Summer 8-2008

# Physical Education Content Knowledge and Physical Activity Behaviors of Mississippi High School Students

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# PHYSICAL EDUCATION CONTENT KNOWLEDGE AND PHYSICAL ACTIVITY BEHAVIORS OF MISSISSIPPI HIGH SCHOOL STUDENTS

by

Christina Leigh Lumpkin Martin

A Dissertation
Submitted to the Graduate Studies Office
of The University of Southern Mississippi
in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy

Approved:

August 2008

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The present study investigated physical education content knowledge, physical activity behaviors, and body mass indexes of 386 Mississippi ninth (n=236 ) and twelfth (n=150) grade students with a goal of establishing evidence-based needs to modify physical education curricula. Results of this study suggested that a significant, direct relationship did exist in the *Assessment of Sub-disciplinary Knowledge in Physical Education: Exercise Physiology* (*ASK PE: EXP*);(Ayers, 2004) scores and scores from the *Modifiable Activity Questionnaire for Adolescents* (*MAQ-A*);(Aaron & Kriska, 1997) for both ninth and twelfth grade students. Findings also suggested that physical education content knowledge (exercise physiology) is more likely to contribute to twelfth grade reported physical activity scores than ninth grade reported physical activity scores. However, ninth graders were more active than twelfth graders. This is possibly explained by the small difference (5%) in *ASK PE: EXP* scores between ninth (M *ASK PE: EXP* score = 52%, SD=.22) and twelfth graders (M *ASK PE: EXP* score = 57%, SD = .21). As a whole, results indicated that Mississippi ninth and twelfth grade students' average *ASK PE: EXP* score was lower (M = 53%, SD = .22) than students in 16 other states (M = 62%, SD = 7.65). Further, majority of Mississippi high school students are performing significantly below the established, research-based cutoff score of 62% (observed *N*

below 62% = 236 and observed *N* above 62% = 150). This is notable, because findings also suggested that students who scored higher (M knowledge = 76%, SD = .08);(M activity = 8.6 hours/week, SD = 9.7) or above 62% on the *ASK PE: EXP* were more likely to be active during a weekly basis compared to those who scored lower (M knowledge = 39%, SD = .14);(M activity = 5.8 hours/week, SD = 9.8) or below a 62% on the *ASK PE: EXP.* With this noted, it was recommended that Mississippi high schools evaluate the current physical education programs, and strive to implement curricula that can provide students with the necessary knowledge and skills to make lifelong healthy decisions.

# DEDICATION

This is dedicated to my parents who have always encouraged me to pursue challenging endeavors, to my husband who has provided love, support, and understanding throughout this entire process, and to my dear son who is the most precious and wonderful blessing I have ever known. Thank you and I love you all!

# ACKNOWLEDGEMENTS

I would like to first acknowledge my committee members for their guidance and support throughout this process. You have all supported me academically, professionally, and personally, and I am forever grateful to each of you. To my Chair, Dr. Speed, you have been so motivating and encouraging. I am most thankful for your understanding and compassion throughout this process. You are a wonderful mentor, and I have gained valuable experiences from working with you. Thank you! To Dr. Gould, you have truly made this an incredible learning experience. I feel that through you, I have gained insight and understanding of numerous research components. Thank you for always taking the time to provide feedback and recommendations to make this project stronger. To Dr. Krebs, it has been great to work with you on numerous projects. I hope to continue working with you in the future. Thanks for everything! To Dr. Blom, I admire you for being a great leader and role model. Your energy is contagious, and your professionalism is superior. You are someone who I truly look up to and respect! Thank you for always taking the time to answer my questions, and, further, providing feedback in such an uplifting manner. You have been a cheerleader for me in this process – so thanks for just being you! To, Dr. Phillips, thank you for always taking the time to help me grow professionally! You have been a great teacher and role model for our industry! Thanks, mostly, for being dependable throughout my entire program! I truly appreciate your support!

To my peers, this process would not have been the same without you! We have leaned on each other throughout this program, and I can not express how much your support has meant! A special thanks to Laurie Neelis, Dr. Ashley Gibson, Dr. Stacey

Hall, and Dr. Laura Miller. Laurie, it has been nice to have you a couple of doors down, so that we could talk each other through this! You truly made the long, hard days a bit better – it was nice to know I had someone to share the ups and downs with! Stacey, it seems like every time I am around you, I learn something new! You are fun to work with, and I hope to continue working together in the future! Ashley, you have become one of my best friends, and friendships like yours have made this process worth it! You have been an encourager when I needed it most! Thanks for all of your love and support! And, to Laura, I do not know what I would have done without you! You are my lifetime best friend! You have been a shoulder for me to cry on and the best pal ever to share a laugh with! I love you so very much, and I am so thankful to have you in my life!

There have been so many individuals in my life who have supported me through this process, and I thank you all! To my family and friends, you mean the world to me! You each make my life's journeys worthwhile!

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# CHAPTER I

## INTRODUCTION

Obesity is a disease that is plaguing people of each gender, all ages, races, and socioeconomic statuses within this nation (Dietz, Lee, Wechsler, Malepati, & Sherry, 2007). In a recent poll conducted by the Trust for America's Health Foundation (TFAH), 85% of Americans believe obesity is an epidemic (Levi, Segal & Gadola, 2007). Increasing prevalence rates, which can be defined as ratios representative of the number of occurrences of a disease at a given time period or event to the number of units at risk in the population (Webster-Online, 2008), have helped to justify an obesity "epidemic" label. According to the Center for Disease Control and Prevention (CDC, 2007, a.), the obesity trend from 1985 to 2005 has increased dramatically. For example, the CDC reported that in 1991 four states, Louisiana, Michigan, Mississippi, and West Virginia, had obesity prevalence rates of 15 to 19% and no states had rates at or above 20% (¶1). As of 2005, the CDC reported that four states had obesity prevalence rates less than 20%, while 17 states had prevalence rates equal to or greater than 25%, with three of those states, Louisiana, Mississippi, and West Virginia, having prevalence rates equal to or greater than 30% (¶3). In 2005 and 2006, the state of Mississippi was named at the bottom of the healthiest states, ranking 49$^{th}$ and 50$^{th}$ respectively (Infoplease, 2007; Levi et al., 2007). In addition to this title, Mississippi has also been labeled as the "fattest state" (CDC, 2007; Levi et al., 2007). Mississippi currently has the eighth highest rate, 17.8%, for overweight adolescents, but is the first state to acquire an adult obesity prevalence rate of 30.6% (Segal, 2007).

In an attempt to combat health issues among Mississippi adolescents, Governor Haley Barbour passed Senate Bill 2369, the "Mississippi Healthy Students Act" (Barbour, 2007). This has paved the way for more time in physical education beginning in the fall of 2007. Specifically, the bill will require schools to provide at least 150 minutes of physical activity-based instruction as well as 45 minutes of health education per week for students in kindergarten through eighth grade (¶4). Additionally, the bill will require that students in ninth through twelfth grades complete one-half of a Carnegie unit, or approximately 60 hours, of physical education or related activity to meet graduation criterion (¶4).

Though the Mississippi Healthy Students Act is movement in the right direction to contend with health issues in Mississippi, there is one major gap with the plan. Students in grades nine through twelve are only required to take one-half of a Carnegie unit in physical education or complete 60 hours of physical education from the time they enter ninth grade through the final semester of their twelfth grade year in order to be eligible for graduation. Beyond this requirement, high school students have no physical education obligation. This is problematic because research suggests that physically active adolescents are more likely to remain physically active into adulthood (CDC, 2007; Telama, Yang, Hirvensalo, & Raitakari, 2006). Additionally, some studies show that there is a correlation among fitness knowledge and physically active individuals (Adams, Graves & Adams, 2006; Cason & Logan, 2006; DiLorenzo, Stuckey-Ropp, Vander & Gotham, 1998; Lubans & Sylva, 2006; Roberts, Evans & Ormond, 2006). Therefore, if educators can expose students to physical education concepts and practices

through their high school careers, with the goal of providing students a broader knowledge base of physical education, students may make healthier lifestyle choices.

Efforts to increase physical activity among youth have led the CDC, the National Association for Sport and Physical Education (NASPE), and the American Heart Association (AHA) to propose comprehensive daily physical education for children K-12 (Summerfield, 2008). For many youth, the only preparation for active lifestyles stems from the promotion of physical activity and fitness through physical education. Therefore, emphasis for physical education should be placed on preparing youth to make healthy choices, thereby providing students the necessary knowledge and skills to make such decisions. In accordance with this belief, NASPE has a fundamental goal to teach quality physical education that focuses on teaching skills and concepts to make lifelong healthy choices (NASPE, 2007). Expanding on this idea, NASPE defines a physically educated person as: "1) one who has learned necessary skills to perform a variety of physical activities; 2) one who is physically fit; 3) one who participates regularly in physical activity; 4) one who knows the implications and benefits of involvement in physical activity; and, 5) one who values physical activity and its contribution to a healthful lifestyle" (Mohnsen, 2003, p. 2).

Much of the literature focused on quality physical education emphasizes the "education" aspect of physical education with a goal of preparing students to make lifelong healthy choices (Ayers, 2001; Ayers, 2004; Mohnsen, 2003; NASPE, 2007). Mississippi Governor Haley Barbour agrees, and in 2007 stated that, "By teaching our children the importance of good nutrition and physical activity, we are taking the necessary actions to ensure the benefits of a healthier lifestyle—lower costs, more job

creation, mental clarity, and a longer and better quality of life" (Barbour, 2007, ¶5). In line with this statement is the mission of the Council on Physical Education for Children (COPEC): "COPEC is committed to helping children develop motor skills, healthy lifestyles, and positive attitudes for lifelong physical activity through the development, review, and dissemination of information that enhances and promotes quality physical education" (NASPE, 2007, ¶1). Several studies support this claim (Irwin, Symons, & Kerr, 2003; Ayers, 2004; Wallhead & Buckworth, 2004) and some studies make the link between knowledge and behaviors (Adams et al., 2006; Cason & Logan, 2006; DiLorenzo et al., 1998; Lubans & Sylva, 2006; Roberts et al., 2006). However, no studies report what students actually know relative to the field of physical education and the impact of such knowledge on physical activity and obesity (Ayers, 2004). Furthermore, Ayers suggests that no research exists on whether or not physical educators are teaching the essential physical education concepts that students should know upon graduating.

With developed physical education philosophies, one would think that students would be progressing towards healthy lifestyles. However, inactivity and obesity trends are escalating and accounting for a nation that is approximately two-thirds overweight (Levi et al., 2007). Though numerous genetic, environmental, and behavioral factors contribute to being overweight and obese (CDC, 2007; Hill & Donahoo, 2002; Wing et al., 2001; Wing & Tate, 2002), the focus for this research project is centered on the cognitive domain of physical education and physical activity behaviors, both of which can be considered as behavioral factors of obesity. Specifically, this study sought to investigate physical education content knowledge, physical activity behaviors, and body

mass indexes of Mississippi high school students with a goal of establishing evidence-based needs to modify physical education curricula.

## Purpose of Study

The purpose of this study was to investigate physical education content knowledge, physical activity behaviors, and body mass indexes of Mississippi high school students with a goal of establishing evidence-based needs to modify physical education curricula. Specifically, the study sought to determine if Mississippi high schools were teaching quality physical education by: 1) determining if a relationship existed between physical education content knowledge and physical activity behaviors of ninth and twelfth grade Mississippi high school students, 2) examining if differences existed in the level of physical education content knowledge between ninth and twelfth grade students (as well as between high schools classified by academic rating), 3) investigating body mass indexes of Mississippi high school students to determine if relationships existed between self-reported BMI level of physical education content knowledge, and level of physical activity, and 4) exploring the overall proportion of students in Mississippi schools who completed the *Assessment of Sub-disciplinary Knowledge in Physical Education: Exercise Physiology* (*ASK PE: EXP*) with a literature-based cutoff passing score (62% of accuracy). Ultimately, the study sought to identify physical "education" in combination with physical activity as key components related to physical activity behaviors, thus having the possibility of attacking the obesity epidemic. The status of Mississippi high schools in teaching this information was addressed. The results of this study contributed to existing literature on the importance of

physical education content knowledge as well as offered state-specific information for Mississippi physical education programs.

## Research Questions

This study was guided by the following research questions:

Question 1: Does a relationship exist between physical education content knowledge scores and the physical activity behavior scores of ninth grade Mississippi high school students?

Question 2: Does a relationship exist between physical education content knowledge scores and the physical activity behavior scores of twelfth grade Mississippi high school students?

Question 3: Do differences exist in physical education content knowledge scores between ninth grade and twelfth grade Mississippi high school students?

Question 4: Do differences exist in physical activity behavior scores between ninth grade and twelfth grade Mississippi high school students?

Question 5: Do differences exist in physical education content knowledge scores among Mississippi high schools based on academic rating?

Question 6: Does a relationship exist between physical education content knowledge scores and BMI of ninth grade Mississippi high school students?

Question 7: Does a relationship exist between physical education content knowledge scores and BMI of twelfth grade Mississippi high school students?

Question 8: Does a relationship exist between physical activity scores and BMI of ninth grade Mississippi high school students?

Question 9: Does a relationship exist between physical activity scores and BMI of twelfth grade Mississippi high school students?

Question 10: What is the proportion of ninth grade students who complete the *ASK PE: EXP* with a literature-based cutoff passing score?

Question 11: What is the proportion of twelfth grade students who complete the *ASK PE: EXP* with a literature-based cutoff passing score?

## Null Hypotheses

This study was guided by the following null hypotheses:

$H_{O1}$: No relationship will exist between Mississippi ninth grade physical education content knowledge scores and Mississippi ninth grade average weekly physical activity behavior scores.

$H_{O2}$: No relationship will exist between Mississippi twelfth grade physical education content knowledge scores and Mississippi twelfth grade average weekly physical activity scores.

$H_{O3}$: No differences will exist between Mississippi ninth grade physical education content knowledge scores and Mississippi twelfth grade physical education content knowledge scores.

$H_{O4}$: No differences will exist between Mississippi ninth grade physical activity behavior scores and Mississippi twelfth grade physical activity behavior scores.

$H_{O5}$: No differences will exist in physical education content knowledge scores between Mississippi high schools based on academic ratings.

$H_{O6}$: No relationship will exist between Mississippi ninth grade physical education content knowledge scores and Mississippi ninth grade high school students' BMI.

$H_{O7}$: No relationship will exist between Mississippi twelfth grade physical education content knowledge scores and Mississippi twelfth grade high school students' BMI.

$H_{O8}$: No relationship will exist between Mississippi ninth grade average weekly physical activity scores and Mississippi ninth grade high school students' BMI.

$H_{O9}$: No relationship will exist between Mississippi twelfth grade average weekly physical activity scores and Mississippi twelfth grade high school students' BMI.

