signed Data Use Agreement was made to the chairperson of the science department to justify the absence of students' consent and assent forms.

Summary

This study formally evaluated the effectiveness of an integrated HPE program on the academic achievement of ninth grade students in Biology-1 at an urban high school in central Mississippi. The test scores from two groups of ninth grade Biology-1 students from an urban high school in central Mississippi were used in this study. One set of scores came from Biology-1 students (Group *A*) who were enrolled in a HPE class while the other set of scores came from Biology-1 students (Group *B*) who were not enrolled in a girls' HPE class. The test scores from Group *A* were from students who participated in the integrated HPE program that consisted of researcher-directed, action-based learning strategies in which Biology-1 content were incorporated in the regular girls' HPE class as well as regular instruction from their Biology-1 teacher. The test scores from Group *B* were from students who received only regular instruction from their Biology-1 teacher. The October's Biology-1 practice test was used as the pretest for both groups. The

April's Biology-1 practice test and the May's MSATP were used as the posttests for both groups.

An ANCOVA was performed to determine the effectiveness of the integrated HPE program on the posttest scores (dependent variables), with pretest scores as the covariate. The students were selected using a convenience sample with nonrandom assignment since all students enrolled in a Biology-1 class represented the sample for the study.

The integrated HPE program in this study can be duplicated throughout the district (as well as other schools) to provide structure and continuity in the HPE curriculum, and may replace the practice of pulling students out of HPE classes to receive tutorial services designed to increase scores on state testing. In an effort to keep HPE an important part of students' curriculum as well as meet the AYP mandates of NCLB (2002), time for HPE in the daily curriculum may be increased and possibly required (Hall, 2007). Recent research have shown that the brain requires time to fuse new knowledge so that learning can go from short term to working memory to long term memory (Blaydes-Madigan, 2005; Ratey, 2008; Sousa, 2007). that the brain requires time to fuse new knowledge so that learning can go from short term to working memory to long term memory (Blaydes-Madigan, 2005; Ratey, 2008; Sousa, 2007). Movement may help anchor new information by bringing the body and the brain into balance producing an environment that is conducive for student learning (Blaydes-Madigan, 2010; Ratey, 2008). Physical

activities may help students to balance their bodies physically, chemically, electrically, and emotionally (Blaydes-Madigan, 2010). The results of this integrated HPE program and the analyses are presented in Section 4. An overview of the study, as well as conclusions, interpretations, study recommendations, and implications for social change are presented in Section 5.

Section 4: Results

The purpose of this causal-comparative study was to evaluate the effectiveness of a integrated Health and Physical Education (HPE) program on the academic achievement of ninth grade students in Biology-1 at an urban high school in central Mississippi. The study's objective was to see if the integrated HPE program would improve student scores in Biology-1; specifically, scores on the Biology-1 state test. Students' (n = 204) test scores were obtained to address the research question.

Section 4 presents the results of the research study based on pre- and posttest scores of two groups of students. Analysis of covariance (ANCOVA) was used to test for between group differences using students' pretest scores as a covariate. The posttest scores were the independent variable and the integrated HPE program was the dependent variable.

Research Question and Hypotheses

This study sought to answer the following research question: Will an integrated HPE program improve students' scores in Biology-1?

Null Hypothesis

The null hypothesis stated that an integrated HPE program will not improve students' scores in Biology-1.

Alternate Hypothesis

The alternative hypothesis stated that an integrated HPE program will improve students' scores in Biology-1.

The ANCOVA revealed that the relationship between the scores of Group *A* and the scores of Group *B* was significant for both posttests, $p < .001$. The results indicated that the null hypothesis should be rejected.

Research Tools

To facilitate this study, all test scores that were used in this study came from the results of the Biology-1 Subject Area Test (SAT) practice test that was administered in October 2010 which was used as the pretest; the Biology-1 SAT practice test that was administered in April 2011 which was used as posttest1; and the actual Biology-1 state test, the Mississippi Subject Area Testing Program (MSATP) Test that was administered in May 2011 which was used as posttest2. The two practice tests used in this study were components of the MSATP test. All tests were administered by classroom teachers. These tests were selected because they assess the students' understanding of fundamental biological theories, the application of biological skills, and the relevance of biology to everyday life (MDOE, 2009). The results of these tests were used to evaluate whether the integrated HPE program increased student achievement in Biology-1.

Two groups of students' ($n = 204$) test scores were obtained to address the research question: "Will an integrated HPE program improve students' scores in Biology-

1?" Of these 204 students' scores, one group consisted of 79 scores and the other group consisted of 125 scores. Students were identified as being either in the integrated HPE program or not (Table 2). Group *A* participated in the integrated HPE program and Group *B* did not.

Section 4 presents the results of the research study based on pre- and posttest scores of two groups of students. Analysis of covariance (ANCOVA) was used to test for between group differences using students' pretest scores as a covariate Creswell, 2003).

Table 2

Frequency Counts for Selected Variables

Variable Category	*n*	%
Group *A* (Integrated HPE)		
Females	79	100
Group *B* (Not Integrated)		
Males	86	69
Females	39	31
Total	204	100

Data Analysis

Descriptive statistics were used to report the mean differences in posttest scores for both groups (Table 3). An ANCOVA was used to examine whether the integrated PE program increased student achievement in Biology-1. The ANCOVA was used to adjust

or control for differences between the groups based on the covariate (Creswell, 2003). The ANCOVA is an extension of the analysis of variance (ANOVA)
that usually provides a way of statistically controlling for the effects of variables that one does not want to examine in a study (Creswell, 2003). The dependent variables were the posttest scores and the pretest scores represented the covariate. The independent variable was the integrated HPE program. The total scores were tallied for members of both groups on the pretests and posttests in Biology-1 and then entered into SPSS 16.0 for Windows for analysis.

Because of the gender differences in the two groups, the analysis was conducted at two different angles to see if gender made a difference in the results. To equalize the genders, the ANCOVA was first conducted with Group *A* and the females of Group *B*. Then the ANCOVA was conducted with Group *A* (all females) and Group *B* (mixed gender). Group *A* consisted of all females (100%) and Group *B* consisted of mixed genders with more males (69%) than females (31%). Two analyses were conducted on both groups using posttest1 scores and posttest2 scores. Conducting the analysis using the results of the practice test and another using the results of the state test (posttest2) would validate the consistency between the two posttests as well as the alignment between the two posttests.

Table 3

Descriptive Statistics for Posttest1 and Posttest2 of Both Groups

Student Groups	Gender	*M*	*SD*	*n*
Posttest1				
Group *A* (Integrated PE)	Females	54.1772	14.05462	79
	Total	54.1772	14.05462	79
Group *B* (Not Integrated)	Females	38.1026	12.83661	39
	Males	46.6512	18.92634	86
	Total	43.9840	17.65940	125
Posttest2				
Group *A* (Integrated PE)	Females	65.4684	16.06384	79
	Total	65.4684	16.06384	79
Group *B* (Not Integrated)	Females	48.6154	15.61311	39
	Males	55.7442	18.73542	86
	Total	53.5200	18.06422	125

Analysis of Group *A* and the Females in Group *B*

Before the ANCOVA was conducted, the homogeneity-of regression (slopes) assumption was tested. This test evaluated the interaction between the covariate and the factor (independent variable) in the prediction of the dependent variable. A significant interaction between the covariate and the factor suggested that the differences on the dependent variable among groups varied as a function of the covariate which means that the use of the ANCOVA would be inappropriate.

For the females in this study, when the homogeneity-of regression (slopes) assumption was tested, the interaction in posttest1 was not significant, $F(1, 114) = .092$, $p = .762$, p (.762) > (.05). Likewise, the interaction in posttest2 was not significant, $F(1, 114) = .145$, $p = .704$, p (.704) > (.05). Since the interactions were not significant (See Table 4), the ANCOVA analysis was then conducted for both posttests.

Table 4

Results of the Homogeneity-of Regression (Slopes) Assumption Test for the Females of Both Groups

	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.
Posttest1					
Interaction	12.872	1	12.872	.092	.762
Error	15962.060	114	140.018		
Posttest2					
Interaction	29.040	1	29.040	.145	.704
Error	22870.425	114	200.618		

With the alpha level set at .05, the one-way ANCOVA for both posttests (see Table 5) indicated that the relationship between the groups for posttest1 was significant, $F(1, 115) = 29.329$, $p < .001$, $\eta^2 = .211$ and the relationship between the groups for posttest2 was significant, $F(1, 115) = 22.326$, $p < .001$, $\eta^2 = .155$.

Table 5

ANCOVA Results for the Integrated HPE Program with the Females from Both Groups

	Sum of Squares	*df*	Mean Square	*F*	Sig.	η^2
Posttest1						
Group	4280.000	1	4280.000	30.567	.000	.211
Error	15974.932	115	138.912			
Posttest2						
Group	4445.768	1	4445.768	22.326	.000	.155
Error	22899.465	115	199.126			

Effect size indicates the relative magnitude of the differences between the means of the groups. Partial eta squared (η^2) was used to indicate the proportion of variance of the dependent variable that was explained by the independent variable (Gravetter & Wallnau, 2008). The results of this study indicated η^2 values of .211 and .155, which, according to the scale presented in Table 6, represent a large effect size. Therefore, 21.2% of the total variance in the scores of posttest1 was accounted for by the integrated HPE program and 15.5% of the total variance in the scores of posttest2 was accounted for by the integrated HPE program.

The estimated marginal means represent an adjustment from the raw posttest means, based on pre-existing differences found between groups within the covariate (pretest scores). As a result of this adjustment, the estimated marginal means facilitate a

comparison between groups based on an equal starting point. The estimated marginal means in Table 7 were based on a covariate (pretest) mean score of 17.6186.

Table 6

Criteria for Interpreting the Value of η^2

Percentage of Variance Explained, η^2	
$\eta^2 = .01$	Small effect
$\eta^2 = .06$	Medium effect
$\eta^2 = .138$	Large effect

Table 7

Estimated Marginal Means for Group A and the Females of Group B

			95% Confidence Interval	
Student Groups	*M*	Std. Error	Lower Bound	Upper Bound
Posttest1				
Not Integrated with PE	40.481[a]	2.025	36.468	44.493
Integrated with PE	53.125[a]	1.345	50.460	55.790
Posttest2				
Not Integrated with PE	50.665[a]	2.424	45.862	55.468
Integrated with PE	64.273[a]	1.610	61.083	67.463

a. Covariates appearing in the model are evaluated at the following values: B&A Pretest = 17.6186.

The estimated marginal means show that the mean test scores of female students who did not participate in the integrated HPE program were significantly lower than the mean scores of female students who participated in the integrated HPE program. Figure 1 shows the estimated marginal means for posttest1 scores. These values correspond to those found in Table 7.

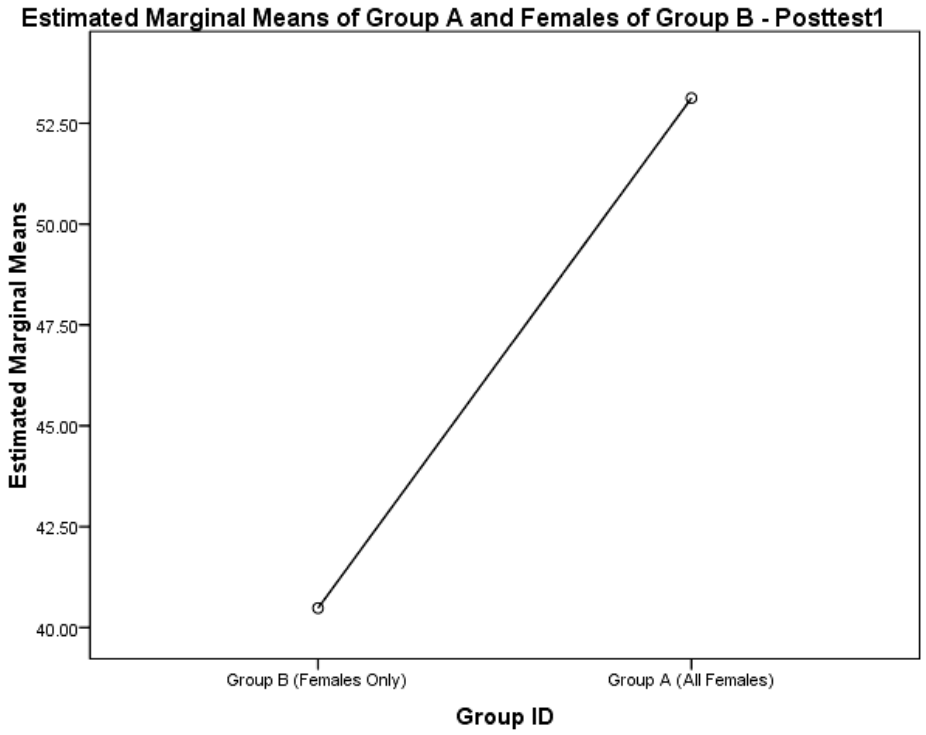

Figure 1. Profile plot: Estimated marginal means for posttest1.

Figure 2 shows the estimated marginal means for posttest2 scores. These values also correspond to those found in Table 7.

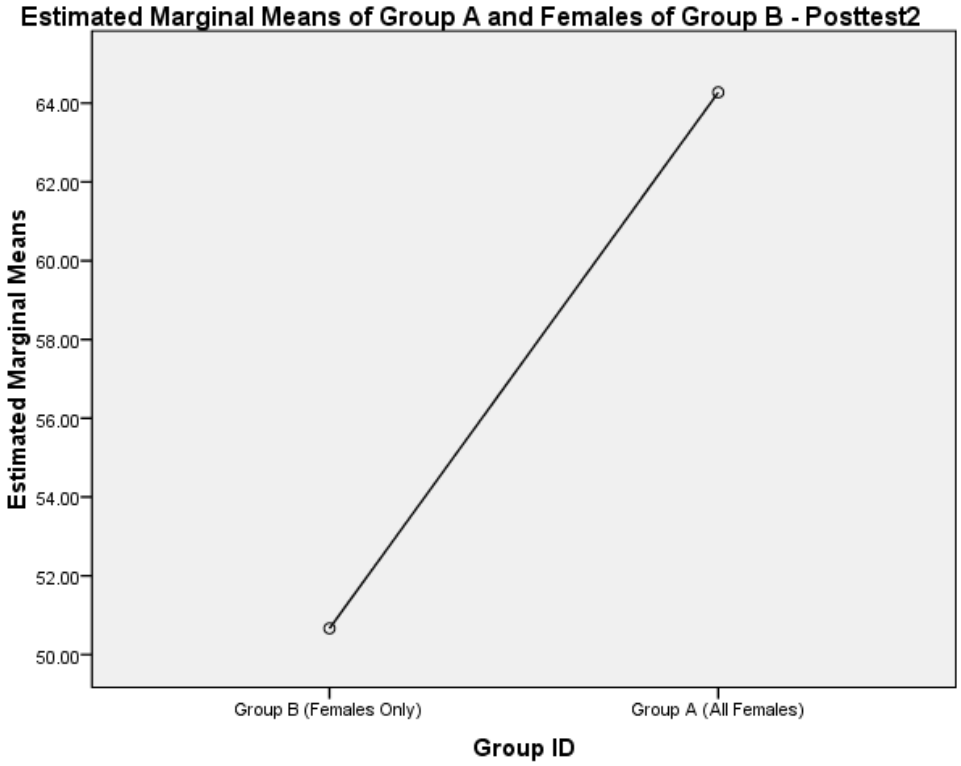

Figure 2. Profile plot: Estimated marginal means for posttest2.

Analysis of Group *A* and Group *B*

When the Females of Group *A* was compared to the mixed genders of Group *B*, the homogeneity-of regression (slopes) assumption was tested. The interaction in posttest1 was not significant, $F(1, 200) = 1.281$, $p = .094$, p (.094) > (.05). Likewise, the interaction in posttest2 was not significant, $F(1, 200) = 2.579$, $p = .110$, p (.110) > (.05). Since the interactions were not significant (See Table 8), the ANCOVA analysis was conducted for both posttests.

Table 8

Results of the Homogeneity-of Regression (Slopes) Assumption Test for Group A (All Females) and Group B (*Mixed Gender)*

	Type III Sum of Squares	*df*	Mean Square	*F*	Sig.
Posttest1					
Interaction	882.529	1	882.529	1.281	.094
Error	33874.455	200	169.372		
Posttest2					
Interaction	506.994	1	506.994	2.579	.110
Error	39324.415	200	196.622		

With the alpha level set at .05, the one-way ANCOVA for both posttests indicated that the relationship between the groups for posttest1 was significant, $F(1, 200) = 99.620$, $p < .001$, $\eta^2 = .332$ and the relationship between the groups for posttest2 was significant, $F(1, 200) = 94.555$, $p < .001$, $\eta^2 = .321$ (See Table 9).