$H_{O10}$: The proportion of selected Mississippi high school ninth grade students who complete the *ASK PE: EXP* will be equally distributed above and below a research-based, cutoff score of 62%.

$H_{O11}$: The proportion of selected Mississippi high school twelfth grade students who complete the *ASK PE: EXP* will be equally distributed above and below a research-based, cutoff score of 62%.

## Definition of Terms

*Assessment of Sub-disciplinary Knowledge in Physical Education Battery (ASK PE Battery):* *The ASK PE Battery* measures the physical education content knowledge of students at the kindergarten level through twelfth grade. The *ASK PE Battery* assesses knowledge in the following areas: motor learning, motor development, biomechanics, exercise physiology, historical perspectives, social psychology, and aesthetic experiences. For this study, 38 questions adapted from the Exercise Physiology section were included on the test (Ayers, 2004).

Body Mass Index (BMI): A measure of body weight that is useful in classifying the health risks of body weight. It uses a mathematical formula that takes into account an

individual's height and weight. BMI equals a person's weight in kilograms divided by height in meters squared (American College of Sports Medicine [ACSM], 2000).

Carnegie Unit: One "Carnegie" unit is equivalent to 120 hours of instruction. It is a factor used to standardize all credits indicated on transcripts across the study. It is defined as the number of credits a student receives for a course taken every day, one period per day, for a full school year (The Carnegie Foundation, 2007).

*Modifiable Activity Questionnaire for Adolescents (MAQ-A):* *The Modifiable Activity Questionnaire for Adolescents* is an instrument that measures total past-year averaged hours of activity per week (Aaron & Kriska, 1997).

National Association for Sport and Physical Education (NASPE): NASPE is an organization that seeks to enhance knowledge and professional practice in sport and physical activity through scientific study and dissemination of research-based and experiential knowledge to members and the public (NASPE, 2007, ¶ 1).

Obesity: Obesity is defined as the percent body fat at which disease risk increases. It may be classified as a body mass index of 30.0 $kg/m^2$ (ACSM, 2000, p. 214; CDC, 2007).

Overweight: Overweight refers to increased body weight in relation to height, when compared to some standard of acceptable or desirable weight. Individuals with a BMI of 25 $kg/m^2$ to 29.9 $kg/m^2$ are considered to be overweight (CDC, 2007).

Physical Activity: Physical activity can be defined as bodily movement that is produced by the contraction of skeletal muscle and substantially increases energy expenditure (ACSM, 2000, p.4).

Physical Education: Physical Education can be considered as an educational process that uses physical activity as a means to help people acquire skills, fitness, knowledge and attitudes that contribute to their optimal development and well-being (NASPE, 2007).

Prevalence: Prevalence is a term used in epidemiology that provides a ratio (for a given time period) of the number of occurrences of a disease or event to the number of units at risk in the population. Prevalence can be obtained by looking at the number of cases in an area (at a specified time period), and dividing those cases by the population at risk (at the specified time period);(Online, 2008).

Recommended physical activity requirements: As a general guideline, the CDC recommends that individuals participate in 60 minutes of activity per day (at least 7 hours weekly);(CDC, 2007).

## Assumptions

1.) Participants responded to the *ASK PE: EXP* completely and accurately.

2.) Participants responded to the *MAQ-A* completely and accurately.

3.) Participants were ninth and twelfth grade students enrolled in Mississippi public high schools, for academic year 2007-2008.

4.) Participants spent majority of their kindergarten through twelfth grade education enrolled in Mississippi public schools.

5.) Data was obtained, recorded, and interpreted accurately.

6.) Students self-reported BMI accurately.

## Delimitations

1.) The study was delimited to randomly-selected public high schools in Mississippi, and does not include every Mississippi high school.

2.) The study was delimited to randomly selected ninth and twelfth grade high school students, and does not include every ninth or twelfth grade student enrolled in a Mississippi public high school.

3.) All students were evaluated on the same activity standard, where seven hours of activity is recommended per week.

4.) Physical education content knowledge was assessed using the *ASK PE: EXP*.

5.) Only content knowledge of Exercise Physiology was assessed and compared to NASPE standards. Therefore total NASPE content knowledge was not addressed.

6.) Physical activity lifestyle behaviors were measured using the *MAQ-A*.

## Limitations

1.) The *ASK PE: EXP Test* and the *MAQ-A* were given by numerous principals and teachers.

2.) Students' recall of past year's physical activity were not controllable.

3.) Students' self-report of BMI were not controllable.

4.) Response rate was not controllable.

5.) Total Physical Education knowledge was not addressed.

6.) Only the Exercise Physiology subsection of the *ASK PE Battery* was used to assess physical education knowledge.

## Justification of the Study

As previously mentioned, obesity is plaguing people of each gender, all ages, races, and socioeconomic statuses within this nation (Dietz et al., 2007). Combating obesity remains a challenge with numerous specialists and researchers. One reason the battle is difficult is due to the fact that obesity is the result of numerous factors, most

often a combination of genetic, behavioral, and environmental factors (CDC, 2007; Hill & Donahoo, 2002; Wing et al., 2001; Wing & Tate, 2002). Of these, behavioral factors, which include energy intake, physical activity and sedentary behavior, are more controllable than genetic or environmental aspects (CDC, 2007, ¶4-7). Considering behavioral factors, physical activity can impact energy intake and sedentary behaviors. Therefore, for the purpose of this study, the emphasis is on physical activity, and the promotion of physical activity through physical education knowledge.

On a yearly basis, the CDC (2007) collects and reports data from adults using the Behavioral Risk Factor Surveillance System (BRFSS), a series of monthly telephone interviews conducted by health department officials, to assess obesity trends in the United States. Results indicate that over the past 20 years, obesity has risen significantly among adults and children. More specifically findings suggest that over 30 % of adults are obese, while overweight and obese children and adolescents have tripled since 1980. These statistics are alarming because overweight or obese individuals have a much greater risk of many conditions including: hypertension, dyslipidemia, type 2 diabetes, coronary heart disease, stroke, gallbladder disease, osteoarthritis, sleep apnea, respiratory problems, some cancers, and psychological stresses (CDC, 2007; Joyal, 2004). As it is well-known, most of these conditions can be controlled through diet and exercise (ACSM, 2000). For this reason, poor diet and physical inactivity have been identified as leading causes of death, contributing to approximately 400,000 deaths in 2000 (Kiem, Blanton, & Kretsch, 2004).

Physical inactivity and poor diet are no longer a concern for health alone, but additionally, they are proving to be a financial trepidation for everyone (Sanchez, 2004).

Some have estimated that nine percent or $93 billion of total health care costs stem from overweight or obese causes. The CDC (2007) actually estimates that obesity indirect and direct costs are as high as $117 billion annually. Both calculations are startling, and provide evidence that obesity is an epidemic plaguing an entire nation.

Though this disease is affecting the nation, the state of Mississippi has an obesity problem like few other states (Segal, 2007). As noted earlier, Mississippi consistently ranks at the bottom of the healthiest states, and holds the "fattest" state title (CDC, 2007; Levi et al., 2007). The United Health Foundation (2006) claims the state of Mississippi has an obesity prevalence rate of 30.9%. Also, as reported by the United Health Foundation, Mississippi's obesity prevalence rate has increased 106% since 1990. This is especially disturbing, because even in 1990, Mississippi ranked as the second most obese state. Additionally, data from the National Center for Health Statistics (NCHS) (2007), compared the state of Mississippi's health averages to those of the nation's health averages, and results were disconcerting. It was determined that Mississippi children exercise and participate in sport less than other children throughout the nation. Also, for Mississippi youth, ages 10 through 17, overweight and obese averages were higher than the nation's averages. This is consistent with findings from Kolbo, Penman, Meyer, Speed, Molaison, and Zhang (2006) who gathered measured height and weight reports versus self-reported height and weight, and found that 24% of Mississippi students in first grade through eighth grade are overweight, while another 14.7% are at risk for becoming overweight. This estimate is higher than previous reports which have suggested that 17.8% of Mississippi youth are overweight. Due to the discrepancy in results, Kolbo et al. suggested that the subsequent self-reported data may have actually underestimated the

prevalence of overweight Mississippi youth. Though an estimated six percent difference was found, one thing holds consistent, Mississippi has an overweight and obesity problem.

The TFAH (Levi et al., 2007) reported the state of Mississippi had the highest adult obesity percentage for the third year in a row. Also, Mississippi's youth ranked eighth for overweight status (2007). Other key findings by the TFAH reported for the state of Mississippi conclude that:

- Thirty-two percent of adults in Mississippi compared to a national average of 22% of adults, report that they do not engage in any physical activity.
- Mississippi is not one of 17 states that require their school lunches, breakfasts, and snacks to meet higher nutritional standards than the U.S. Department of Agriculture (USDA).
- Mississippi is not one of 22 states that have set nutritional standards for foods sold in vending machines, a la carte, in school stores, or in bake sales in schools.
- Mississippi is not one of 26 states that limits when and where these foods may be sold on school property beyond federal requirements.
- Mississippi is not one of 16 states that screen students' body mass indexes or fitness status and confidentially provide information to parents or guardians.

Numerous data support that Mississippi has an overweight and obesity dilemma (CDC, 2007; Dietz et al., 2004; Levi et al., 2007). Given Mississippi's difficulties with this epidemic, the state is a prime location for obesity research. Due to the many factors

contributing to this disease, it is critical that researchers find appropriate channels to challenge this epidemic. Providing adolescents greater knowledge to make healthier lifestyle decisions may potentially provide relief to this state's epidemic and pave the way for a healthier Mississippi.

# CHAPTER II

# REVIEW OF LITERATURE

The aim of this review is to clearly represent the need to examine the relationship of Mississippi high school students' physical education content knowledge and physical activity lifestyle behaviors by evaluating existing literature. It is important to note, that due to limited research on the effectiveness of physical education programs as well as activity trends in Mississippi high schools, related information is examined. In order to introduce an organized and direct presentation of the literature, this chapter has been primarily divided by the study's variables into the following sections: 1) The Obesity Epidemic, 2) Theoretical Framework, 3) Mississippi Public Schools, 4) Physical Education and Physical Activity, 5) Physical Education Content Knowledge, 6) Physical Education Curricula, 7) Healthy Impacts of Physical Education and Physical Activity Programs, 8) Assessing Body Mass Index, and 9) Summary.

## The Obesity Epidemic

As defined by Green, Swartz, Mayshar, Lev, Leventhal et al., (2002), an epidemic is a classification of an illness, health behavior, or health-related event in a given human population, during a given period, at a rate that substantially exceeds what is "expected,". For some, this definition is subjective versus objective, because it is based solely on what is or is not expected. As the definition relates to obesity, unexpected increases over a 20 year time period in overweight and obese cases have been reported by the Center for Disease Control (2007). In a recent poll conducted by the Trust for America's Health Foundation (TFAH), 85% of Americans believe obesity is an epidemic (Levi, Segal & Gadola, 2007).

Gaining control of rising overweight and obese cases has proven to be difficult for medical professionals and researchers primarily because obesity is related to numerous contributing factors. Often, obesity is a result of a combination of such factors, most of which are categorized in one of the three areas: genetic, behavioral, or environmental (CDC, 2007; Hill & Donahoo, 2002; Wing, Goldstein, Acton, Birch, Jakicic, Sallis, et al., 2001; Wing & Tate, 2002). Distinctly and collectively these factors have contributed to a nation that is approximately 60% overweight among the adult population and 20% to 25% among the youth population (Hill & Donahoo, 2002). The effect that genetics has on obesity is not clear. However, it is documented that individuals who have at least one overweight or obese parent are likely to become overweight or obese as an adult (Baba, Iwao, Koketsu, Nagashima, & Inasaka, 2006; Miller, 2004).

Baba et al. (2006) studied 39,837 (males = 20,207, females = 19,734) high school students by providing a short questionnaire with family history and extent physical activity participation questions. Two-way ANOVA with repeated measures analyses revealed that family-history of high BMI combined with unfavorable exercise conditions, or low activity levels, yielded increases in BMI. Researchers concluded that interventions to promote exercise in adolescents, particularly adolescents with overweight or obese parents, should be encouraged. Obesity trends are apparent in families, but, the question is raised of whether or not it is an "uncontrollable" gene or whether the issue is a result of family habits (Clark, 2007).

Though genetic research is an area of interest for researchers, most approaches for obesity interventions center on either behavioral (Sharma, 2006) or environmental aspects due to their changeability. Behavioral factors encompass two major aspects of an

individual's health routine, physical activity level and nutritional practices (CDC, 2007).

Traditionally, research that is focused on behavioral modification addresses topics including: self-monitoring, diet modification, physical activity, stimulus control, changing the act of eating, problem-solving, social support, restaurant eating, changing cognitions, managing stress, motivation, and relapse-prevention (Wing & Tate, 2002). Though there is some cross-over of behavioral and environmental factors (Hill & Donahoo, 2002; Wing et al., 2001), they are distinct; behaviors are actions or responses to environments, surroundings, or situations. In a recent review, it was noted that environmental changes may be leading to the increasing prevalence of obesity (Wing et al., 2001). Specific to American culture, environmental factors include the availability of high, energy-dense foods; the modernization and technical innovations that allow individuals to move less; the adherence or implementation of company, governmental or other organizational policies; the accessibility to educational systems (and the ratings of those educational systems); and the influences from home, community, church, and school atmospheres (Hill & Donahoo, 2002). Unlike genetics, modifications can be made in either behaviors or environments.

Though there are genetic, behavioral, and environmental factors related to obesity, there are few variables that can easily be altered. Most variables that can be modified without as much difficulty are behavioral. For example, behavioral factors like diet, activity level, problem-solving, and cognition changes are less complicated to alter when compared to implementing environmental changes such as: the availability of high, energy-dense foods; the modernization and technical innovations that allow individuals to move less; the adherence or implementation of company, governmental or other

organizational policies; the accessibility to educational systems (and the ratings of those educational systems); and the influences from home, community, church, and school atmospheres (Hill & Donahoo, 2002). Additionally, the escalation of obesity parallels increases in behaviors of mean food energy intake and physical inactivity (Joyal, 2004).

In a related study, main predictors of obesity such as eating behaviors and physical activity were explored (Holstein, Henriksen, Iner, Rasmussen, & Due, 2007). The intent of the study was to examine self-reported physical activity versus inactivity trends of adolescents. Over a 14 year period, children between the ages of 11 and 15 were investigated. This study defined low activity as less than seven hours of activity per week, while moderate to high levels of activity were seven or more hours of activity per week. Results indicated that high activity is greater among male adolescents. However, as a whole, adolescents are not meeting the recommended, 60 minutes per day of activity. Therefore, the study suggested that great efforts be made to increase physical activity in the adolescent population.

Even with numerous recommendations to increase physical activity and reduce overweight or obese incidences, this disease seems to be on the rise (CDC, 2007; Dietz, Lee, Wechsler, Malepati, & Sherry, 2007). Data recorded using the National Health and Nutrition Examination Survey (NHANES) reported that prevalence rates for children and adolescents are three times that of the *Healthy People 2010* goal (2007), which equals approximately 30% of American youngsters being overweight or obese (Keren, 2005). Though many factors play a role in this epidemic (CDC, 2007; Clark, 2007; Hill & Donahoo, 2002; Joyal, 2004; Wing et al., 2001; Wing & Tate, 2002) a lack of emphasis

on physical activity in the adolescent population seems to be a primary culprit aiding the escalation of obesity (Dietz, 2004; Keren, 2005).

This is advanced by the limited research that examines the determinants of exercise behavior among youth, specifically to establish whether adolescents are meeting recommended exercise guidelines. Downs, Graham, Yang, Bargainnier, and Vasil (2006) sought to contribute research regarding psychosocial and cognitive determinants of physical activity and specifically, predictors that could promote lifelong fitness. Researchers examined the determinants of exercise intention and past exercise behavior (PEB) using theories of reasoned action and planned behavior (TBP). Additionally, researchers studied the influences of sex and group, which was defined as those who met exercise guidelines and those who did not meet exercise guidelines. Various self-report measures were utilized for this study including a *Personal History Questionnaire*, attitude, subjective norm, perceived behavioral control (PBC), intention, and past exercise behavior assessments. This study was part of another longitudinal project assessing correlates of physical activity among adolescents. A cross-sectional design was used with descriptive statistics, Multiple Analysis of Variance (MANOVA), and Pearson correlations. The interaction of sex and grade, and the main effect for grade were not significant. However, group differences among sex were significant. Males scored higher on measures of intention, perceived behavioral control, and past exercise behavior. After further examining sex, running correlations across measures, intention to exercise was most strongly correlated with past exercise behavior and perceived behavioral control was most strongly correlated with intention among all participants and for both males and females. Overall findings suggested that perceived behavior control and

intention predicted past exercise behavior. TBP, a belief-based, social cognitive theory developed as an extension of the reasoned action theory, was found to predict exercise intention for individuals who did and did not meet exercise recommendations. Downs et al. (2006) suggested that future research should include having a better understanding of active versus inactive youth; this grasp will potentially enable youth to attain activity levels that meet exercise recommendations.

## Theoretical Framework

Though statistics support the need to fight obesity as well as provide direction in battling the disease (CDC, 2007; Hill & Donahoo, 2002; Levi et al., 2007) difficulties in pin-pointing preventive focus areas are impeding progress. It is determined that increases in activity can help account for consuming increased amounts of energy-dense foods (ACSM, 2000), but a remaining question for health professionals is, "What steps are necessary to encourage individuals to pursue physically active lifestyle?"

Numerous theories have been developed to explain reasons for which individuals perceive activity as important, and further add to the motivation that contributes to the actuality of engaging in exercise. Some popular theories include but are not limited to: Social Cognitive Theory, Health Belief Model, Protection Motivation Theory, Theory of Reasoned Action, Theory of Planned Behavior, Transtheoretical Model, and the Self Determination Theory (Carron, Hausenblas, & Estabrooks, 2003). Though each of these theories present rationale for participating in physical activity, no single theory accounts for sole justification of why individuals partake in physical activity (2003). In other words, individuals who engage in exercise do so for varying reasons, most of which are established in the aforementioned popular models and theories.

The focus of this study is to explore the cognitive component of physical education, and determine if it has any influence on physical activity and BMI, particularly in the adolescent population. Therefore, it is critical to highlight and understand some of the basic knowledge components of popular theories. For instance, the Social Cognitive Theory implies that behavior is ultimately influenced by a combination of environmental factors and personal factors (Carron et al., 2003). Cognition or knowledge is a deciding personal factor, and therefore, indirectly impacts behavior.

The Health Belief Model is a widely-used theoretical framework for health behavior (Carron et al., 2003). According to the Health Belief Model, the underlying variables for behavior modification depend on values assigned to a particular goal and the perceived likelihood that a certain action will contribute to the achievement of that goal. Also, demographic, psychosocial, and structural factors are deemed important for predicting health behavior (2003). Once again, knowledge does not directly or solely influence behavior, but it is considered a structural factor, that may indirectly contribute to behavior modification.

The Transtheoretical Model consists of five main components all which occur over time and play a role in behavior change. These stages include: pre-contemplation, contemplation, preparation, action, and maintenance (Carron et al., 2003). Yet again, knowledge is not singled-out as a primary contributor of behavior change, but the Transtheoretical Model subtly refers to knowledge as an important initiator of the process of change. Specifically, it is noted that in order to begin a stage of change, an individual must gather information including benefits and consequences of regular physical activity,

and make a decision to change and existing behavior (2003). Therefore, knowledge is indirectly a part of the Transtheoretical Model.

Though the aforementioned theories and models are more popular in evaluating behavior change specifically related to exercise or physical activity, this study employed the Knowledge-Attitude-Behavior Model (K-A-B), which corresponded with the ideals that were likely to be taught in an academic setting. The K-A-B model is considered a communication campaign model and is used primarily for public and family health initiatives (Farrior, 2005). As a premise, "the K-A-B Model asserts that education leads to greater awareness, attitude change, and responsible behavior" (p.4). As with most models, the K-A-B Model has its limitations. The K-A-B Model exclusively focuses on knowledge to promote behavior change. For this reason, it corresponds well with this study; however, this is also a shortcoming of this model. It is not as complex as the previously mentioned models, and therefore lends way for two major barrier groups: individual capabilities and external constraints. Individual capabilities would include "lack of specific skills, illiteracy, low social status, lack of resources, lack of empowerment, habits and routines" (p.4). External constraints might include: "lack of choices, laws and regulations, available technologies, social norms and expectations, social, economic, and political contexts" (p.4). In reviewing these barriers, a positive school environment can contribute to minimizing most of these obstructions to gaining knowledge.

## Mississippi Public Schools

Knowledge can be a contributor whether indirectly or directly to behavior change. Therefore, it is valuable to explore this component as it relates to adolescent physical

activity and BMI, especially given that adolescent physical activity is at a low and obesity levels are at a high. By exploring adolescent behavioral factors such as the association of physical education knowledge and physical activity patterns on obesity, researchers potentially can narrow down preventive focus areas of obesity. This idea will be advanced by conducting research in the state of Mississippi, which has consistently proven to be a leader in the nation's obesity epidemic (Segal, 2007). Theoretically, this will allow researchers access to an available sample of overweight or obese subjects.

Research shows that overweight and obese children are more likely to be overweight and obese as adults (Quill, 2006). CDC studies (2007) suggest that 80% of children who are categorized as overweight and obese will also be overweight or obese at the age of 25. Also, 25% of obese adults were overweight as children. Therefore, it is critical to learn more about behaviors impacting children and adolescents.

Research has distinguished that family lifestyle (Beets, Vogel, Chapman, Pitetti, & Cardinal, 2007) as well as fitness knowledge (Adams, Graves, & Adams, 2006; Cason & Logan, 2006; DiLorenzo, Stuckey-Ropp, Vander Wal, & Gotham, 1998; Lubans & Sylva, 2006; Roberts, Evans, & Ormond, 2006) influences physical activity behaviors of children and adolescents. Therefore, not every young individual has the same source of education or examples. With this in mind, a public school in which all students are provided the same learning opportunities may serve as an appropriate control. As a result, if educators can expose students to physical education concepts and practices through their high school careers, with the goal of providing students a broader knowledge base of physical education, students may make healthier lifestyle choices.

Though numerous statistics support the need for lifestyle changes among adolescents (Joyal, 2004; Keim, Blanton, & Kretsch, 2004; CDC, 2007), challenges related to increasing quality physical education and physical activity time remain to exist within public school settings. Lack of emphasis on physical education and activity in an educational environment may be the result of multiple causes. One possible source could be that school systems are striving to meet "No Child Left Behind" (NCLB) goals, which do not emphasize physical or health education (Hellmich, 2006).

"No Child Left Behind" is a United States federal law that is aimed at improving performance of U.S. primary and secondary schools by increasing standards of accountability for states, school districts and schools, as well as providing parents more flexibility in choosing which schools their children will attend (U.S. Department of Education, 2007). NCLB is based on outcome-based education, which is a belief that high expectations and goal-setting will result in success for all students. Though the theory behind NCLB is sensible, its attention is focused on reading and math with science to be added as an emphasis. Therefore, little opportunity for physical education remains in a traditional primary or secondary curriculum (Hellmich, 2006; Tappe & Burgeson, 2004).

Though physical education has not been nor does it continue to be a primary focus for NCLB, the state of Mississippi has established guidelines for physical education. Prior to the academic year 2007-2008, the Mississippi Office of Healthy Schools (2006) had physical education requirements for grades K-9, and no physical education or fitness requirements existed for youth in tenth through twelfth grade, although classes were offered on an elective basis. Additionally, there was no required physical educational

assessment. The Mississippi Office of Healthy Schools suggested a long-term plan of comprehensive health education for grades K-12, which would include physical education and fitness as a component of the curriculum (2006).

Developing curricula that will promote physical activity among youth may be a positive direction for the state of Mississippi. As previously noted, Mississippi's youth rank eighth for being overweight and obese (Levi et al., 2007). This might be linked to the fact that Mississippi children exercise and participate in sport less than other children throughout the nation (NCHS, 2007).

In an effort to battle Mississippi's youth overweight and obesity problems, Governor Haley Barbour passed regulations for 2007 school-based physical education programs (Barbour, 2007). The "Mississippi Healthy Students Act", Senate Bill 2369, requires schools to provide at least 150 minutes of physical activity-based instruction as well as 45 minutes of health education per week for students in kindergarten through eighth grade (¶4). Additionally, the bill will require that students in ninth through twelfth grade complete one-half of a Carnegie unit, or approximately 60 hours, of physical education or related activity to meet graduation criterion (¶4). Current, physical education mandates and codes for Mississippi students grades K-12 are listed below:

- Mandate: Code §37-13-134 (2007) requires the following for physical education: 150 minutes weekly for K-8 and ½ of a Carnegie unit of physical activity or physical education for graduation (grades 9-12).
- Code §37-13-151 (1999) requires school districts to provide home economics education programs in grades 10, 11 or 12 that contain instruction in preparing

students to assume responsibility for their care and guidance with emphasis in physical health.

- Code §37-13-131 (1994) calls for the MS Department of Health and the Office of Student Development-Branch of Health-Related Services of the State Department of Education to develop a long-term strategic plan for a comprehensive school health program for grades K-12. This program shall include physical education and fitness as one of its components of curriculum.
- Exemptions: None specified.
- Curriculum Content: Standard 33 of the Mississippi Public School Accountability Standards states the basic curriculum of each elementary and middle school to include physical education. Standard 32 requires physical education be a part of the high school basic curriculum on an elective basis.
- Code §37-13-134 (2007) requires the following for physical education: 150 minutes weekly for K-8 and ½ of a Carnegie unit of physical activity or physical education for graduation (grades 9-12).
- Physical Fitness Assessment: None.

Additionally, physical educators in the state of Mississippi must meet the following requirements:

- Pre-service Requirement: The minimum requirement for prospective physical education teachers in elementary, middle, and high school grades prior to licensure is a bachelor's degree, a standard MS license, and 21 semester hours in physical education. The specific details of initial licensure are outlined in the Licensure Guidelines (2004) from the Commission on Teacher and Administrator Education, Licensure, and Development. The Mississippi Public School

Accountability Standards and State Board Policy DFB-1 (1992) allow secondary teachers endorsed in an academic subject area to teach in grades 5-6, and the Standards also allow a regular elementary classroom teacher to provide physical education in a self-contained classroom setting.

- Professional Development: The state does require teachers to attend professional development in order to obtain continuing education credit to renew their teaching license outlined in the Licensure Guidelines from the Commission on Teacher and Administrator Education, Licensure, and Development. The content of professional development is left to the teachers/districts. State Board Policy GAD-1 (1997) requires the department of education to develop and disseminate a professional development model that establishes the expectations for individual educators and local district programs (MDE, 2007).

Though the "Mississippi Healthy Students Act" and the present mandates and codes are movement in the right direction to combat health issues in Mississippi, there is one major gap with the curricular plan. Students in grades nine through twelve are only required to take one-half of a Carnegie unit in physical education for graduation. Beyond this requirement, high school students have no physical education obligation.

This is problematic because research suggests that physically active adolescents are more likely to remain physically active into adulthood (CDC, 2007; Telama, Yang, Hirvensalo, & Raitakari, 2006). For instance, in one 21-year longitudinal study the results of positive, health-enhancing activity behaviors stemming from youth activity are evident. Telama et al. noted that participation in youth sport significantly predicts adult physical activity. A random sample (N=2,309) of boys and girls between the ages of nine

and eighteen (in 1980) were included in the study. Researchers used a short, validated questionnaire to assess physical activity from the years 1980 to 2001. Multi-nominal logistic regression analyses using odds ratios and corresponding 95% confidence intervals were used to assess the impact of youth sport experiences on adult physical activity. For individuals who were very active as well as those who had short sport experiences, participation had a strong effect on adult physical activity, males = $p<.000$ and females = $p<.023$. If youth activity impacts adult physical activity, it is critical for practitioners to implement strategies to improve activity levels during adolescent years.

Prior to the academic year 2007, Mississippi physical education guidelines did not require students to enroll in physical education after their ninth grade year. Even at present, the "Mississippi Healthy Student Act" does not necessarily require that physical education be a part of the tenth through twelfth grade years. Instead, it requires that high school students enroll in 60 hours of physical education at some point during their high school careers. For this reason, this study chooses to focus on evaluating physical education content knowledge, physical activity levels, and body mass indexes for grades nine and twelve. These two groups were identified based on the history of Mississippi's physical education programs. Therefore, by concentrating on these two groups, gaps in physical education knowledge, if existent, can be identified. Ideally, Mississippi students' knowledge of healthy lifelong practices would progress over their high school careers. Therefore, twelfth grade knowledge level should surpass ninth grade level. One research study supports this concept of progressive knowledge, and found statistically different levels of knowledge between ninth and twelfth grade students. Cano (1993) examined differences among grade levels on subtests of the *Developing Cognitive*

*Abilities Test* (DCAT) and *Watson-Glaser Critical Thinking Appraisal* and found that overall twelfth graders scored higher than ninth graders in areas including: application, critical thinking, inferences, and recognition of assumptions, deductions, interpretations, and arguments. Also, a One-way Analysis of Variance was conducted and yielded significant differences on the total DCAT score among the group of students, $p<.05$. Post hoc analyses revealed that the significant result existed only between ninth and twelfth grade students. Though statistical differences did exist among this group of students, it may not be the case in this study's sample. This may be due to the state's history of not requiring physical education consistently throughout the high school academic career.