Table 9

ANCOVA Results for the Integrated HPE Program with Group A (All Females) and Group B (*Mixed Gender)*

	Sum of Squares	*df*	Mean Square	*F*	Sig.	η^2
Posttest1						
Group	16872.870	1	16872.870	99.620	.000	.332
Error	33874.455	200	169.372			
Posttest2						
Group	18591.678	1	18591.678	94.555	.000	.321
Error	39324.415	200	196.622			

The results of this analysis indicated η^2 values of .332 and .321, which, according to the scale presented in Table 6, represent a large effect size. Therefore, 33.2% of the total variance in the scores of posttest1 was accounted for by the integrated HPE program and 32.1% of the total variance in the scores of posttest2 was accounted for by the integrated HPE program.

The estimated marginal means in this analysis were based on a covariate (pretest) mean score of 17.6029. Table 10 shows that the mean test scores of students who did not participate in the integrated HPE program were significantly lower than the mean scores of students who participated in the integrated HPE program.

Table 10

Estimated Marginal Means for Group A (All Females) and Group B (*Mixed Gender)*

			95% Confidence Interval	
Student Groups	*M*	Std. Error	Lower Bound	Upper Bound
Posttest1				
Not Integrated with PE	45.062[a]	1.169	42.756	47.367
Integrated with PE	53.107[a]	1.480	50.188	56.025
Posttest2				
Not Integrated with PE	54.593[a]	1.260	52.108	57.077
Integrated with PE	64.252[a]	1.595	61.108	67.397

a. Covariates appearing in the model are evaluated at the following values: B&A Pretest = 17.6029.

Figure 3 shows the estimated marginal means for posttest1 scores and These values correspond to those found in Table 10.

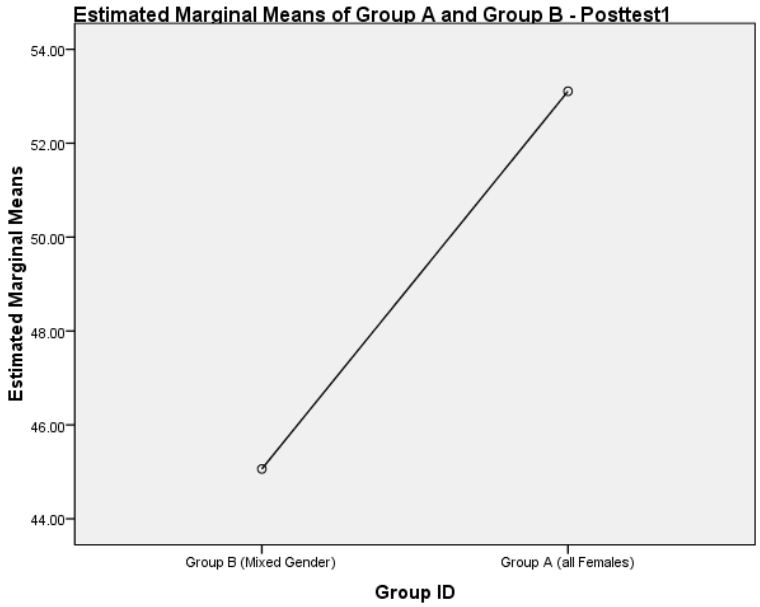

Figure 3. Profile plot: Estimated marginal means for posttest1.

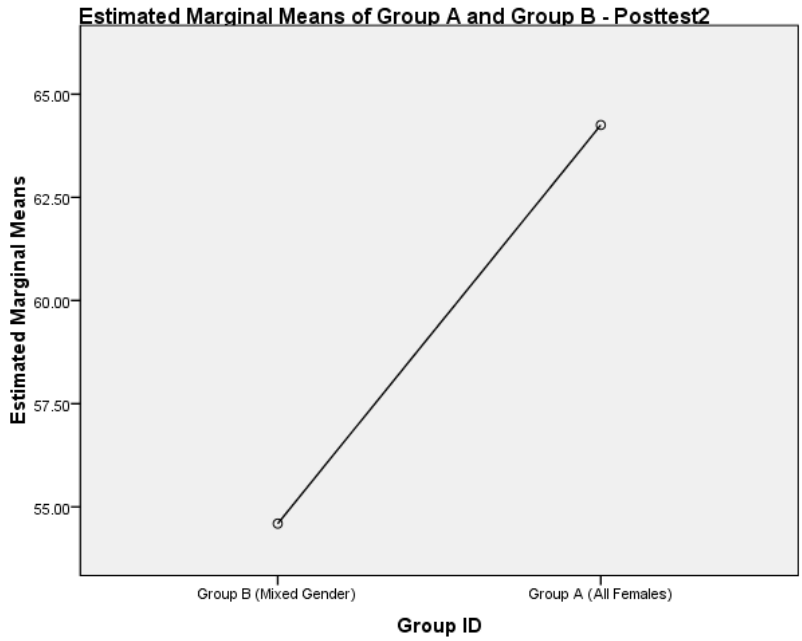

Figure 4. Profile plot: Estimated marginal means for posttest2.

Conclusions

This study sought to answer the following research question: "Will an integrated HPE program improve students' scores in Biology-1?" The null hypothesis stated that an integrated HPE program will not improve students' scores in Biology-1. The alternative hypothesis stated that an integrated HPE program will improve students' scores in Biology-1.

Addressing the Research Question and Hypothesis

To address the research question, the results of the ANCOVA comparing the groups' Biology-1 posttest scores after controlling for the students' pretest scores showed that an integrated HPE program will improve students' scores in Biology-1. In analyzing Group *A* (all females) and the females of Group *B*, the ANCOVA resulted in significant differences between the groups, $F(1, 115) = 29.329$, $p < .001$, $\eta^2 = .211$ for posttest1 and the relationship between the groups for posttest2 was significant, $F(1, 115) = 22.326$, $p < .001$, $\eta^2 = .155$. In analyzing Group *A* (all females) and Group *B* (mixed gender), the ANCOVA resulted in significant differences between the groups, $F(1, 200) = 99.620$, $p < .001$, $\eta^2 = .332$ for posttest1 and the relationship between the groups for posttest2 was significant, $F(1, 200) = 94.555$, $p < .001$, $\eta^2 = .321$. The results of all ANCOVA tests were significant, $p < .05$.

The adjusted means also indicated that the null hypothesis should be rejected. The marginal means scores for Group *A* ($M = 53.125$) were significantly higher than the

marginal means scores of the females in Group *B* (*M* = 40.481) for posttest1 and also for posttest2 (Group *A* - *M* = 64.273 vs. Group *B* - *M* = 50.665). Likewise, the marginal means scores for Group *A* (*M* = 53.107) were significantly higher than the marginal means scores of Group *B* (*M* = 45.062) for posttest1 and also for posttest2 (Group *A* - *M* = 64.252 vs. Group *B* - *M* = 54.593) which supported the acceptance of the alternative hypothesis.

Additionally, based on the findings in Table 3, the female students in Group *A* deviated more from the mean than the scores of the females in Group *B* for posttest1 (*SD*= 14.05462 vs. *SD* = 12.83661) and posttest2 (*SD*= 16.06384 vs. *SD* = 15.61311). However, the scores of the students in Group *B* (mixed gender) deviated more from the mean than the test scores of the females of Group *A* for posttest1 (*SD*= 14.05462 vs. *SD* = 17.65940) and posttest2 (*SD*= 16.06384 vs. *SD* = 18.06422) which supported the alternative hypothesis.

Summary

The results of this quantitative, causal-comparative study were presented in Section 4. Based on the findings, the null hypothesis was rejected and the alternative hypothesis was accepted ($p < .001$). The Biology-1practice test (which was used as the pretest) was administered to all participants in October 2010 and posttest 1 was administered to all participants in April 2011, with the state test (posttest 2) administered in May 2011. Pre- and posttest scores were collected for all Biology-1 students. The 79

participants in Group *A* participated in an integrated HPE program that incorporated Biology-1 content into the girls' HPE classes utilizing action-based learning strategies while the 39 female participants in Group *B* did not. The students who participated in the integrated HPE program scored significantly higher than the students who did not participate in the integrated HPE program.

Section 5 presents a brief overview of why and how the study was conducted. Additionally, Section 5 reports the results, interprets the findings, offers suggestions for application, discusses the implications for social change, and makes recommendations for further research. Section 5 ends with a summary that captures the essence of this study.