For this study it is not only important to understand how the two identified groups of ninth and twelfth graders might differentiate, but it is also important to know what preexisting differences might occur at a state and school level. For example, it is critical to understand that during the academic periods 2006-2007, the state of Mississippi did not meet the Reading/Language scores or Math scores for the adequate yearly progress report for "No Child Left Behind" (MDE, 2008). Additionally, in a report evaluating academic success and performances, the state of Mississippi ranks $50^{th}$, claiming a spot as the least successful public school system in the nation (Quality Counts, 2008).

At an individual school level, Mississippi has an academic rating system of "Level 1 – low performing", "Level 2 – under performing", "Level 3 – successful", "Level 4 – exemplary", and "Level 5 – superior". Schools are evaluated on select variables, including scores from Mississippi Curriculum Test (MCT), Math subjects, Science subjects, English subjects, and History subjects. Overall, there are a total of 67 possible variables, and each Mississippi school is provided a rating based on the

percentage of students who perform at a "basic and above level" or a "proficient and above level" (MDE, 2008). Achievement levels are assigned to each Mississippi school based on the following Basic Achievement Index (BAI) criterion:

- If the BAI value is -1.10 or lower (more negative), the achievement level is 1.
- If the BAI value is between -1.10 and -0.24, the achievement level is 2.
- If the BAI value is between 0.617 and 0.992, the achievement level is 4.
- If the BAI value is 0.992 or higher, the achievement level is 5.
- If the school's basic achievement is too high for levels 1 and 2 and its higher achievement is too low for levels 4 and 5, the achievement level is 3.

In addition to current understanding of the state's physical education programs, students, and academic performances, there are demographic variables that may impact findings. Statistics from the 2006 United States Census Bureau (U.S. Census Bureau) estimate that the state of Mississippi has a population of 2,910,540. As of 2005, individuals under the age of 18 represented approximately 25.6% of the state's population. Also, as of 2005, about 72.9% of Mississippi residents had graduated high school. Mississippi's population is majority White persons at 61.2%, followed with 36.9% Black persons, 1.7% persons who have Hispanic or Latino origins, .7% are Asian persons, and .4% persons who are Alaska Native or American Indian (U.S. Census Bureau, 2006). Current Mississippi high school enrollment by racial and gender subgroups is 47% White students, 51% Black students, 2% Hispanic students, 1% Asian students, 49% female students, and 51% male students (MDE, 2008). Additionally, information obtained from the MDE (2008) suggests that total ninth and twelfth grade

enrollment is 68,484 students, with 61% of those students being ninth graders and 39% being twelfth graders.

## Physical Education and Physical Activity

Physical education, when practiced with quality, is a medium for beneficial physical activity (Dietz et al., 2007). Physical activity can be defined as bodily movement that is produced by the contraction of skeletal muscle and substantially increases energy expenditure (ACSM, 2000, p.4). Physical activity may include planned activity such as walking, running, basketball, or other sports. Physical activity may also include other daily activities such as household chores, yard work, and walking the dog (2000). In order to achieve health benefits, such as managing weight, enhancing muscular strength, enhancing aerobic fitness, strengthening bone mass, managing blood pressure, decreasing anxieties and stresses, and increasing self-esteem, the CDC (2007) recommends that individuals exercise at moderate intensities for a minimum of 60 minutes per day.

Though these health benefits are undisputable, many adolescents are not meeting physical activity standards (CDC, 2007). With escalating overweight and obesity incidences, the lack in attainment of physical activity standards is not surprising (Dietz, 2004). This elicits the question, "How can the implementation and promotion of physical activity improve among adolescents?" One recommendation by numerous entities is to incorporate collaborative physical education programs that place emphasis on teaching lifestyle physical behavior skills and concepts (Mohnsen, 2003; NASPE, 2007; Summerfield, 2008).

Quality physical education that focuses on teaching skills and concepts to make lifelong healthy choices is a fundamental goal of NASPE (Mohnsen, 2003). NASPE has spent years forming standards and concepts that support curricula development and content assessment in physical education courses (2003; Ayers, 2004). According to NASPE Outcomes Committee, those responsible in forming standards and concepts, the most significant question that educators should ask themselves is "What knowledge and experiences do high school graduates need in order to live high quality lives in the 21st century?" (Mohnsen, 2003, p. 1). The committee responded to this question by referencing the definition of a physically educated person. NASPE defined a physically educated person as: "1) one who has learned necessary skills to perform a variety of physical activities; 2) one who is physically fit; 3) one who participates regularly in physical activity; 4) one who knows the implications and benefits of involvement in physical activity; and, 5) one who values physical activity and its contribution to a healthful lifestyle" (p. 2).

After referencing the definition of a physically educated person, the NASPE Standards and Assessment Committee identified seven standards of physical education. These standards are:

1) Demonstrates competency in many movement forms and proficiency in few movement forms.

2) Applies movement concepts/principles to the learning and development of motor skills.

3) Exhibits a physically active lifestyle.

4) Achieves and maintains a health-enhancing level of physical fitness.

5) Demonstrates responsible personal and social behaviors in physical activity settings.

6) Demonstrates understanding and respect for differences among people in physical activity settings.

7) Understands that physical activity provides opportunities for enjoyment, challenge, self-expression, and social interaction.

(p. 2).

Though these standards were developed in 1986, it was not until 1998 that specific concepts related to the achievement of the standards were cultivated and presented in Bonnie Mohnsen's first edition of *Concepts of Physical Education: What Every Student Needs to Know.* Mohnsen, along with many physical education colleagues, have refined the concepts in a second edition of *Concepts of Physical Education: What Every Student Needs to Know.* Mohnsen's work provides many methods to incorporate concepts and standards into the classroom. Additionally, Mohnsen and colleagues' work paved the way for the development of the *ASK PE Battery* which assists in assessing physical education content knowledge among high school students. Such an instrument is beneficial in guiding physical educators with curriculum management and subject evaluation, and should be integrated into the classroom. However, it is unclear as to whether or not physical educators are including such tools.

## Physical Education Content Knowledge

Though it is often emphasized and considered a critical component of physical education, the cognitive province of physical education is the least represented domain in

the profession (Ayers, 2004). For more than 35 years, experts in the field of physical education have agreed upon fundamental concepts that should be taught in a K-12 setting, yet little research reports results indicating such basics are being taught in public schools. Therefore, Ayers indicates there is a lack of information regarding students' knowledge in sub-disciplinary areas that are deemed important by physical educators.

One reason there is a deficiency of information related to what students are learning in physical education is because, historically, there have been few tools to assess such information (Ayers, 2004). As previously mentioned, the *ASK PE Battery* was developed following Mohnsen and colleagues' work of what students should know. The *ASK PE Battery* is a combination of seven area tests: Aesthetic Experiences, Biomechanics, Exercise Physiology, Historical Perspectives, Motor Development, Motor Learning, and Social Psychology. As each of these areas represents a crucial component of physical education, it is important to have accurate assessments for these areas. The *ASK PE Battery* is the initial attempt by Susan Ayers to provide accountability for the cognitive domain of the NASPE Standards, and therefore, offers functional feedback on the nation's physical education programs.

According to Susan Ayers (2001), the cognitive domain has been the most challenging area for practitioners. Assessments historically have accentuated psychomotor skills, but rarely emphasized the cognitive areas of physical education. One challenge for physical educators in evaluating student knowledge is that the academic discipline is comprised of numerous areas such as motor learning and development, sport psychology and sport sociology, biomechanics, and exercise physiology (Karp & Woods, 2001). However, Karp and Woods imply that cognitive information should allow

students to understand and enhance motor skill acquisition and performance. Furthermore, motivation towards an active, healthy lifestyle may be a result stemming from comprehension of health and fitness concepts (Morgan, 2001).

Ayers and colleagues (2004) helped to construct a test that examined physical education content standards. For the first time, a formal measurement tool was used to assess physical education cognitive knowledge. After administering the test to over 3,263 high school students at schools with 17 "NASPE Teachers of the Year," in 16 states, Ayers determined that the test was effective in measuring content, but that differences did exist among gender, race, and experience. Of those sampled and who participated in the Exercise Physiology section of the exam, 61.1% were female, 38.9% were male, 8.7% were African American, 8.2% were Asian, 60.4% were Caucasian, 6.4% were Hispanic, and 16.3% were of other origins. Also, 52.1% were ninth graders, 17.6% were tenth graders, 14.9% were eleventh graders, and 14.9% were twelfth graders. There were no significant interactions of gender, race, and experience for the Exercise Physiology sub-disciplinary portion. Total average score for the Exercise Physiology sub-disciplinary section was 62% of accuracy. Factorial ANOVAs revealed significant main effects for gender across all seven tests. On average, girls (M=21.75, SD=7.22) scored higher than boys (M=17.76, SD=8.08) on the Exercise Physiology content area. Factorial ANOVAs also revealed significant main effects for race across all seven tests. Caucasian persons (M=22.25, SD=6.96) scored significantly higher on the Exercise Physiology content area than all other examinees.

Findings from Stewart and Mitchell (2003) are consistent Ayers' results (2004). Stewart and Mitchell examined instructional variables related to personal fitness

instruction and students' knowledge and conceptions of health related fitness concepts. A total of 270 classes from 62 high schools were included in a stratified-random sample. Descriptive statistics, providing mean school scores, were utilized for the dissection of teacher surveys, grading, and student knowledge. The mean school score for students achieving competency on the fitness knowledge exam was 57%, (SD=31). Findings indicate that there is a lack of foundational knowledge, misconceptions, and incorrect generalizations about fitness. Overall, researchers concluded the possibilities that physical educators are giving a message that "trying hard" is as important as content mastery. Questions raised from the study and directed towards practitioners include:

1) Is the content not worthy of holding students accountable for mastery?
2) Are students incapable of learning this content?
3) Are teachers unable to teach?
4) Is there another defensible reason for not holding students accountable for learning in physical education?

(2003, p. 551).

Achieving competency and proficiency in physical education may be hindered by multiple factors (Collier & Oslin, 2001; Wirszyla, 2002). Factors such as misunderstandings of what constitutes competency and proficiency, too much content and too little time in curriculum, and differences among students also contribute to the physical education dilemma (Collier & Oslin, 2001). However, the implementation of sound student evaluation techniques can assist the advancement of physical education (Parker & Hellison, 2001), particularly in the cognitive domain (Ayers, 2001; Shen & Chen, 2006).

## Physical Education Curricula

The lack of emphasis on physical education is evident in observing percentages related to the nation's percentage of daily physical education program offerings and student enrollment in such classes. David Satcher (2005) stated that fewer than 30 % of high school students attend physical education per day. Also, *Facts on Kid's Health* (2007) suggests that only 36% of children attend physical education one to two days a week. One study showed a 9% decrease in total high school physical education enrollment in 14 years (Hellmich, 2006). Also, it was noted that as children age, they become less active (*Facts on Kids Health*, 2007). For instance, grade school children are around 24% more active than high school students. Female students exercise about seven and a half percent less each year, while boys exercise approximately three percent less each year (2007). For the reasons that physical education is becoming less of a priority in an educational environment and a natural decline seemingly occurs in activity levels of adolescents, emphasis should be given to the promotion of behavioral factors of physical activity in the adolescent population, particularly in a school setting.

In 2006, a journal article published in *Obesity Reviews*, reported a total of 11 school-based obesity interventions from the USA and UK throughout 1999 to 2004. Overall, the review established that most interventions are based on some type of "behavioral theory". Findings indicated that watching television was the "most" modifiable behavior, immediately followed with physical activity and nutritional behaviors (Sharma, 2006), both of which can be controlled for in a school environment. Sharma recommended that changes in school-based interventions be integrated in public schools in order to enhance positive, health-altering behaviors.

Physical educators are in a prime and unique position to guide children and adolescents to more productive and healthful lives (Irwin, Symons, & Kerr, 2003). Not every physical education setting is created equal. Some programs are mandatory, others are not. Some meet multiple times per week, some meet once. Some engage students in moderate to vigorous activity, some do not. Such impediments placed on physical education programs by administrators and teachers inhibit the full potential of the discipline. With consistency among programs and support from governmental agencies and school administrators and teachers, physical education can be a catalyst to promote health and activity in youth (Dietz et al., 2007).

According to Satcher (2005) and Yaussi (2005) poor nutrition and sedentary lifestyles are the root causes for overweight and obese incidences in American youth. Yaussi notes that parents are not adequately teaching adolescents about physical activity and proper nutrition, and therefore the responsibility falls on the educational system. Also, Satcher (2005) suggests that schools can be a "powerful catalyst" for modifications in reducing or preventing overweight and obesity. Simply stated, schools provide equitable learning opportunities. Therefore, schools can be an influential channel in providing adolescents information that will impact health-related lifestyle decisions.

In the field of Physical Education, focusing on fitness and health have remained steadfast overtime (Bulger, Mohr, Carson, & Wiegand, 2001; McKenzie & Kahan, 2004). Concentrating on the development of healthy individuals requires understanding vital components of health like physical fitness (an outcome) and physical activity (a process) (McKenzie & Kahan, 2004). Traditionally, physical education has focused on fitness as an indicator for healthful living. Recently, a shift towards the need to assess physical

activity behaviors, due to their relationship with health factors, has evolved. Therefore, in order to move towards preventing negative effects of idleness within both an adult and youth population, McKenzie and Kahan recommend modifications in physical education curriculum to include activity-focused versus fitness-focused results.

Suggestions to modify physical education curricula are prolific (Bulger et al., 2001; McKenzie & Kahan, 2004). For example, in one recent study, the state of South Carolina reported successful results from a state-mandated curricula change (Wirszyla, 2002). To effectively evaluate the curricula modifications, three high schools were included in the sample. Physical educators went through a three-year (5-days per year) training in Physical Education Institute (PEI), a program developed to assist in reforming physical education. Interviews were held and videos were made throughout the three year period. After a qualitative analysis was conducted, three interest areas emerged as components vital for physical education change: 1) facilitators and hindrances related to change 2) degree of curriculum implementation, and 3) accountability for student performance. Key findings from the study suggested that support from administration and teacher collaboration is crucial for physical education change. Obstacles in change included lack of student discipline, poor facilities, lack of equipment and collaboration, inconsistent grading policies, and failure to hold students accountable. One important finding documented by Wirszyla was that students in most classes were not responsible or accountable for their learning, affecting student participation and performance.

Though practitioners face many challenges with inspiring adolescents to become physically active, physical education environments can be favorable for impacting lifestyle behaviors (Butler & Anderson, 2002). In a study conducted on middle school

students, daily physical education showed positive fitness results (Woodard, Wayda, Buck, Lund, & Pauline, 2004). The study consisted of a convenience sample of 454 seventh and eighth grade students (n=212, females and n=242, males). Students participated in a 20 week, daily physical education program, where they were engaged in moderate-intensity exercise for a minimum of thirty minutes a day. Independent t-tests were performed to determine if physical fitness components had progressed at the completion of the fall and spring academic term. Fall term results indicated significant improvements in body composition and flexibility. Results for the spring term showed significant improvements in body composition, flexibility, muscular endurance, and cardiovascular endurance.