Section 5: Summary, Conclusion, and Recommendations

Section 5 begins with a brief overview of why and how the study was conducted as well as a summary of the findings reported in Section 4. A discussion of the interpretations of the findings and conclusions are presented next as they relate to the literature and the theoretical framework of the study followed by practical applications of the findings. The implications for social change and the significance of the findings are then presented followed by recommendations for action as well as further research. Section 5 ends with a summary of the research problem which includes details of how this study addressed the research question, the findings of the study, and the conclusion.

Overview of the Study

The purpose of this quantitative, causal-comparative study was to evaluate the effectiveness of an integrated HPE program on the academic achievement of ninth grade students in Biology-1 at an urban high school in central Mississippi. This study was designed to answer the following research question: "Will an integrated HPE program improve students' scores in Biology-1?" The findings presented in Section 4 supported the rejection of the null hypothesis which stated that an integrated HPE program will not improve students' scores in Biology-1 and the acceptance of the alternative hypothesis which stated that an integrated HPE program will improve students' scores in Biology-1. Based on the findings, an integrated HPE program is effective in enhancing student achievement in Biology-1. These findings guide the implications for social change as

well as the recommendations for action and further research on curricular concerns that may be addressed by integrating core subject content into the HPE program to provide students with physical activities while reinforcing core subject content.

The ninth grade girls' HPE students have participated in an integrated HPE program in which Biology-1 content was incorporated into the HPE curriculum for the past three years. All ninth grade Biology-1 students take the Biology-1 state test at the end of the school year and are required to pass the test in order to graduate from high school. All Biology-1 students who were tested in May 2011 made up the sample for this study. There were 79 students' test scores in one group (Group *A*) and 125 students' test scores in the other group (Group *B*). These sample sizes (79 and 125) coincided with the recommended sample size that was discussed in Section 3. Due to the fact that all elective teachers were required to integrate core subject content into their curriculum, the integrated HPE program was designed to satisfy this requirement set by the school's administrators; however, the integrated program had never been evaluated. Students in Group *A* were Biology-1 students who were also enrolled in a girls' HPE class, and thus, participated in the integrated HPE program. Students in Group *B* were also Biology-1 students, but they were not enrolled in a girls' HPE class; thus, did not participate in the integrated HPE program. All Biology-1 students took the Biology-1 practice test in October 2010 (which was used as the pretest), another practice test in April (which was used as posttest 1), and the state test in May (which was used as posttest 2).

The integrated HPE program used four Action-Based Learning (ABL) activities: (a) Visual-Motor Control which aided the brain in focusing on reading for longer periods, discriminating sounds, and organizing information; (b) Visual Tracking which aided the brain in processing thought, organizing thoughts in sequence, discriminating likeness and differences, discriminating sounds, and advancing to higher-level thinking; (c) High Level Thinking which aided the brain in anchoring information and improved memory retrieval, preparing the brain to take a test, and combining many skills for higher-level thinking; and (d) Jump Rope which was used to prepare the brain for optimal learning (Blaydes-Madigan, 2009).

The ANCOVA showed that the posttest scores of Group *A* and the females in Group *B* to be statistically significant, $F(1, 114) = 20.974$, $p < .001$ after controlling for differences in the pretest scores; therefore, the null hypothesis was rejected. The gain scores, determined by subtracting pretest scores from posttest scores, revealed that Group *A* had significantly higher gains compared to the females of Group *B* (35.6709 vs. 22.2821 for posttest1 and 46.9621 vs. 32.7949 for posttest2). Likewise, the gain scores revealed that Group *A* also had significantly higher gains compared to all of Group *B* which was mixed genders (35.6709 vs. 26.896 for posttest1 and 46.9621 vs. 36.432 for posttest2).

Interpretations of Findings

The overall purpose of this study was to evaluate the effectiveness of an integrated HPE program on the academic achievement of ninth grade students in Biology-1 at an urban high school in central Mississippi. Researchers have been conducting studies to examine the relationship between physical activity and student achievement. Past researchers have found that there is a relationship between physical activity and academic achievement; however, they found no evidence that justified the inclusion of a PE program in the schools (Coe et al., 2006; Martin & Chalmers, 2007; Scheuer, 2004; Scheuer & Mitchell, 2003; Stevens et al., 2008). Recent researchers found that students can receive the same physical benefits from participating in physical activities other than PE in the schools (Coe et al., 2006; Stevens et al., 2008). Other researchers found similar results indicating that there is a relationship between physical fitness and academic achievement, but they did not indicate whether PE should or should not be included in the schools to help students achieve academically (Castelli et al., 2007; Ferris, Williams, & Shen, 2007; Houston, 2007; Siegel, 2007a). Since students do not exercise regularly on their own (Blaydes-Madigan, 2005; Greer & Gilbert, 2006; Lynn, 2007; Yaussi, 2005), it is the responsibility of the parents to ensure that their children are physically active. When this does not happen, then the schools should provide an avenue by which the students can be physically active. For these reasons, the results of this study justified the need for quality HPE programs in the schools, especially if the HPE

instructors integrate core subjects into their curriculum. These premises formed the groundwork for developing the integrated program since all elective teachers in the school district in this study were required to participate in cross-curricular integration. The findings that are presented next are based on the analysis of the data conducted in Section 4.

Addressing the Research Question

The data showed that students from Group *A* participated in the integrated HPE program and had significantly higher posttest mean scores than the students in Group *B* (*MD*=10.1932 for posttest 1; *MD*= 11.9484 for posttest 2) who did not participate in the integrated program. There were concerns about the compositions of the two groups based on gender. Although Group *B* was made up of mixed genders (see Table 2), when the female students from Group *B* were compared to Group *A* (all females), the findings show that the mean test scores for the female students in Group *A* (*M*=54.1772 for posttest1 and *M*=65.4684 for posttest2) were significantly higher than the mean test scores of the female students in Group *B* (*M*=38.1026 for posttest1 and *M*=48.6154 for posttest2).

Likewise, when test scores of the students from Group *B* (86 males and 39 females) were compared to the test scores of Group *A* (all females), the findings also showed that the mean test scores for the female students in Group *A* (*M*=54.1772 for posttest1 and *M*=65.4684 for posttest2) were significantly higher than the mean test

scores of the students in Group *B* (*M*=46.6512 for posttest1 and *M*=55.7442 for posttest2). However, the mean test scores for the males in Group *B* (*M*=46.6512 for posttest1 and *M*=55.7442 for posttest2) were higher than the mean test scores of the females in Group *B* (*M*=38.1026 for posttest1 and *M*=48.6154 for posttest2), but the difference was not significant, $p > .05$. This difference could be attributed to the fact that males, especially during their ninth grade school year (Kin-Isler et al., 2009), are more physically active than females (Agbuga, 2011; Kin-Isler et al., 2009; Ridgers et al., 2011). Since males, particularly at this age group, are normally physically active, this movement in their daily schedule may have impacted their test scores making their scores higher than the females' scores in the group.

Additionally, the school in this study regularly pulled students out of their HPE class to provide tutorial services in an effort to help students pass the Biology-1 and Algebra-1 state tests. Since the girls' HPE classes integrated Biology-1 content, females were not pulled for tutorial services in Biology-1. However, the boys' HPE classes did not have Biology-1 integration; therefore, male HPE students were pulled from their HPE class to receive tutorial services in Biology-1. Even with this extra assistance, the scores of the males in Group B were significantly lower than the scores of the female students in Group *A*, who participated in the integrated HPE program.

The test scores of Group *B* deviated more from the mean score (*SD*=17.65940 for posttest1 and *SD*=18.06422 for posttest2) than the test scores of Group *A* (*SD*=14.05462

for posttest1 and *SD*=16.06384 for posttest2), indicating that students who participated in the integrated HPE program improved their test scores in Biology-1 to a higher level than students who did not participate in the integrated HPE program (see Table 3).

From the one-way ANCOVA, the relationship between the scores of the females in Group *A* and the scores of the females in Group *B* for posttest1was significant, $F(1, 115=22.326, p = .001; p < (.05)$ and also significant for posttest2, $F(1, 115=29.329, p = .001; p < (.05)$ indicating that the integrated HPE program did improve students' scores in Biology-1 (see Table 4). The relationship between the scores of Group *A* (all females) and the scores of Group *B* (mixed gender) for posttest1 was significant, $F(1, 115=21.057, p = .001; p < (.05)$ and was also significant for posttest2, $F(1, 115=19.973, p = .001; p < (.05)$ which further indicate that the integrated HPE program improved students' scores in Biology-1 (see Table 5).