The previous study (Woodard et al., 2004) was able to implement a "daily" physical education program, resulting in improved student fitness levels. However, most schools do not have such a curriculum in action (*Facts on Kids Health*, 2007; Hellmich, 2006; Satcher, 2005). Additionally, physical educators limit student achievement by not consistently maximizing class time (Curtner-Smith, Sofo, Chouinard, & Wallace, 2007).

For example, in an exploratory study, Curtner et al. (2007) assessed the percentage of time that physical education students were engaged in moderate to vigorous activity. The sample consisted of 20 teachers employed at 20 high schools. Activity sessions were videotaped three times, and then analyzed by SOFIT, a systematic observation instrument designed to quantify health-related fitness factors. Results indicated that pupils engaged in moderate to vigorous activity on average 50.47% of the time. Additionally, it was determined that 2.54% of time was allocated for fitness knowledge, .52% of time was spent towards promoting fitness, and .18% was focused on

teacher demonstrations of fitness.

Approaching physical education with creative interventions has proven to be an effective method for presenting physical activity principles and skills (DiLorenzo et al., 1998; Pate, Ward, Saunders, Felton, Dishman, & Dowda, 2005; Cason & Logan, 2006). In most of the physical education research projects that utilized forms of intervention, the "interventions" were nothing more than an inventive presentation of the materials.

In one control study, conducted among a fourth grade student population, students who received education intervention in physical and health education had significant, positive changes in knowledge, physical activity behaviors, food-related behaviors, and food consumption (Cason & Logan, 2006). More impressive, at the five-month follow-up, students in the intervention group maintained significant differences. This information is valuable to practitioners of physical education and obesity, because it proves that school settings are ideal for the implementation of innovative interventions for physical and health education.

In another comparable study, fifth and sixth grade students (N=111) along with each student's mother (N=111) were investigated over a three-year period in order to determine significant social learning determinants that could be predictive of physical activity (DiLorenzo et al., 1998). Males (n=57) and females (n=54), with a mean age of 11.2 years old, were classified into "Phase 1, fifth and sixth graders" and "Phase 2, eighth and ninth graders". Instruments used in the study included the *Physical Activity Interview, Children's Physical Activity Questionnaire, and* the *Parental Physical Activity Questionnaire.* Regression analyses were used to determine factors that could predict exercise activity in males and female children. DiLorenzo et al. determined that at the

fifth and sixth grade level, enjoyment of exercise was the only consistent predictor of physical activity. However, at the eighth and ninth grade level, multiple predictors of physical activity emerged and included: child's exercise knowledge, mother's activity, parental or family modeling, and interests in sports media. Exercise knowledge in eighth and ninth grade students significantly predicted physical activity.

In a continuation for review of school based interventions, a randomized control trial showed a school's success in the execution of a physical activity program (Pate et al., 2005). For the reason that adolescent girls are failing to meet physical activity guidelines, in addition to increases in obesity, Pate et al. examined the effects of a comprehensive school-based intervention on physical activity among high school girls. The study included 24 different high schools and eighth grade females (N=2,744) who participated in a program where the instructional program and the school environment were altered to create more positive support for physical activity among girls. Participants in the control group received different delivery methods for the content of physical and health education. Baseline measurements for height and weight were taken during the spring of the eighth grade year. The *Three-Day Physical Activity Recall* was used to gain activity data, while height and weight measurements were taken to determine Body Mass Index results. Analysis of Covariance (ANCOVA) results showed that 45% of girls in intervention schools and 36% of girls in control schools reported vigorous activity over a three day period. Overall findings denote that a comprehensive school-based intervention can increase participation in activity, and therefore, school-based interventions can make an important contribution to the nation's public health objective, relative to obesity and activity. Though this study was only conducted on adolescent

females, it was the first study to show that a school-based intervention can increase regular participation in vigorous activity among this population.

As suggested by Pate et al. (2005), school-based interventions can be effective in promoting physical activity and reducing overweight and obesity incidences. Other literature supports this notion of educating adolescents on activity skills and concepts so that students will be prepared to make healthier lifestyle choices (Mohnsen, 2003; NASPE, 2007). Lubans and Sylva (2006) conducted a study with controls which included 78 students between the ages of 16 and 18 (30 males and 48 females). The effects of a Lifetime Activity Program intervention were assessed with the hopes of finding more evidence-based physical activity guidelines. Researchers implemented a 10-week conceptual physical education program to encourage positive changes in physical activity by increasing individual knowledge. Forty students were assigned to the control group, while 38 students were in the intervention group. Students completed a questionnaire three times throughout the study period that assessed physical activity and psychosocial factors. Overall findings from independent t-test and ANCOVA analyses indicated that students in the intervention group on average exercised 78 minutes more per week. Additionally, students in the intervention group reported significantly better results for exercise self-efficacy and personal physical activity ratings. It is important to mention that at the three-month follow-up, no statistically sound differences existed between the intervention and control group. Also, differences in knowledge were not examined among the groups, only differences in activity levels.

Roberts, Evans, and Ormond (2006) attempted to support the concept that education and planned interventions combined with practical activity experiences would

enhance overall physical activity. In an effort to defend introductory college fitness courses, researchers obtained data from cardiorespiratory fitness test results and attitude questionnaires of former (N=605, males=358 and females=247) and current students (N=188, males=140 and females=48). Descriptive statistics explained that students were learning fundamental fitness and wellness principles that were applicable to the development of lifetime physical activity behaviors. From current students surveyed, 93% of all students reported improvements on performance tests, 86% of current and former students supported maintaining a required fitness course for all freshmen, 80% of current and former students reported that their physical education experience improved their understanding of fitness and wellness concepts, and 78% of current and former students said the introductory fitness or wellness class impacted their current health habits. From a student perspective, this study implies that content education is important in the behaviors of individuals; however, no statistically sound tests were implemented and, therefore, significance can not be determined.

In a very similar study, the immediate and long-term effectiveness of a university level conceptually-based fitness course was examined (Adams et al., 2006). Participants (N=277) were grouped into six categories: 1) never have taken the course, 2) currently taking the course, 3) took the course between one and 52 weeks ago, 4) took the course between 53 and 104 weeks ago, 5) took the course between 105 and 156 weeks ago, and 6) took the course 157 or more weeks ago. An 80-item instrument was given to measure health and fitness knowledge. One-way Analysis of Variance (ANOVA) results indicated that significant differences did exist among the six groups. Post hoc analyses revealed there were no differences between groups three through six, but group one and

all other groups differed as well as group two and all other groups. Findings imply that students who complete a college fitness and health course retain and present higher levels of health and fitness knowledge than students who never have or are currently enrolled in a related course. There was no link examined to determine if knowledge, in fact, affected behavior. Also, age and gender were not reported in the methods-subjects section, but this information could be related to the study at hand because many higher educational institutions offer basic fitness and health courses. With this in mind, there could be an approximate age difference in the two samples, ranging from one year to five years.

Considering that within the adolescent population, obesity is on the rise, physical activity is declining, physical education programs are not adhering to state requirements, and limited tools exist to measure such information, attention should be given to the promotion and accountability of school-based physical education programs. However, simply allotting more time in physical education, which most states have passed legislation for, is not the answer (Hellmich, 2006). Cawley, Meyerhoefer, and Newhouse (2005) found that increased time in physical education had no effect on health benefits of adolescents. However, Cawley et al. did not analyze student physical education concept knowledge, which in theory (Iso-Ahola & St. Clair, 2000) could affect adolescents' decisions related to health. Also, Cawley et al. (2005) did note that a quarter of the nation's high schools were not meeting state physical education requirements. Therefore, there is opportunity for numerous revisions in school-based physical education programs (Hemlich, 2006). Hemlich suggests modifications to include: increasing activity time in physical education, revising the physical education curricula to include content relevant

to healthy lifestyle decision-making skills, and holding policy makers, educators, and students accountable for the achievement of standards.

## Healthy Impacts of Physical Education and Physical Activity Programs

The importance that physical activity plays in adolescence is assured by numerous researchers (CDC, 2007; Keim, Blanton, & Kretsch, 2004; Telama et al., 2006). One statewide, California study, conducted by the California Department of Education, showed that a distinct relationship among academic achievement and physical fitness existed (Thomas, 2002). This study, conducted in 2001 and reported in the California Department of Education's news release in 2002, matched approximately 954,000 individual Standardized Achievement Test scores with results of the state-mandated physical fitness test, the *FITNESSGRAM*, to determine a significant correlation between academic performance and physical fitness. California State Superintendent, Delaine Eastin noted that "this statewide study provides compelling evidence that the physical well-being of students has a direct impact on their ability to achieve academically" (Thomas, 2002). Eastin also stated that physical education is the primary source for promoting physical fitness. In addition to improving academic performance, physical activity is related to reducing the risk of premature mortality from all causes, and is inversely related to the incidence of obesity, type 2 diabetes mellitus, and cardiovascular disease (Keim et al., 2004).

As noted in the above paragraph, physical education can be a mechanism for enhancing total academic achievement as well as serving as the primary basis for the promotion of physical fitness (Keim et al., 2004). This is aligned with NASPE's primary goal of promoting quality physical education which includes teaching activity skills as

well as concepts that are applicable in making healthy lifestyle decisions (NASPE, 2007). Such education would, in practice, provide knowledge on the importance and benefits of activity, therefore, aid in decreasing overweight and obesity (Iso-Ahola & St. Clair, 2000).

As studied by Cawley et al., (2005), providing students with a broader knowledge base may be challenging because approximately 26% of physical education programs do not meet education requirements, which are developed and implemented at a state level. Cawley and associates sought to explore the impact of state physical education requirements on youth physical activity and overweight. Due to minimal research with the adolescent population, a high school setting and youth participants (N=36,888) were selected for the study. *The Youth Risk Behavioral Surveillance System* (YRBSS) and the *Schools Health Policies and Programs Study* (SHPPS) were employed to gain insight for the selected research areas. Overall findings were that states that encouraged schools to comply with regulations had significant increases in physical education active time. Additionally, increases in active physical education time were positively and significantly correlated to one, two, and/ or three physical activity measures where the student participated in at least 20 minutes of vigorous exercise, at least 30 minutes of light activity, or strength building exercise. Lastly, researchers noted that increased physical education time did not impact student weight nor did it affect Body Mass Index (BMI) or weight classification. Cawley et al. did not place emphasis on knowledge, but instead researched the effect of physical education requirements on physical activity and overweight or obesity. It seems that content knowledge of physical education can be assumed to be a part of the course requirement, but due to each state having various

regulations, this assumption can not be made. Also, though Cawley and associates stated they were evaluating physical education requirements, their study placed emphasis on physical activity requirements.

In a global project comparing obesity prevalence in school-aged youth and their relationships with physical activity, the importance of physical activity was reiterated and, additionally, noted a need for government involvement with the obesity epidemic (Jansen, Katzmarzyk, Boyce, Vereecken, Mulvihill, Roberts et al., 2005). Researchers examined results from youth respondents (N=162,305) of the *Health Behavior in School Aged Children* survey. Youth from 34 countries ranging in age from 10 to 16, were analyzed. Descriptive results indicated that North America had one of the highest rates of adolescent pre-obesity (25.1%) and obesity (6.8%), which was the result of low activity levels and higher television viewing (46.7% of U.S. participants watched television three or more hours per day), two common determinants of overweight adolescents throughout the industrialized world (2005). Jansen, et al. concluded that to take control of the obesity pandemic, increased efforts from all levels, regional, national, and international agencies, are necessary. Specifically, it was suggested that more evolved guidelines, evidence-based guidelines versus evidence-informed guidelines, specific for children and adolescents be developed to help account for current obesity and physical activity obstacles (Jansen et al., 2005; Armstrong & Welsman, 2006).

The results of positive, health-enhancing activity behaviors stemming from youth activity are evident in a 21-year longitudinal study that determined that participation in youth sport significantly predicts adult physical activity (Telama et al., 2006). A random sample (N=2,309) of boys and girls between the ages of nine and 18 (in 1980) were

included in the study. Researchers used a short, validated questionnaire to assess physical activity from the years 1980 to 2001. Multi-nominal logistic regression analyses using odds ratios and corresponding 95% confidence intervals were used to assess the impact of youth sport experiences on adult physical activity. For individuals who were very active as well as those who had short sport experiences, participation had a strong effect on adult physical activity. If, indeed, youth activity impacts adult physical activity, then it is critical for practitioners to implement strategies to improve activity levels during adolescent years.

Thus far, the presented literature has primarily focused on adolescent physical education and physical activity. Though various adolescent age ranges and genders have been represented, consistencies have emerged. Consistencies include: 1) interventions within a physical education setting overall affect physical activity (Cason & Logan, 2006; DiLorenzo et al., 1998; Pate et al., 2005), 2) physical education knowledge affects physical activity (Adams et al., 2006; Cason & Logan, 2006; DiLorenzo et al., 1998; Lubans & Sylva, 2006; Roberts et al., 2006), and 3) levels of physical activity are linked to obesity (Baba et al., 2006; Holstein et al., 2007; Miller, 2004). Drawing from such consistencies paves the way for the exploration of existing relationships between obesity and physical education content knowledge as well as physical activity levels.

## Assessing Body Mass Index

Prior to understanding relationships of obesity and physical education or activity, it is essential to understand the assessment of body mass index. Obtaining BMI is one recognized technique for measuring obesity. According to the ACSM (2000), BMI can be calculated by dividing body weight in kilograms by height in meters squared. ACSM

guidelines classify individuals with a BMI of 25.0 to 29.9 kg/m$^2$ as overweight and individuals with a BMI of 30 kg/m$^2$ as obese. However, it is critical to note that though BMI measurements overall provide estimates of overweight and obesity accurately, there is error with the method. It can unfairly gauge an individual who has large amounts of muscle mass and result in an incorrect classification of overweight or obese (Zellman, 2007). Additionally, BMI does not account for age and gender (2007).

Adolescent BMI is a reliable indicator of body fatness in youth (CDC, 2007). For children and adolescents, BMI is age-specific and is plotted against BMI percentiles of other children and adolescents who are the same age. For example, individuals aged 2 through 20 are classified as: "underweight" if a BMI is less than the 5$^{th}$ percentile, "healthy weight" if a BMI is in a range of 5$^{th}$ percentile to 84$^{th}$ percentile, "at risk of overweight" if a BMI is in a range of 85$^{th}$ to the 94$^{th}$ percentile, and "overweight" if a BMI is equal to or greater than the 95$^{th}$ percentile (CDC, 2007).

In a recent study, conducted to determine the accuracy of self-reported BMI among adolescents and parents, Goodman, Hinden, and Khandelwal (2000) determined that employing BMI self-reported height and weight correctly classified 96% of adolescents as obese. Goodman et al. used data from the National Longitudinal Study of Adolescent Health (N=15,483). Students and parents provided a self-reported BMI as a baseline measurement, and one-year later 74% of the sample was re-interviewed, providing both a self-reported BMI and a measured BMI. At the one-year interview, the self-report and measured BMI had a strong correlation for obesity. BMI also yielded a strong positive predictive value, .86, and a strong negative predictor value, .978. There were no significant differences found in gender. Thus, results indicate studies can

effectively use a self-reported height and weight BMI to understand adolescent obesity and its correlates.

However, in contrast to this study are results from Kolbo et al. (2006) who suggested that self-reported BMI results may not reveal the true depth of the obesity epidemic, particularly in the state of Mississippi. Kolbo et al. randomly selected 37 classes from middle schools throughout Mississippi. Height and weight measures were recorded by trained individuals and then compared to data from the *Youth Risk Behavior Surveillance.* Results indicated that 24% of Mississippi students in sixth grade through eighth grade are overweight, and another 14% of children in first grade through eighth grade are at risk for becoming overweight. This outcome is greater than previous reports which have suggested a prevalence rate of 17.8% for overweight Mississippi youth. Therefore, Kolbo et al. made suggestions to implement more sound assessments of body fat.

## Summary

It is evident that physical activity levels are determinants of obesity (Baba et al., 2006; Holstein et al., 2007; Miller, 2004). And, in earlier sections of the review, education was noted to have an effect on physical activity (Adams et al., 2006; Cason & Logan, 2006; DiLorenzo et al., 1998; Lubans & Sylva, 2006; Roberts et al., 2006). There is little uncertainty that changes in adolescent physical activity behaviors are necessary (Holstein et al., 2007). For the fact that level of physical activity is linked to obesity, recommended changes include increasing youth physical activity to meet established CDC guidelines, and promoting lifelong healthy decisions through physical education. This is aligned with fundamental components of the K-A-B model, which suggests that

knowledge will lead to greater awareness and ultimately to changes in behavior. The K-A-B Model has been implemented in other school healthy policy projects such as reducing drug use, promoting awareness of sexually transmitted disease, and obesity campaigns). Though many practitioners suggest that an educational component would be beneficial in providing students with life skills that could help them make healthier decisions (Ayers, 2004; Mohnsen, 2003) little research has followed up on this concept. With this in mind, this study hopes to further explore the relationship of physical education concept knowledge and physical activity behaviors. These behaviors will be investigated in a high school setting, with the goal of establishing an evidence-based need to modify physical education curricula that can influence adolescent physical education content knowledge, physical activity, and BMI.

# CHAPTER III

# METHODS

## Research Design

A non-experimental, exploratory design was selected for this study, so that the scope of selected Mississippi high school students' physical education content knowledge and its impact on activity levels and body mass indexes could be evaluated. Additionally, no manipulation of the independent variables was necessary at this stage of exploration. Also this study will serve as a foundation for future experimental studies based on significant relationships deemed meaningful enough to warrant further investigations on any of the studied hypotheses.

By implementing this design, the strength and direction of relationships among selected variables was able to be determined. Also, differences among variables were able to be evaluated for significance. However, though these findings added value to the existing research and assisted in providing areas for future research, there were limitations with its use. Findings were only able to be generalized to the sampled population. Also, due to the lack of manipulation and control of the independent variables, no cause and effect findings were made.

## Sampling Procedures

The sampling frame for this study consisted of ninth and twelfth grade students attending public Mississippi high schools. A multi-stage sampling technique was employed to obtain a random sample of 2,790 ninth and twelfth grade Mississippi public high school students with an approximate age range of 14-20. Three stages were utilized to ensure that schools from all areas of the state had an equal chance of being selected for

representation based on the percentage of ninth and twelfth grade students that each area was accountable. Additionally, the academic ratings of each school were considered. Schools with an academic rating of "Level 2, 3, 4, or 5" were included in the sample. No "Level 1" schools were represented in the sampling frame because few Mississippi schools have this rating. Only students attending public high schools, not including vocational or alternative schools, were included in the sample.

*Stage One: Stratified Sampling*

The initial sampling procedure involved dividing the state of Mississippi into seven geographical regions to ensure that schools from all areas of the state had an equal chance of being selected for representation based on the percentage of ninth and twelfth grade students that each area was accountable. The seven geographical regions included in the sampling frame were the North East, North Central, North West, East Central, West Central, South East and South West. Information obtained via the Mississippi Department of Education's (MDE) website, http://www.mde.k12.ms.us/ allowed each region to be dissected to determine the number of high schools and the number of ninth and twelfth grade students that comprised each area. The Mississippi regions, along with the corresponding totals and percentages of ninth and twelfth grade students are found in Table 1. Information regarding high schools and ninth and twelfth grade enrollment was collected by examining county information via the MDE website (http://www.mde.k12.ms.us/Districts/msmap2.htm). The MDE website allows users to link to every Mississippi County and obtain information regarding which school districts and schools are located in each county. Furthermore, the website offers links from

districts and schools to view enrollment numbers by state or district level (http://orsap.mde.k12.ms.us:8080/MAARS/index.jsp).

Thus, the state was divided by the seven geographical regions, and then each region was examined by the counties comprising each area. Once information was examined at a county level, it was then checked for accuracy by viewing the district-level data. Information was recorded into an Excel spreadsheet for future use and reference. Recorded information included: high school, region, and county, ninth grade enrollment, twelfth grade enrollment, and academic ratings. The spreadsheet calculated total schools in the state, total schools in each region, total ninth and twelfth graders in each region, and percentage of schools, as well as percentage of ninth and twelfth grade students that comprise each region.

*Stage Two: Cluster Sampling*

Once the total percentage of ninth and twelfth grade students comprising each geographical area was determined, high schools were randomly selected from the seven regions to represent the complimentary percentage of total students in each area. Each high school in each geographical area had a 1/10 (sampling fraction) chance of being selected for the study. The developed spreadsheet was used to assist in the selection process. Schools were reviewed by total ninth and twelfth grade enrollment as well as academic rating. A balance of ninth and twelfth grade enrollment was desired for each of the seven geographical areas. Additionally, a balance of students attending schools with academic ratings of "Level 2, 3, 4, and 5" was desired for the total sample. Therefore, as every tenth school appeared in the sampling pool, the researcher reviewed this criterion. If the criterion was achieved across all levels (a balance of desired schools was achieved

by geographical region, academic rating, and ninth and twelfth grade enrollment proportionate to each region) schools were selected for the sample. School selection, every one out of ten schools, continued in each geographical area until the percentage of students which were representative of each area was achieved.

*Stage Three: Inclusive Sampling*

At the final stage of sampling, all ninth and twelfth grade students from the randomly-selected schools were included in the sample.

## Sample Size Determination

*Alpha Level and Power*

A software program, G-Power, was downloaded from the internet (http://www.psycho.uni-duesseldorf.de/aap/projects/gpower/) and employed to generate the recommended sample sizes for each hypothesis based on alpha level, power, effect size, and type of statistical test. The alpha level was set at .20 while an 80% power level was selected for all hypotheses.

*Effect Size*

Due to limited research in the area of physical education curricular movements, the effect sizes were determined subjectively by the researcher. Therefore, explanations were offered for the selection of each effect size.

*$H_{O1}$ and $H_{O2}$:* Provided that the null hypotheses were rejected and a significant relationship existed between physical education content knowledge and average weekly physical activity of ninth and twelfth grade Mississippi students, then the relationship needed to be strong enough to warrant physical education curricular changes. Also, it was critical to analyze the possible directions of an existing

relationship among physical education content knowledge and physical activity levels. Considering the alternative hypotheses could have been a negative, inverse relationship, then a medium effect could have justified that Mississippi ninth and twelfth grade students may not have been educated on the proper physical education concepts; however, if the relationship was positive or direct, then a moderate effect size could have justified implementing change given the health status of the state. Therefore, considering both possibilities, a medium effect size was selected for both hypotheses, $r^2$=.3.

*$H_{O3}$* and *$H_{O4}$*: It was expected that no differences in physical education content knowledge or physical activity behaviors would exist among selected Mississippi ninth and twelfth grade students (Cano, 1993). Therefore, the effect size was based on the possibility of rejecting the null hypothesis which would have indicated the two groups did not differentiate significantly. For the selection of the effect size, it was essential to understand the history of Mississippi physical education programs, and consider the recent curricular changes. Given that the "Mississippi Healthy Students Act" was just implemented in the fall of 2007, the sampled students may or may not have completed the 60 hours of physical education necessary for graduation. Also, having considered the health status of the state, any impact that could positively affect Mississippians' health was deemed important. However, even though small differences in ninth and twelfth grade groups could warrant curricular changes, it was deemed more likely that actual changes would be implemented for medium group differences. Thus, a medium effect size was selected for this hypothesis, d=.25.

*$H_{O5}$:* It was expected that students would not perform differently based on which high school (academic ratings) was attended. Therefore, the effect size was based on the possibility of rejecting the null, and accepting that significant differences existed between the selected Mississippi schools based on previous academic ratings. For this particular hypothesis it would have been positive for reporting purposes for no significant differences to exist. This was due to the fact that a public school system should provide all students equal learning environments and opportunities. Therefore, effect size was based on the possibility of significant differences existing among the selected Mississippi high schools. Also, of importance was the idea that physical education content knowledge possibly was positively correlated with higher levels of physical activity. Taking this into consideration, differences needed to be large enough in-scale, so that to persuade governmental assistance with needed curricular changes. Therefore, a medium effect size was recommended for this hypothesis, d=.25.

*$H_{O6}$ and $H_{O7}$:* It was expected that no relationship would have existed between the level of physical education content knowledge and Mississippi ninth and twelfth grade students' BMI. Therefore, the effect size was based on the possibility of rejecting the null hypothesis which would have indicated a significant relationship between level of physical education content knowledge and selected Mississippi ninth and twelfth grade students' BMI. Given that the state of Mississippi had a ranking of 1$^{st}$ nationally, with the highest adult obesity prevalence rate and 8$^{th}$ nationally, for youth obesity, a small to medium correlation was deemed strong enough to warrant

change in physical education curricula. Therefore, in considering both criteria, a medium relationship was desired, $r^2$=.3.

*$H_{O8}$ and $H_{O9}$:* It was expected that no relationship would exist between the levels of physical activity and Mississippi ninth and twelfth grade students' BMI. Therefore, the effect size was based on the possibility of rejecting the null hypothesis which would have indicated a significant relationship did exist between level of physical activity and selected Mississippi ninth and twelfth grade students' BMI. Considering that the state of MS is the "fattest" state for adult obesity and ranks 8$^{th}$ for youth obesity, a small to medium correlation could warrant change in physical education curricula. Therefore, considering both criteria, a medium relationship was desired, $r^2$=.3.

*$H_{O10}$* and *$H_{O11}$:* It was expected that 50 % or more of the selected Mississippi high school students completed the *ASK PE: EXP Test* with a $\geq$ 62 % of accuracy. Therefore, the effect size was based on the possibility that the null hypothesis was rejected and the alternative hypothesis which indicated that 50 % or more of the students did not complete the *ASK PE: EXP Test* with a $\geq$ 62 % of accuracy was accepted. Given that the *ASK PE: EXP Test* had a reliability and validity assessment with two different populations, both of which performed higher than the selected ninth and twelfth grade public high school students and considering overall, the *ASK PE: EXP* had limited use in research, a medium effect size was deemed suitable to warrant curricular modifications. Therefore, for the purpose of this hypothesis, a medium effect size was desired, d=.3.

*Expected Response Rate*

Expected response rate was determined by considering the selected sampling procedures as well as project implementation plans. A state-wide sample was desired, and therefore, schools were randomly selected throughout Mississippi. Hence, there was no control over the schools which were included in the sample, and no incentives were given for participation. Additionally, the chosen methods of project implementation required that multiple individuals (high school principals, school nurses, other assigned personnel, and teachers) assist in administering data, collecting data, and retuning data. Therefore, the final response rate was expected to be lower than observed comparable research studies. The expected response rate was 10%.

After establishing the expected response rate, each suggested sample size for all hypotheses were reviewed. The hypotheses requiring the largest sample size were used to determine the overall study sample. Multiple hypotheses required 356 participants. Thus, this participant number was utilized to determine overall sample size based on the expected response rate. Estimating that 10% of the sample would return the study's instruments, approximately 3,560 Mississippi high school ninth and twelfth grade students were targeted for the project (3,560 subjects x .10 = 356 participants). Table 2 displays sampling information and includes applied statistical test, alpha level, effect size, power, and suggested sample size for each hypothesis.

## Participants

A total of 386 Mississippi public high school students (females: n=198 and males: n=188) in grades nine (n=224) and twelve (n=147) participated in the study. The sample was representative of five geographical regions throughout Mississippi including: North

East (24.7%), North Central (22.6%), East Central (5.9%), South East (25.4%) and South West (21.3%). (The North West and West Central regions of the state were not included in the sample). Also, six different high schools were represented in the sample. Of the participants, 22.6% attend "Level 2" schools, 5.9% attend "Level 3" schools, 24.6% attend "Level 4" schools, and 46.7% attend "Level 5" schools. (No "Level 1" schools were included in the sampling frame). The sample included race demographics similar to the state's census demographics with majority of the sample 263 or 68.3% Caucasian (Mississippi = 61.2% Caucasian), 103 or 26.8% African American (Mississippi = 36.9% African American), 7 or 1.8% Asian (Mississippi = .7% Asian), 5 or 1.3% American Indian (Mississippi = .4% American Indian), 4 or 1.0% Hispanic (Mississippi = 1.7% Hispanic), 2 or .5% Pacific Islander (no comparable Mississippi data), and 1 or .3% other (U.S. Census Bureau, 2006).

*Actual Response Rate*

The actual response rate obtained from selected Mississippi ninth and twelfth grade students was 11% (386/3560). Additionally, of 19 randomly selected schools, two schools withdrew prior to data collection. So, of 17 schools included in the mail-out of instruments, six returned completed instruments. Thus, school response rate was 35% (6/17).

*Non-Response Bias*

Actions were taken to minimize non-response bias (please refer to data collection). However, only 35% of schools included in the sample allowed their students to participate, yielding a 14% student response rate. Non-response bias was evaluated on the "potential" for biases to have occurred. Therefore, mean differences in participant

subgroups (geographic location, academic rating, sex, race, and grade) were examined and compared to existing Mississippi normative data. In reviewing the geographic regions that were represented, the North West and West Central regions were not represented, and therefore, potential for bias existed in geographical representation. Additionally, the responses appear to have favored the Level 5 or superior-performing schools, and did not favor the Level 3 schools. Level 3 schools participated at a 5.9% rate, while Levels 2 and 4 schools participated at about the same rate (around 23%), and Level 5 schools participated at 46.7%. Therefore, this project may have favored the superior performing schools. Though potential for bias existed in geographical and academic representation, the representation of race was fairly proportionate to the state's demographics. The sample closely represented the Mississippi Caucasian (+7%), African American (-10%), Asian American (+1%), American Indian (+1%), and Hispanic (-.7%) populations.