The Need for Physical Activity

The findings of this study supported the need for physical activity. Recent results from brain research have revealed that students need physical activities in order to prepare the brain for learning (Blaydes-Madigan, 2009; Ferris et al., 2007; Levinger et al., 2008; Manabe, 2002; Pica, 2006b; Ratey, 2008). Researchers have found that kinetic movement can reduce stress and anxiety by deterring the production of a chemical called cortisol which causes individuals to be less capable of planning, judging, and problem solving, as well as completing other higher-order skills that are needed to process

information (Covelli, 2007; Nieuwenhuys et al., 2008). Most importantly, movement is vital to learning because it activates the manufacture and flow of a brain-derived neurotrophic factor (BDNF; Ferris et al., 2007; Levinger et al., 2008; Manabe, 2002). A BDNF is a chemical that is active in the hippocampus, which is responsible for long-term memory in humans and aids in learning (Manabe, 2002; Ratey, 2008). It also helps neurons to exchange information with one another (Manabe, 2002). Structured HPE provides students with physical activities that can help enhance learning by stimulating the flow of BDNF in the student's brain, which further provide support for integration (Blaydes-Madigan, 2009; Ferris et al., 2007; Levinger et al., 2008; Manabe, 2002; Pica, 2006b; Ratey, 2008). When Biology-1 content was added to the HPE program which used action-based learning strategies, students in Group *A* outscored their peers on posttest1 by 75% (*MD*=10. 1932) and posttest2 by 78% (*MD*= 11.9484). The female students in Group *A* also outscored the female students in Group *B* by 63% (*MD*=16. 0746) on posttest1 and by 55% on posttest2 (*MD*=16.853). The findings of this study supported the action-based learning theories which resulted from brain research which conceived that physical activity promotes learning.

The Need for Cross-Curricular Integration

The findings of this study also supported the need for cross-curricular integration, because it is another factor that positively affects student achievement (Pica, 2006b). Recent findings from research presented strong support for integrating other subject

matter with HPE to increase student learning. Kalyn (2005) felt that integrated HPE programs would justify the need for quality HPE programs in the schools which could improve students' physical fitness and increase academic achievement at the same time.

The integrated HPE program was designed to teach the whole child and not just the mind. Students who did not have the action-based learning that was incorporated into the integrated HPE program had lower posttest scores (M=43.9840; M=53.5200) than the students who had the action-based learning program (M=54.1772; M=65.4684).

Designing an Integrated Health and Physical Education Program

The findings from this study support the designing of an integrated HPE program to enhance student learning. Hall (2007) contended that an integrated HPE program would allow physical educators to teach using verbal instruction, visual demonstrations, and kinesthetic movement. The integrated HPE program that was evaluated in this study incorporated physical activities that involved all the senses in order to improve whole brain learning, especially the parts of the brain that were not fully developed (Blaydes-Madigan & Hess, 2004). This integrated HPE program taught to the whole child so that each child's intellectual, physical, emotional, social, and moral system could be developed to reach high levels of achievement (Blaydes-Madigan & Hess, 2004). Each child's abilities were evaluated and various learning strategies were used to reach the different learners (Askell-Williams, Murray-Harvey, & Lawson, 2007; Orland-Barak & Yinon, 2007; Roekel, 2009). The action-based learning program in this study offered

useful means of presenting knowledge in a variety of ways to increase student learning (Askell-Williams et al., 2007; Blaydes- Madigan & Hess, 2004; Orland-Barak & Yinon, 2007). This action-based, integrated HPE program was an ideal means of providing students with motor learning for increased cognition.

How the Integrated Program Worked

When students move, the cerebellum works with the body's vestibular system to control balance, provide coordination, and develop spatial awareness. Hypothetically, when ideas are turned into actions, students are able to read and write better. Students need visual fields in order to reinforce their eye tracking when reading. These visual fields were enhanced when students in the integrated HPE program had to plot courses through space and cross the brain and body midlines. The movement through space that crossed the brain and body's midlines helped students to assimilate and organize the hemispheres of the brain. The cross lateral activities provided more blood flow to the brain which helped students to be more alert and eager to learn (Blaydes-Madigan, 2009; Ratey, 2008). The senses that were used to improve balance, coordination, spatial awareness, directionality, and visual literacy were developed when students participated in the integrated HPE program (Blaydes-Madigan, 2009).

Brain researchers contend that the mental development of children is contingent on their early progress in motor development (Lengel & Kuczala, 2010; Ratey, 2008). As the brain and body work together to process motor sequences and patterns, the brain

generates corridors for understanding reading and math (Blaydes- Madigan, 2009; Ratey, 2008). Information enters the brain and travels left to right across the Corpus Callosum and front to back across the Motor Cortex (Blaydes-Madigan, 2009). As discussed in an earlier section, the three basic human motor movements that correspond with the way information travels in the brain are (a) walking, (b) jumping, and (c) rolling (Blaydes-Madigan, 2009; Ratey, 2008). When the students walked, jumped, and rolled while participating in the integrated HPE program, they helped their brain to process information for better cognition (Blaydes- Madigan, 2009; Lengel & Kuczala, 2010; Ratey, 2008). Therefore, the movement in the integrated HPE program offered students the opportunity to give their brains the required practice to process Biology-1 information efficiently.

In this study, Biology-1 content was integrated into the HPE program as a requirement of the school district in order to help students make science connections relevant to everyday living while participating in daily physical activities. Ways for students to use this knowledge in everyday situations were created and students were required to review Biology-1 content while working out in HPE class. According to researchers, integrating physical movement during the school day has been shown to enhance academic performance (Buchanan et al., 2002; Castelli et al., 2007; Ferris et al., 2007; Hall, 2007; Houston, 2007; Leppo & Davis, 2005; Maeda & Murata, 2004; Pica, 2006a, 2006b; Siegel, 2006, 2007a, 2007b; Smith & Lounsbery, 2009; Tomporowski et

al., 2008; Yaussi, 2005). Tomporowski et al. (2008) asserted that the more muscles one activates while learning new information with core subject content, the greater and more concrete the learning. Kinetic movement increased the blood flow and oxygen delivery to the brain and muscles, thus increasing mental functioning (Pica, 2006b; Tomporowski et al., 2008). Kinetic movement increased brain function and produced more neurons; thus, the ability to learn and make better grades increased (Nieuwenhuys et al., 2008; Pica, 2006b). Since higher grades may be related to kinetic movement, a structured PE program may be helpful, especially when the pressure for students to increase performance on high stakes tests continues to increase (Houston, 2007; Siegel, 2007b; Smith & Lounsbery, 2009).

The integrated HPE program in this study provided all of these functions. The one-way ANCOVA compared the students' posttest scores after controlling for differences in the pretest scores and found that posttest scores were significantly higher ($p < .001$) for the students who participated in the integrated HPE program. Thus, the mind and the body were educated by physical activity that stimulated the brain.

Potential Factors Influencing the Results

Based on the findings in Section 4, the results strongly indicated the effectiveness of the integrated HPE program; however, it is important to discuss other factors that may have influenced the results. A factor that may have been an influence is that all students took a practice test (posttest1) before they took the actual state test (posttest2) in May

2011. During the practice test, students were asked to construe facts and figures, put theories to use, and draw conclusions. The students may have gained insight that helped them perform better on the state test as well as helped students to overcome test anxiety. This practice test also gave students the opportunity to be tested without being penalized for lack of knowledge. Additionally, the students who participated in the integrated HPE program may have enjoyed the fun way that Biology-1 content was presented; thus, increasing students' motivation and learning. Students who were kinesthetic learners may have benefited more from the instructions delivered in the integrated HPE program than the traditional instructional program from the Biology-1 classroom teacher (Gardner, 2006) because the movement that was provided helped meet their needs.

Another potential influence is that the school in this study practiced pulling students out of their HPE class to provide tutorial services in an effort to help students excel on state tests. The females in Group A were not pulled from their HPE class because they were participating in the integrated HPE program that incorporated Biology-1 content into the HPE curriculum. However, the boys' HPE classes did not offer an integrated program in which Biology-1 content was incorporated into the HPE curriculum; therefore, the males in Group B were pulled from their HPE class three days each week to receive tutorial services in Biology-1. Since the females in Group B did not take HPE, they were not pulled from other classes to receive tutoring in Biology-1. The extra assistance that the males received may have influenced their test scores. The mean

test scores for the males in Group *B* (*M*=46.6512 for posttest1 and *M*=55.7442 for posttest2) were higher than the mean test scores of the females in Group *B* (*M*=38.1026 for posttest1 and *M*=48.6154 for posttest2) but not high enough to yield a significant difference, $p > .05$.

Implications for Social Change

This study, concerning the integration of Biology-1 content into the HPE program to increase student achievement in Biology-1, has many potential benefits to student learning. This study incorporated a practical approach toward providing kinetic movement to students that may influence administrators who narrow the curriculum to promote reading and math skills. This study should encourage administrators to consider implementing an integrated HPE program that embraces physical fitness as well as academic achievement (Hall, 2007; Houston, 2007; Kayln, 2005; Yaussi, 2005). An integrated HPE program, like the one in this study, is based on instructional practices that are supported by action-based learning and various learning theories.

Since the implementation of the No Child Left Behind (NCLB) Act of 2001 (2002), many educational systems have resorted to having fewer quality PE programs (Hall, 2007; Houston, 2007; Siegel, 2006); issuing heavier doses of a narrowed program that sacrifices physical activity (Houston, 2007). An integrated HPE program would alleviate the need to cut out quality PE programs in the school because core subject content would be reinforced as students improve their fitness level. This will help

students improve their mental functioning. The integrated HPE program in this study yielded statistical significant results that support improved mental functioning of students (Blaydes-Madigan, 2009). This will benefit the students, educators, the schools, and society by ensuring that physical activity through HPE is part of the school's curriculum (Hall, 2007; Houston, 2007).

This study's statistically significant results bring about enormous implications for social change. First, students who become accustomed to being physically active in their daily schedule while in school, may began to value the benefits of exercise and decide to develop an active lifestyle for lifelong learning (Castelli et al., 2007; Stork & Sanders, 2008; Yaussi, 2005). This would replace any sedentary habits to which students may be accustomed. Students have different learning styles (Gardner, 2006). Educators must teach using an eclectic blend of learning strategies that would reach each learner so that every student would experience academic success (Askell-Williams, Murray-Harvey, & Lawson, 2007; Orland-Barak & Yinon, 2007; Roekel, 2009). An integrated HPE program would particularly assist kinesthetic learners because their academic learning style craves kinetic movement in order to mentally process new information to achieve academic success (Blaydes-Madigan, 2009; Gardner, 2006; Ratey, 2008). When students have academic success, they are most likely to become productive members of society (Salpeter, 2003).

Recent studies have indicated that many parents and educators are not aware that poor nutrition, inactivity, and obesity problems among students in the United States are negatively affecting their academic achievement (Maeda & Murata, 2004; Pica, 2006b). The implications of this study may help parents, educators, and all constituents across the world to recognize the importance of encouraging students to participate in vigorous physical activities. Previous research has acknowledged that poor nutrition, inactivity, and obesity problems have had a negative effect on the academic success of students in the United States and abroad (Maeda & Murata, 2004; Pica, 2006b). The problem is that the main goals in education have been to develop the mind and not the body, when in fact, non-core subjects such as art, PE, and music can contribute to students' overall achievement by stimulating various parts of the brain that will positively affect academic achievement (Blaydes- Madigan & Hess, 2004; Houston, 2007; Maeda & Murata, 2004; Siegel, 2006, 2007b). This may be far-reaching, but if the results of this study lead schools to implement integrated HPE programs in the schools and students sustain physical activities throughout their lives as a result of the integrated programs, then the dangers of obesity may be reduced, health costs may be lowered, and student achievement may be increased (Blaydes- Madigan & Hess, 2004; Maeda & Murata, 2004; Preisser, 2004; Stork & Sanders, 2008).

The significant results of this study may also support new thinking on the need for students to participate in daily PE in school. My plans, as a local practitioner and

researcher, are to develop integrated HPE programs that incorporate all core subject content for all grade levels that can be delivered through the PE department as a practical application and enhancement to academic achievement. These integrated HPE programs would be designed by subject areas so that teachers may select the subject area that needs the greatest attention based on the needs of the students, the needs of the school, and year for the administration of state tests. Additionally, when it is time for students to select their classes for the next school year, the school counselors would work with the parents and students in selecting the courses that address the needs of the students.

This study contributes to the current body of knowledge by identifying the possibilities for improving student learning through an integrated HPE program that teaches core subject content while applying action-based learning strategies. The results of this study will be disseminated to the educators and administrators that were involved in this study.

Recommendations for Action and Further Research

This study was conducted in an urban high school in central Mississippi. The sample was ninth grade students' Biology-1 test scores and the findings were significant regarding the effectiveness of the integrated HPE program. I recommend that this research be duplicated in two ways: duplicating the study using a larger sample and with integration all of the core subject areas. By repeating this research using larger samples,

it could provide a broader understanding of the benefits of physical activity to student learning in the schools.

Additionally, the significant results from this study's integrated HPE program provided the groundwork for examining student achievement using other core subjects to enhance the academic success of students, especially those who have developed a sedentary lifestyle. All of the core subject areas could be integrated in the following ways:

1. by days of the week (e.g. English on Mondays, Science on Tuesday, History on Wednesday, Mathematics on Thursday, and Reading and Writing on Friday),
2. by semesters (Science and Mathematics the first semester and English, Reading and Writing during the semester), or
3. by dividing areas among the different PE instructors (one PE teacher integrates Science and Mathematics, another integrates History and Reading, and another on integrates Writing and English).

Further research should explore factors that call for additional investigations, including the effects of an integrated HPE program between schools that provide daily PE classes. In schools that offer limited or no PE, administrators could consider implementing a trial integrated HPE program in order to enhance student achievement.

Other factors that should be examined are the influence of an integrated HPE program on obesity, student motivation, and student interest. By examining these factors,

other elements may surface that need further attention. Another recommendation is to expand this study to include the elementary populations as well as other high school populations across the nation.

Methodological Enhancements

The integrated HPE program in this study was used by ninth grade girls' HPE students. This integrated program could be used by the boys' HPE students as well as the HPE program in other schools. As part of the study, students would have the opportunity to enhance their mental functioning; thus, improve academic achievement. Students' standardized test scores would be collected, compared, and analyzed with other schools that do not offer HPE or the integrated HPE program. This may provide for generalizations across the state of Mississippi, other states, and the nation. This may also provide possibilities for the implementation of an integrated HPE program in other schools, especially those that do not offer PE.

Policy Recommendations

Mandates from NCLB (2002) pressure administrators to constantly examine ways to meet the adequate yearly progress (AYP) requirements (Rothstein & Jacobsen, 2006). It is recommended that state officials embrace the results of this study and urge school districts to take advantage of the benefits of an integrated HPE program. No Child Left Behind (2002) provides funding opportunities for innovative programs that targets improved school programs and increased levels of student achievement. To help meet

the mandates of NCLB, it is recommended that policymakers allocate funds for expanded research with students in other schools. This funding could be used to provide training to physical educators to administer the integrated HPE program effectively.

Unlike the school in this study, many schools have a part-time PE program in which the students are only offered limited time in PE class, such as once a week. Students in this study were fortunate in that they have daily PE class participation. Unfortunately, other schools across the nation have reduced or limited PE instructions (Hall, 2007; Houston, 2007; Lewis & Shaha, 2003). In an effort to reduce the pressure placed upon schools and teachers to increase students' academic performance, school principals would be motivated by the positive results of this study in improving state test scores (Hall, 2007; Siegel, 2006; Smith & Lounsbery, 2009). Students from Group *B* who still needs to pass the Biology-1 state test are required to take PE. The integrated program will be offered to these students during their PE class.

Summary

Although the school district in this study has not resorted to allotting less time for HPE in the daily program, as other districts have done (Lewis & Shaha, 2003), it has resorted to pulling particular students out of high school HPE classes to receive small group and one-on-one tutoring in the tested areas to prepare them for state tests, which replicates the practice of replacing HPE time with additional course work time identified by Lewis and Shaha (2003). Despite these efforts, ninth grade students' test scores in

Biology-1 were not progressively improving at the rates set by the district. This problem affects all students whose school days are filled with large amounts of acquisition of core subject knowledge at the expense of other subjects, including PE (Hall, 2007; Houston, 2007). Under the mandates of NCLB (2002), schools must assess the progress students make in the tested areas. Recent findings (including the findings in this study) are providing insights to the positive relationship between physical activity and student achievement that may assist educational systems in improving student progress.

The literature on brain research provided evidence that there is a relationship between movement and learning. The theoretical basis for this study was guided by the action-based learning theories and the results from brain research that were discussed, researched, and extensively studied by Caine & Caine (1995), Blaydes-Madigan (2009), Ferris et al. (2007), Gardner (2006), Jackson (1999), Jensen (2000), Lengel & Kuczala (2010), Levinger et al. (2008), McGill & Beaty (1995), Ratey (2001, 2008), Revans (1982), Schiller & Willis (2008), Sousa (1998), Stevens et al. (2008), and Tomporowski et al. (2008). All of the above researchers discussed the relationship between physical activity and learning outcomes in academic achievement. Most importantly, movement was examined in relation to brain biology and mental functioning. This theoretical basis maintained that movement builds the framework for learning (Gardner, 2006; McGill & Beaty, 1995; Ratey, 2001; Revans, 1982).