## Instrumentation

### *Assessment of Sub-disciplinary Knowledge in Physical Education: Exercise Physiology*

The *ASK PE: EXP* measures the physical education content knowledge of students at the kindergarten level through grade twelve (Ayers, 2004). Developed by multiple physical educators, the *ASK PE: EXP* assesses knowledge in the following areas: motor learning, motor development, biomechanics, exercise physiology, historical perspectives, social psychology, and aesthetic experiences. Though utilizing questions from all sub-disciplinary sections would provide a more accurate examination of total physical education content knowledge, this study only included 38 adapted questions from the *ASK PE: EXP*. Specifically, this study emphasized the Exercise Physiology

sub-disciplinary area due to its relevance with physical activity. No other section from the *ASK PE: EXP* was used. The *ASK PE: EXP* may be taken either on-line, or with pencil-and-paper. For the purpose of this project, all tests were printed out for students. Ayers (2004) developed *ASK PE: EXP* through systematic test item development and analysis, including multiple stages for review, revision, and pilot testing. Additionally, tests were issued to 3,200 high school students in 16 states (not including the state of Mississippi). All seven areas of the *ASK PE: EXP* had a reliability range of .7 to .94. Specifically, the Exercise Physiology section had a rating of .91. As previously reported in Chapter II, Ayers found that the *ASK PE: EXP* was effective in measuring content, but differences did exist among gender, race and experience (2004).

Though Ayers (2004) had a strong reliability analysis for the Exercise Physiology sub-disciplinary section of the *ASK PE: EXP,* a pilot study was conducted prior to this study to determine if the reliability remained at a strong level for Mississippi high school students. Results are discussed at the end of this chapter. Permission to use the *ASK PE: EXP Test* is given to all physical educators, and is noted in the Appendix B.

*Modifiable Activity Questionnaire for Adolescents*

*The Modifiable Activity Questionnaire for Adolescents* was developed by Dr. Andrea Kriska and Dr. Deborah Aaron, and measures past-year physical activity levels of adolescents (Aaron & Kriska, 1997). Reliability and validity were tested on a sample of 100 female and male junior high school students between the ages of 15 and 18. Reliability and validity were tested on three levels of activity output: hours per week (h/wk), met hours per week (met-h/wk), and vigorous hours per week (v-h/wk). Reliability and validity measures were tested using Spearman correlations, with

significance set at the .05 level. Reliability for both males and females, across all measures of activity, from the first test one-month/one-year retests display significance, indicating that the test was a good predictor of average weekly physical activity. Additionally, measurements showed significant correlations among the past-year questionnaire and an average of four past-week questionnaires. Reliability and validity correlations for *The Modifiable Activity Questionnaire for Adolescents* are reported in Table 3.

The *MAQ-A* assesses past-year activity behaviors, specific to type of activity or activities, as well as the time spent partaking in each activity, by asking students to provide details of activities over the past year. Formulas are provided to account for physical activity in hours per week, met hours per week, and vigorous hours per week. For the purpose of this study, calculations for hours per week and total hours per week will be utilized.

*H/week = (Past year/mo) x (4.3wk/mo) x (days/wk) x (min/day) / (60 min/h) / (52wk/yr)*

The hours for all activities are summed to determine the total past-year activity levels of adolescents (1997). Permission to use the *MAQ-A* was provided to the researcher and is noted in the Appendix C.

## Data Collection

Prior to writing the Institutional Review Board (IRB) application, the researcher contacted a local high principal and requested permission to conduct a pilot study at his high school. Once permission was granted by the high school principal, the IRB application was submitted. Subsequent to data collection, the study was approved by the IRB at The University of Southern Mississippi.

The principal allowed two of his teachers and their ninth and twelfth grade classes to participate. A total of two ninth grade classes and two twelfth grade classes participated in the pilot study (N=74). Passive parental consent forms were provided to the students one week prior to pilot study implementation. If students did not return the passive consent form, parental consent was assumed. Students were asked to provide assent prior to the administering of the questionnaire. Assent forms were collected separately from all questionnaires, so that students remained anonymous. All data was gathered in one day. The researcher administered all of the instruments to each of the four classes. Observations were made on the students' level of clarity, ease and/or difficulty in completing the instruments.

On average, the students completed the instruments in 25 to 30 minutes. As students completed the instruments, they were collected by the researcher. All data was immediately transferred into a statistical analysis program. Upon subjectively reviewing students ease or difficulty of understanding and completing the questionnaires, and also, examining the *ASK PE: EXP* modifications were made. Modifications included item revisions to the *ASK PE: EXP* (Please see Table 4). After changes had been made, all questionnaires were printed and packaged.

All schools were contacted via fax (high school contact information was obtained from the Mississippi Department of Education's website) two weeks prior to questionnaires being mailed-out. Schools were informed they had been randomly-selected to participate in a state-wide research study. Information in the fax included: purpose of study, date to expect materials, materials to expect, brief explanation of process, statement of IRB approval, and the researcher's contact information. Also, prior

to questionnaires being mailed, follow-up phone calls were made to all randomly-selected schools to ensure that the fax was received.

Due to the large number of questionnaires being mailed to each school, 14x14x14 boxes were selected for the delivery method. Inside of the 14x14x14 box were the study materials (instructions for the administrators, teachers, and students; demographic forms to be completed by administrators and students; passive parental consent forms; student assent forms; and the questionnaires to be completed by students), and a 12x12x12 box that was pre-addressed and pre-paid for completed study materials. All boxes were mailed from The University of Southern Mississippi's post office. Additionally, return boxes were pre-addressed to The University of Southern Mississippi.

All materials were filed in folders, and labeled on the outside by recipient and content. Instructions and high school demographic forms for principals and/or school nurses were labeled in a colored folder (red or green) and distinguishable from materials to be distributed into the classroom. This instruction sheet provided detailed instructions to the administrators. (Refer to Instructions in Appendices E and F). Separate from the colored folder, were sets of two folders, which were held together by rubber-bands. One folder contained 25 passive parental consent forms, and the other folder contained 25 student assent forms (stapled to the questionnaires) and questionnaires (*MAQ-A* and *ASK PE: EXP*). Principals, school nurses, or other assigned individuals were asked to provide each first-period ninth and twelfth-grade classroom teacher with the appropriate number of pre-organized folders. The teachers' instructions were stapled inside the folder, so that they were distinguishable from the student materials. In order to maintain student

anonymity, all participants were asked to tear the student assent form away from the questionnaire and return it to the classroom teacher.

Prior to any student participating in the study, teachers were asked to send home the passive parental consent form. With the use of the passive consent form, students were considered to have parental consent, as long as they did not return the form by the teacher's requested date. Students who returned the passive parental consent form did not have parental consent to participate. These students were assigned another project by their teacher during the time period of study implementation.

Teachers were asked to collect any returned passive parental consent forms, and all student assent forms prior to the actual study implementation. Once students provided assent to participate and teachers had collected all assent forms, the teachers were asked to read student instructions aloud.

Once students had completed instruments, they were asked to turn materials into their teachers. Teachers were then asked to return instruments to their administrative office. High school administrators or other assigned personnel were asked to place completed passive parental consent forms, student assent forms, demographic information (high school and student), and questionnaires in the provided pre-addressed, pre-paid package. Once study materials were received by the researcher, a numeric code was assigned to each school and case. After all data had assigned numeric codes, it was keyed into SPSS software.

A date of completion was provided to administrators and teachers, but within this time period, each school and teacher had the choice of the actual implementation date.

All schools were allotted six weeks to complete the materials. Study materials received after this date were not included in the results.

Actions were taken by the researcher to minimize non-response bias. These actions included:

1. sent a fax to inform principals of the upcoming study (researcher's contact information was provided)
2. called principals to ensure they had received the fax
3. sent an email to confirm receipt of the fax
4. called schools to make sure they had received the study materials
5. sent an email to make sure schools had received the study materials
6. called non-respondents and encouraged them to participate
7. called non-respondents a second time and encouraged them to participate
8. sent a fax to non-respondents and encouraged them to participate

## Analyses

Prior to data analysis, data was checked for missing values. Due to computational formulas being applied to data, all missing data for the *MAQ-A* and *ASK PE: EXP* were assigned values of zero. Other data fields remained as provided by the questionnaires. Continuous variables were examined for normality by histogram charts.

Quantitative research techniques including: Pearson's correlation analysis, Spearman's correlation analysis, independent t-test, analysis of variance (ANOVA), and a Goodness of Fit/Chi Square were used to analyze data. Descriptive statistics were also employed to assist in explaining overall findings. The measures for this project were the *Assessment of Sub-disciplinary Knowledge in Physical Education: Exercise Physiology*,

*The Modifiable Activity Questionnaire for Adolescents – MAQ-A*, and a student, self-reported BMI.

Raw data from the *ASK PE: EXP* and *MAQ-A* were input into the statistical analysis software program, SPSS. Codes were assigned for incorrect and correct responses, "0=incorrect" and "1=correct". Formulas generated through SPSS software were used to compute *ASK PE: EXP* percent of accuracy (0 to 100%), total average weekly activity, and body mass index percentile.

Demographic information on schools and students, individual accuracy scores for total concept knowledge, student responses from the *ASK PE: EXP*, and total averaged activity hours per week from *MAQ-A* were entered into SPSS. Pearson's correlation analysis was employed to determine if a relationship existed between physical education concept knowledge and physical activity levels. Additionally, Pearson's Correlation was used to determine if a relationship existed between physical education content knowledge and BMI as well as physical activity level and BMI. Independent t-tests were used to establish if differences in physical education content knowledge existed between selected Mississippi ninth and twelfth grade students. Also, differences in students' physical education content knowledge were examined by each school's academic rating. A Chi Square – Goodness of Fit analysis was used to explain the proportion of selected Mississippi high school students who performed above or below a 62% of accuracy on the *ASK PE: EXP.* Descriptive statistics were used to further explain and support any notable findings. Only group data was reported for all statistical analyses.

## Pilot Study

The purpose of the pilot study was to analyze psychometric properties of the *ASK PE: EXP,* specific to a population of Mississippi high school students, gather information on the clarity of the researcher's instructions, and evaluate the ease or difficulty of the selected instruments.

### *Participants*

A convenient sample of ninth and twelfth grade students (N=74; 40 ninth graders and 31 twelfth graders; 32 females and 42 males) attending a south Mississippi private school were selected for participation in the pilot study. So that the public school sampling frame would not be compromised, a local private school was selected for pilot testing.

Students attending the local private school score an average of 24.8 on the ACT, and in the last graduating class, 14 students scored a 30 or higher. In just 5 years, the private school has had 14 National Merit Finalists, 1 National Merit Semi-finalist, 2 National Merit Commended Scholars, and 1 National Achievement Award Winner. The last graduating class was awarded over three million dollars in scholarships, which was an average of $47,968 per graduating student. Nearly all students in the past three years have attended college (141/142), with one student going into a family business. The current school curriculum is Christian-based, College Preparatory Academic Curriculum. The school is accredited by the Mississippi Private School Association and the Southern Association of Colleges and Schools.

*Analyses*

Prior to analyzing data, the incorrect and correct responses to the *ASK PE: EXP* had to be coded where "0=incorrect" and "1=correct". Also, data formulas were computed to determine total average weekly activity (Aaron and Kriska, 1997), body mass index percentile ranking, and percent accuracy on the *ASK PE: EXP*.

Data analyses were aligned with the purpose of the pilot study. In order to effectively examine the desired areas, multiple statistical tests were applied. Statistical test included: descriptive statistics, frequencies, internal consistency reports, item analysis, item discrimination, mean comparisons and independent t-tests. Additional subjective observations were made by the researcher.

Descriptive statistics and frequencies were used to detail demographic information on the pilot sample, and provide detail to each *ASK PE: EXP* questions. Prior to other statistical tests, the homogeneity of 42 items from the *ASK PE: EXP* was examined. A Kuder-Richardson 20 (KR20) reliability analysis with corrected item-total correlations was analyzed. Based on the corrected item-total correlations, items not performing strongly were deleted from the reliability analysis and reevaluated in two other examination scenarios.

Additionally, item discrimination was conducted to determine how the items differentiated between the high scoring and low scoring respondents (Crocker & Algina, 1986). Prior to conducting the item discrimination, respondents' z-scores were obtained for the *ASK PE: EXP* percent of accuracy. Obtaining the z-scores allowed the data to easily be sorted in SPSS by low scoring respondents to high scoring respondents. Three groups emerged from viewing the sorted z-scores: 1) respondents who performed above

the mean, 2) respondents who performed at the mean, and 3) respondents who performed below the mean. Of these three groups, the mean group was excluded from the item discrimination, and those who performed above and below the mean, were used for the analysis.

Once the two groups for item discrimination were selected (Crocker & Algina, 1986), their coded correct or incorrect responses for each of the 42 questions (0=incorrect, and 1=correct) was transferred into Excel. The two data groups (those who performed above the mean and those who performed below the mean) were separated in one Excel database. For each of the two groups, the sum of each question's correct responses was determined. For each of the groups (those who performed above the mean and those who performed below the mean), each question's total correct responses, was divided by the number of individuals in that group to provide an overall proportion of correct responses from low-scoring respondents and from high-scoring respondents. As a final step in the item discrimination analysis, the difference in high-scoring respondents' proportion of correct responses and low-scoring respondents' proportion of correct responses was determined to provide an overall discrimination value (D). Items performed at one of four D value ranges: 1) D was less than or equal to .19, indicating the item should be eliminated or completely revised, 2) D was within a range of .2 to .29 indicating the item is marginal and needs revision, 3) D was within a range of .3 to .39 indicating the item needs little or no revision, and 4) D was .4 or greater indicating the item is functioning quite satisfactorily (p. 313).

In addition to the item discrimination, each item was analyzed with descriptive statistics and frequencies. Items were evaluated to determine what percentage of correct

responses was located in "A", "B", "C", or "D" positions. Also, items were evaluated to determine a level of response diversion. More specifically, all responses to all questions were evaluated to determine the percentage of students selecting option "A", "B", "C", or "D". This enabled poor response options based on their level of distraction to be analyzed.