As educational systems continue to work to meet the demands of NCLB (2002), time for PE in the daily program has been reduced and, in some cases, eliminated (Hall, 2007). This practice may have produced an unforeseen negative effect on student achievement. Administrators may not have been aware that students have many systems (intellectual, physical, emotional, social, and moral) that need to work together so that students can perform at maximum levels; therefore, students need to be physically active in order to enhance their academic growth. The integrated HPE program in this study provided students with movement that helped prepare the brain for learning. It provided more opportunities to be taught the same information that was taught in their Biology-1 classroom, but in a different way. And it also gave the students a fun way to learn.

Reviewing the results of this study will help students, teachers, administrators, and policymakers to have a better understanding of the relationship between physical activity and student achievement. This study contributes to the body of knowledge by providing new information on the positive effect that movement have on student learning. Particularly, this study showed that students who participated in the integrated HPE program had significantly higher test scores than the students who did not. This study clearly explained the effectiveness of physical activity and cross-curricular integration to student achievement.

I can visualize changes in schools' PE departments across the nation as qualified physical educators adequately incorporate core subject contents in their PE curriculum to

help students perform better on state tests. This change will allow physical educators to make wise use of their instructional time. Additionally, the implementation of an integrated HPE program in the schools could facilitate meeting AYP requirements and NCLB (2002) mandates by identifying the positive relationship between movement and student learning. Most children do not exercise on their own (Blaydes-Madigan, 2005; Greer & Gilbert, 2006; Lynn, 2007; Yaussi, 2005); therefore, some type of structured physical activity should be put in place to ensure that students' brains are stimulated and information can be processed more efficiently.

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Appendix A

Paragraph 3 of the NCLB Act of 2001

‘‘(3) ACADEMIC ASSESSMENTS.—

‘‘(A) IN GENERAL.—Each State plan shall demonstrate that the State educational agency, in consultation with local educational agencies, has implemented a set of high quality, yearly student academic assessments that include, at a minimum, academic assessments in mathematics, reading or language arts, and science that will be used as the primary means of determining the yearly performance of the State and of each local educational agency and school in the State in enabling all children to meet the State’s challenging student academic achievement standards, except that no State shall be required to meet the requirements of this part relating to science assessments until the beginning of the 2007–2008 school year.

‘‘(B) USE OF ASSESSMENTS.—Each State educational agency may incorporate the data from the assessments under this paragraph into a State-developed longitudinal data system that links student test scores, length of enrollment, and graduation records over time.

‘‘(C) REQUIREMENTS.—Such assessments shall—

‘‘(i) be the same academic assessments used to measure the achievement of all

children;

‘‘(ii) be aligned with the State’s challenging academic content and student academic achievement standards, and provide coherent information about student attainment of such standards;

‘‘(iii) be used for purposes for which such assessments are valid and reliable, and be consistent with relevant, nationally recognized professional and technical standards;

‘‘(iv) be used only if the State educational agency provides to the Secretary evidence from the test publisher or other relevant sources that the assessments used are of adequate technical quality for each purpose required under this Act and are consistent with the requirements of this section, and such evidence is made public by the Secretary upon request;

''(v)(I) except as otherwise provided for grades 3 through 8 under clause vii, measure the proficiency of students in, at a minimum, mathematics and reading or language arts, and be administered not less than once during—

''(aa) grades 3 through 5;

''(bb) grades 6 through 9; and

''(cc) grades 10 through 12;

''(II) beginning not later than school year 2007–2008, measure the proficiency of all students in science and be administered not less than one time during—

''(aa) grades 3 through 5;

''(bb) grades 6 through 9; and

''(cc) grades 10 through 12;

''(vi) involve multiple up-to-date measures of student academic achievement, including measures that assess higher-order thinking skills and understanding;

''(vii) beginning not later than school year 2005–2006, measure the achievement of students against the challenging State academic content and student academic achievement standards in each of grades 3 through 8 in, at a minimum, mathematics, and reading or language arts, except that the Secretary may provide the State 1 additional year if the State demonstrates that exceptional or uncontrollable circumstances, such as a natural disaster or a precipitous and unforeseen decline in the financial resources of the State, prevented full implementation of the academic assessments by that deadline and that the State will complete implementation within the additional 1-year period;

''(viii) at the discretion of the State, measure the proficiency of students in academic subjects not described in clauses (v), (vi), (vii) in which the State has adopted challenging academic content and academic achievement standards;

''(ix) provide for—

''(I) the participation in such assessments of all students;

''(II) the reasonable adaptations and accommodations for students with disabilities (as defined under section 602(3) of the Individuals with Disabilities Education Act) necessary to measure the academic achievement of such students relative to State academic content and State student academic achievement standards; and

''(III) the inclusion of limited English proficient students, who shall be assessed in a valid and reliable manner and provided reasonable

> accommodations on assessments administered to such students under this paragraph, including, to the extent practicable, assessments in the language and form most likely to yield accurate data on what such students know and can do in academic content areas, until such students have achieved English language proficiency as determined under paragraph (7);

‘‘(x) notwithstanding subclause (III), the academic assessment (using tests written in English) of reading or language arts of any student who has attended school in the United States (not including Puerto Rico) for three or more consecutive school years, except that if the local educational agency determines, on a case-by-case individual basis, that academic assessments in another language or form would likely yield more accurate and reliable information on what such student knows and can do, the local educational agency may make a determination to assess such student in the appropriate language other than English for a period that does not exceed two additional consecutive years, provided that such student has not yet reached a level of English language proficiency sufficient to yield valid and reliable information on what such student knows and can do on tests (written in English) of reading or language arts;

‘‘(xi) include students who have attended schools in a local educational agency for a full academic year but have not attended a single school for a full academic year, except that the performance of students who have attended more than 1 school in the local educational agency in any academic year shall be used only in determining the progress of the local educational agency;

‘‘(xii) produce individual student interpretive, descriptive, and diagnostic reports, consistent with clause (iii) that allow parents, teachers, and principals to understand and address the specific academic needs of students, and include information regarding achievement on academic assessments aligned with State academic achievement standards, and that are provided to parents, teachers, and principals, as soon as is practicably possible after the assessment is given, in an understandable and uniform format, and to the extent practicable, in a language that parents can understand;

‘‘(xiii) enable results to be disaggregated within each State, local educational agency, and school by gender, by each major racial and ethnic group, by English proficiency status, by migrant status, by students with disabilities as compared to nondisabled students, and by economically disadvantaged students as compared to students who are not economically disadvantaged, except that, in the case of a

local educational agency or a school, such disaggregation shall not be required in a case in which the number of students in a category is insufficient to yield statistically reliable information or the results would reveal personally identifiable information about an individual student;

''(xiv) be consistent with widely accepted professional testing standards, objectively measure academic achievement, knowledge, and skills, and be tests that do not evaluate or assess personal or family beliefs and attitudes, or publicly disclose personally identifiable information; and

''(xv) enable itemized score analyses to be produced and reported, consistent with clause (iii), to local educational agencies and schools, so that parents, teachers, principals, and administrators can interpret and address the specific academic needs of students as indicated by the students' achievement on assessment items.

''(D) DEFERRAL.—A State may defer the commencement, or suspend the administration, but not cease the development, of the assessments described in this paragraph, that were not required prior to the date of enactment of the No Child Left Behind Act of 2001, for 1 year for each year for which the amount appropriated for grants under section 6113(a)(2) is less than—

''(i) $370,000,000 for fiscal year 2002;
''(ii) $380,000,000 for fiscal year 2003;
''(iii) $390,000,000 for fiscal year 2004; and
''(iv) $400,000,000 for fiscal years 2005 through 2007.

Appendix B

Components of Westbrook's Action-based Learning Lab

Station: Building the Framework for Learning

Skills: Crawling, Creeping, Balance, Jumping
Academic Correlation: The concepts aid the brain in placing words on a page, reading words left to right, and writing patterns in sequence.

Station: Integrating the Senses

Skills: Rolling, Pattern Jumping, Hopping, and Balancing
Academic Correlation: Aid the brain in following flow of words, sequencing patterns in math and reading, solving problems, and sorting information.

Station: Vestibular Development

Skills: Spinning, Jumping and Landing, Bouncing
Academic Correlation: Aid the brain in putting numbers or letters in sequence, discriminating different sounds, placing letters and words on a page, and writing letters in proper proportion.

Station: Visual-Motor Control

Skills: Eye Fitness
Academic Correlation: Aid the brain in encoding the stroke of each symbol of letters and numbers, recognizing numbers, writing letters and numbers, following words from left to right, focusing on reading for longer periods, discriminating sounds, and organizing information.

Station: Visual Tracking

Skills: Ocular Pursuit, Toss and Catch, Bounce, Striking, Rope Jumping, Juggling, Kicking
Academic Correlation: Aid the brain in processing thought, organizing thoughts in sequence, discriminating likeness and differences, discriminating sounds, and advancing to higher-level thinking.

Station: High Level Thinking

Skills: Dynamic Balance, Complex Motor Control, Practice and Reinforce Academic Content
Academic Correlation: Aid the brain in anchoring information and improved memory retrieval, preparing the brain to take a test, combining many skills for higher-level thinking.

Station: Pathways Mat

Skills: Movements that allowed students to traverse pattern on a mat that facilitated the learning of the symbols representing the letters and numbers.
Academic Correlation: Engaged students in whole brain learning. The students navigate patterns on a mat using various locomotor movements. (PE 4 Life, 2010)

Appendix C

Biology I Practice Test Specifications

Test specifications are the guidelines used by the Mississippi Department of Education, test developers, and members of the Biology I Teacher Committee in developing the Biology I Test. The test specifications were drafted and finalized based upon the following information:

- General Considerations—considerations used in developing each subject area test
- Item Format—description of criteria for the development of the multiple-choice test items
- Test Format—general information on how the test is presented.

General Considerations

- Items will be written to measure the competencies of the *2010 Mississippi Science Framework.*

- Items will be appropriate in terms of difficulty, interest, reading level (8th grade), and experience.

- Items included in the assessment will be reviewed specifically for the purpose of eliminating stereotyping and bias related to age, sex, ethnicity, creed, economic status, geographic location, disability, etc.

- Test items will be machine-scorable multiple-choice (MC) questions.

- When possible and appropriate, items will be presented in a real-world context or will show relationships to real-world situations. The term *real-world* is defined as "typical of an average person's actual life experiences." Students will be expected to demonstrate a refined ability to analyze, synthesize, and correlate information to determine the correct response to such test questions.

- Information will be presented through written text or through visual materials such as graphs, tables, maps, models, or other illustrations.

• Items may require students to apply previously acquired scientific knowledge. Other items will provide information the student can use to answer the item.

• Some items may require mathematical computations.

• Decimal numbers less than 1 will be written with leading zeros.

Item Format

• Options such as "none of the above," "both A and B," and "all of the above" will **NOT** be used as answer choices.

• The item stem and answer choices should be on the same page with answer choices arranged beneath the item stem. Items with art in the answer choices may have the answer choices stacked beneath the item stem.

• Item stems will be in the form of a question.

• Numerical answer choices will be arranged in ascending order. Answer choices expressed as letters will be arranged in alphabetical order. In no case will a letter answer choice coincide with its answer option.

Test Format

• The test will be printed in black ink on white paper.

• Scenarios, graphic displays, corresponding items, and answer choices will appear on the same or facing pages.

• Negatives and superlatives used in item stems will be typed in capital letters and boldfaced (e.g., **NOT**, **LEAST**, **BEST**, and **EXCEPT**).

• The test will consist of 60 scorable and 10 experimental multiple-choice items. (Mississippi Department of Education, 2009)

Curriculum Vitae

Myralynn Billingsley Catchings

ACADEMIC BACKGROUND

2011 Doctor of Education in Teacher Leadership, Walden University-GPA 4.0

2004 Teacher Recertification for Mississippi, Mississippi State University, Starkville, Mississippi-GPA 4.0

1990 Masters of Education in Special Education, Mississippi State University, Starkville, Mississippi, Cum laude

1981 Masters of Education in Health and Physical Education, Mississippi State University, Starkville, Mississippi, Magna cum laude

1974 Bachelor of Science in Health and Physical Education, Alcorn State University, Lorman, Mississippi, Cum laude

1970 High School Diploma, N H Pilate High School, Newton, Mississippi

PROFESSIONAL TRAININGS

2009 Cultural Diversity, Mississippi Department of Education

2010 Differentiated Learning Instruction, Mississippi Department of Education

2010 The Kinesthetic Classroom: Teaching and Learning through Movement, Mississippi Department of Education

2010 Action-Based Learning, The Mississippi Department of Education's Office of Healthy Schools and Mississippi Community Education Center (MCEC)

2011 The Pyramid plus Nutrition Curriculum, Mississippi Department of Education

2011 Suicide Prevention Education, Mississippi Department of Education and the Mississippi Department of Mental Health in response to Senate Bill 2770

2011 Innovative High School Model, Mississippi Department of Education

2011 IDEA's Discipline Requirements and Bullying, Mississippi Department of Education

2011 School Health Index Training, Mississippi Department of Education

2011 Choosing the Best Abstinence Curriculum Training, Mississippi Department of Education

2011 Fitness for Life Training, Mississippi Department of Education

PROFESSIONAL MEMBERSHIPS

2004 – present - The American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD)

1977-1984 and 1989-present - National Education Association/Mississippi Association of Educators

1977-1984 and 1989-present - Mississippi High School Activities Association

1984-1986 - Parent and Teacher Organization, West Town Elementary School, Albany, Georgia

1986-1987 - Parent and Teacher Organization, Waller Middle School, Prairie View, Texas

PROFESSIONAL CERTIFICATIONS

Standard First Aid, American Red Cross, Mississippi

CPR, American Red Cross, Mississippi

Commercial Driver's License-Air Brakes (Bus), State of Mississippi

ORGANIZATIONAL MEMBERSHIPS

1971-present - Alpha Kappa Alpha Sorority, Incorporated

1983-2009 - Fellowship of Christian Athletes, Mississippi

1984-1986 - M & W Community Gospel Choir, Albany, Georgia

PROFESSIONAL INTERESTS
Action-Based Learning

Dissertation Title: Integrated Health and Physical Education and Student Achievement

PROFESSIONAL BUSINESS EXPERIENCE
1977-1979 - Income Tax Preparations, Long and Short Forms

1979-1983 - Bookkeeping, C & M Recreation, Mississippi

1986-1988 - Preparations of Budget and Travel Vouchers for Women's Basketball and Cheerleading, Prairie View A&M University, Prairie View, Texas

PROFESSIONAL EXPERIENCE
2007-present – Founder and Director, Diamond Club, Mississippi. Develop and design community service activities for female high school scholars.

2003-2008 – Program Organizer, Alpha Care Summer Program, Lauderdale County Area. Manage educational programs for children (Ages 9 -18) through collaboration with Boys and Girls Club, Alpha Kappa Alpha Sorority, Inc., and Lauderdale County Co-op.

2009-present – Weight and Cardiovascular Training for Teachers. Design physical fitness plans for teachers at ABC High School to promote Healthy Lifestyles.

ACHIEVEMENTS

Personal: Most Valuable Female Basketball Player and Most Creative Majorette, N H Pilate High School, Newton, Mississippi, 1969

Most Outstanding Female Athlete, N H Pilate High School, Newton, Mississippi, 1970

Outstanding (Golden Girl) Majorette, Alcorn's Marching Band of Distinction, Alcorn State University, Lorman, Mississippi, 1972 (Pictured on front cover of Ebony magazine).

Who's who among Students in American Colleges and Universities, Alcorn State University, Lorman, Mississippi, 1974

Author of fictional novel "From Sin to Glory…Getting the desires of your heart" by Myra Billingsley @ authorhouse.com

Coaching: Junior Varsity Cheerleader Coach, ABC High School, Mississippi, 2010-present, 2010 State Champs Junior Varsity

Head Track Coach, DEF Junior High School, Mississippi, 1978-1984, District Five Junior High Track Champs

Junior High Girls' Head Basketball Coach, GHI Junior High School, Mississippi, District Five Junior High Basketball Champs, 1980, 1981, 1982, 1984, 1992, 2002, and 2004.

Outstanding Service Award, Women's Basketball Assistant Coach, Prairie View A & M University, Prairie View, Texas, 1987.

WORKSHOP PRESENTATIONS

- Technology in the Classroom, Training for new teachers
- The Kinesthetic Classroom: Teaching and Learning through Movement
- Action-Based Learning
- The Pyramid plus Nutrition Curriculum
- Suicide Prevention Education
- Healthy School Initiatives
- Walk to School Mississippi