Mean comparisons and independent t-tests helped to further analyze how the *ASK PE: EXP* differentiated between high and low-scoring respondents. Mean comparisons were conducted on the three groups:1) respondents who performed above the mean, 2) respondents who performed at the mean, and 3) respondents who performed below the mean. All groups were evaluated to determine how their performances differed when poor questions based on corrected item-total correlations were deleted. Two versions (with removed questions: version one had 37 questions and version two had 25 questions) were examined and compared to performances with all 42 questions. Independent t-tests were used to determine if differences existed among sex on any of the three versions of the test (42 items, 37 items, or 25 items).

*Psychometric Performance*

A KR20 reliability analysis of the 42 items from the *ASK PE: EXP* indicated that test items functioned at a level of .731. Therefore, given this particular population, the instrument would be a reliable indicator of Exercise Physiology content knowledge about 73% of the time.

The KR20 analysis was followed with an item discrimination analysis, which highlighted the degree of difference between high-scoring respondents and low-scoring respondents on the 42 items of the *ASK PE: EXP*. Item discrimination values suggested

that 21 items (50%) needed to be eliminated or completely revised, $D \leq .19$. Another 12 items (29%) were marginal and needed revision, $.2 \leq D \leq .29$. Five items (12%) needed little or no revision, $.3 \leq D \leq .39$. Four remaining items (10%) functioned quite satisfactorily, $D \geq .4$.

Descriptive statistics and frequencies were employed to analyze correct response positions and response options. Correct "A" response positions comprised 12% of exam answers. Correct "B" response positions comprised 21.5% of exam answers. Correct "C" response positions comprised 21.5% of exam answers. Correct "D" response positions comprised 45% of exam answers. Review of descriptive statistics suggested that 26 items (62%) had one or more responses that were not selected by any student. Additionally, numerous responses had low choice selection.

In evaluating mean comparisons across three variations of the *ASK PE: EXP* (42 items, 38 items, and 25 items), it was noted that majority of students who performed above the mean (42 items – 85%, 38 items – 87%, and 25 items 88%) or at the mean (42 items – 78%, 38 items – 80%, and 25 items – 81%) respectively remained at that level or better across all variations of the exam. While students, who performed below the mean, performed similarly on the 38 item version and lower on the 25 item version of the exam (42 items – 66%, 38 items – 67%, and 25 items 62%).

No statistically significant differences exited between sex and *ASK PE: EXP* score on any version of the test. Additionally, after subjectively reviewing the ease and/or difficulty in which the students had when completing the instrument, no changes to instructions were deemed necessary.

Though the internal consistency rating of the *ASK PE: EXP* had a previous KR20 of .9 (Ayers, 2004), the pilot study population provided varying results, KR20=.73. Though both KR20 values are deemed statistically acceptable, one yields a much higher value for reliability. Differences might be explained by disparity between sample sizes, test items, and/or school setting (public versus private).

After reviewing the KR20 analysis objectively and subjectively, further analyses were used to determine other areas of interest regarding the *ASK PE: EXP*. The item discrimination analysis allowed for each question to be evaluated and helped in determining if, in fact, it distinguished between those who scored high and those who scored low. Only nine items (22%) needed little or no revision. The item discrimination analysis suggested that the remaining 33 items (78%) be eliminated or revised to better distinguish between those who knew the physical education content and those who did not know physical education content.

In an effort to provide more sound justification to modify the *ASK PE: EXP*, an item analysis was performed by viewing descriptive statistics and frequencies. Findings suggested an imbalance of correct responses, particularly in the "D" position which is consistent with research suggesting that most educators do not assign correct choices in the "A" position, but instead default to a "C" or "D" position (McDonald, 2002). McDonald suggests that "there should be an equal number of correct responses in the A, B, C, and D positions" (p.105).

Further analysis of each of the 42 items suggested that some questions had poor distracter responses. For instance, 62% of the questions had one or more responses that were not selected by any student, while multiple responses had low choice selection. All

choices should be equally attractive for individuals who do not know the content (Cohen & Wollack, 2008; McDonald, 2008). Additionally, "all of the above" and "none of the above" choices should be avoided (Cohen & Wollack, 2008; Harasym, Leong, Violato, Brant & Lorscheider, 1998; McDonald, 2002).

Collectively, the KR20 reliability analysis and corrected item-total correlations, item discrimination analysis, and the individual item analyses of correct response position and distracter options, offered an objective basis for specific questions that needed modifications. Further examination of these questions provided performance explanations. For example, some questions were double-barreled. Researchers suggest that questions should be clear, simple, and focused (Converse & Presser, 1986; Devellis, 2003). Additionally, some questions were lengthy. Devellis notes that "length increases complexity and diminishes clarity" and further asserts that questions should be written in simple, straightforward language (2003). After a detailed analysis of the 42 items, suggested modifications for most questions fell into one or more of five categories: 1) The question's responses needed to be moved to another position; 2) The question needed better distracter options (included "all of the above" or "none of the above" responses); 3) The question was double-barreled; 4) The question was lengthy; and/or, 5) The question functioned poorly for overall content assessment. A thorough objective and subjective analysis of the *ASK PE: EXP* revealed that multiple questions needed revisions. A total of 17 out of a possible 42 items were modified. Revisions are noted in Table 4.

*Performance of Revised ASK PE: EXP*

Analyses for revised or adapted questions and responses of the *ASK PE: EXP* matched the previously mentioned analyses for the original *ASK PE: EXP.* A reliability

analysis, KR20, was conducted to ensure the homogeneity of the revised or selected 38 items of the *ASK PE: EXP*. The instrument and each item were evaluated for reliability measures. Additionally, an item discrimination analysis was employed to determine if the revised or selected items were able to better distinguish between high and low scorers. The final analysis conducted was an item analysis. Descriptive statistics were utilized to determine if the response selections were better distributed, indicating overall that all responses were "equally attractive" for those who did not know the content.

Internal consistency for the revised 38 Exercise Physiology test items was .896, a similar result to Ayers (2004) consistency value of .9 for selected test items. Compared to pilot data, an improvement of .165 was achieved. Of the 38 revised items, only one item (question 5) had a negative corrected item-total correlation, indicating that it was not functioning well with the other 37 items to assess Exercise Physiology desired content.

The item discrimination analysis yielded overall positive results. In the previous item discrimination analysis, it was suggested that 78% of questions were not differentiating between individuals who knew the Exercise Physiology content (high scorers) and individuals who did not know the Exercise Physiology content (low scorers). New results indicated that overall 77% of the 38 revised items were, in fact, distinguishing between those who knew the Exercise Physiology content (high scorers) and individuals who did not know the Exercise Physiology content (low scorers). Specifically when compared to the original *ASK PE: EXP*, the revised questionnaire had: 3 items (8%) that needed to be completely revised or eliminated compared to a previous 21 items (50%); 6 items (16%) that were marginal and needed revision compared to a previous 12 items (29%); 9 items (24%) that needed little or no revision compared to a

previous 5 items (12%); and, 20 items (53%) that were functioning quite satisfactorily compared to a previous 4 items (10%).

An item analysis was used to determine if students were more likely to select distracter options, indicating the choices were more equally attractive compared to non-revised options. Modifications which included balancing out the representation of correct response positions and altering selected distracter responses may have impacted student choices. Descriptive statistics and frequencies indicated the original *ASK PE: EXP* had 62% of test items in which one or more responses were not selected by any student, compared to 0% of revised test items indicating that the revised diversion options might have been more appealing to students who did not know the exam content.

# CHAPTER IV

## MANUSCRIPT I

Psychometric Performance of the *Assessment of Sub-Disciplinary Knowledge in Physical Education: Exercise Physiology* (*ASK PE: EXP*)

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Running head: Psychometric Performance – *ASK PE: EXP*

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Psychometric Performance of the *Assessment of Sub-Disciplinary Knowledge in Physical Education: Exercise Physiology (ASK PE: EXP)*

Running head: Psychometric Performance – *ASK PE: EXP*

KEY WORDS: *ASK PE: EXP*, Psychometric Performance

## Abstract

This study investigated the psychometric performance of the *Assessment of Sub-disciplinary Knowledge: Exercise Physiology* (*ASK PE: EXP*) instrument. Data was collected from two samples, with different demographics, and compared to previously reported data. Based on results of $N_1$, modifications were made to the *ASK PE: EXP*. Data collected from $N_2$ reflects use of the revised *ASK PE: EXP*. Detailed analysis of the performance of the *ASK PE: EXP* suggested a Kuder-Richardson's 20 (KR20) reliability rating of .731 ($N_1$) and .896 ($N_2$). Additional measures of assessment of the *ASK PE: EXP* included review of item to total correlations, item discrimination analysis, and item analysis. Results indicated that five items could be deleted, 16 items should be modified, and 21 items functioned well and needed no revision. The result was a 38 item instrument with modifications to questions which were 1) not functioning well with other items; 2) not distinguishing between those who knew and did not know the content; 3) not challenging; 4) lengthy; or 5) double-barreled.

## Introduction

Though it is often emphasized and considered a critical component of physical education, the cognitive component of physical education is the least represented domain in the profession (Ayers, 2004). For more than 35 years, experts in the field of physical education have agreed upon fundamental concepts that should be taught in a K-12 setting, yet little research reports results indicating such basics are being taught in public schools. Ayers (2004) indicates there is a lack of information regarding students' knowledge in sub-disciplinary areas that are deemed important by physical educators.

One reason there is a deficiency of information related to what students are learning in physical education is because, historically, there have been few tools to assess such information (Ayers, 2004). In an effort to provide "a means of accountability for the cognitive domain in an agreement with the national physical education standards" (Ayers, 2004, p.286), the *Assessment of Sub-disciplinary Knowledge in Physical Education (ASK PE Battery)* was developed. The *ASK PE Battery* was developed in alignment with Mohnsen (2003) work, which defines what physical education concepts students should know at each academic level from K-12.

Exploring the cognitive domain has proven to be a challenging area for practitioners (Ayers, 2001). Assessments historically have accentuated psychomotor skills, but rarely emphasized the cognitive areas of physical education. One challenge for physical educators in evaluating student knowledge is that the academic discipline is comprised of numerous areas such as motor learning and development, sport psychology, sport sociology, biomechanics, and exercise physiology (Karp & Woods, 2001). However, Karp and Woods imply that cognitive information should allow students to

understand and enhance motor skill acquisition and performance (2001). Furthermore, motivation towards an active, healthy lifestyle may be a result stemming from comprehension of health and fitness concepts (Morgan, 2001).

The *ASK PE Battery* is the initial attempt by Susan Ayers (2001) to provide accountability for the cognitive domain of the National Association for Sport and Physical Education (NASPE) Standards. It is a combination of seven area tests including: Aesthetic Experiences, Biomechanics, Exercise Physiology, Historical Perspectives, Motor Development, Motor Learning, and Social Psychology. As each of these areas represents a crucial component of physical education, it is important to have accurate assessments for these areas. These assessments have the potential to offer functional feedback on the nation's physical education programs, guide physical educators with curriculum management and subject evaluation, and evaluate students' physical education conceptual knowledge from kindergarten through grade twelve (Ayers, 2004).

The *ASK PE Battery* was developed through systematic test item development and analysis, including multiple stages for review, revision, and pilot testing (Ayers, 2004). The battery of tests was administered to over 3,263 high school students at schools with 17 "NASPE Teachers of the Year," in 16 states. All seven areas of the *ASK PE: EXP Battery* had a Kuder-Richardson's (KR20) reliability rating range of .7 to .94. Specifically, the Exercise Physiology section had a KR20 rating of .91, indicating that for the sampled population, the selected *ASK PE: EXP* questions were functioning as a cohesive group to measure Exercise Physiology content.

The results from Ayers' study (2004) revealed that the *ASK PE Battery* did reflect students' physical education content knowledge, but that differences did exist among subgroups of gender, race, and sport experiences. Factorial ANOVAs revealed significant main effects for gender across all seven sections. Particularly on the Exercise Physiology content exam, girls scored higher than boys. There was also a significant main effect for race across all seven sections. Additionally, Caucasian persons scored significantly higher on the Exercise Physiology content area than all other examinees. The overall average score for the Exercise Physiology sub-disciplinary section for this sample was 62%.

Overall, results from Ayers' (2004) study reported that the seven sub-disciplinary sections had internal consistency values of .70 or higher. Indicating each collectively functions to measure overall physical education content. However, due to the limited use of the *ASK PE Battery* in research, additional studies, across various samples will add value to the instrument's dependability. Ayers (2004) notes that as with "all baseline efforts, there are imperfections and limitations in the *ASK PE Battery*" (286).

For the proposed study, it was deemed important to understand how the *ASK PE: EXP* was functioning on multiple levels. A fundamental goal of this project was to investigate the performance of Ayers' measure. It was critical to determine its ability to differentiate between individuals who knew the Exercise Physiology content and individuals who did not know the Exercise Physiology content due to its selection as an instrument for use in a future study. Therefore, the purpose of this study was to compare the observed psychometrics of the *ASK PE: EXP* across two samples, as an initial process for a prospective study. A final component of this examination was to explore the

impacts of modifications in the *ASK PE: EXP*, and offer suggestions for changes accordingly.

# Methods

Prior to beginning the research study, approval was received from The University of Southern Mississippi' Institutional Review Board.

## *Sampling Procedures*

### *Sample One*

A convenience sample was used to obtain observed psychometric properties of the *ASK PE: EXP*. A local Christian private school was included in the study. A total of 74 ninth and twelfth grade Mississippi private high school students were included. The principal agreed to let his ninth and twelfth grade students participate. A total of four classes were included in the study (2 = ninth grade classrooms, 2 = twelfth grade classrooms).

### *Sample Two*

A multi-stage sampling technique was employed to obtain a random sample of 2,790 ninth and twelfth grade Mississippi public high school students with an approximate age range of 14-20. Three stages were utilized to ensure that schools from all areas of the state had an equal chance of being selected for representation based on the percentage of ninth and twelfth grade students that each area was accountable.

*Stage One: Stratified Sampling.*

The initial sampling procedure involved dividing the state of Mississippi into seven geographical regions to ensure that schools from all areas of the state had an equal chance of being selected for representation based on the percentage of ninth and twelfth grade students that each area was accountable. The seven geographical regions included in the sampling frame were the North East, North Central, North West, East Central,

West Central, South East and South West. Information obtained via the Mississippi Department of Education's (MDE) website, http://www.mde.k12.ms.us/ allowed each region to be dissected to determine the number of high schools and the number of ninth and twelfth grade students that comprised each area.

Information regarding high schools and ninth and twelfth grade enrollment was collected by examining county information via the MDE website (http://www.mde.k12.ms.us/Districts/msmap2.htm). The MDE website allows users to link to every Mississippi County and obtain information regarding which school districts and schools are located in each county. Furthermore, the website offers links from districts and schools to view enrollment numbers by state or district level (http://orsap.mde.k12.ms.us:8080/MAARS/index.jsp).

Thus, the state was divided by the seven geographical regions, and then each region was examined by the counties comprising each area. Once information was examined at a county level, it was then checked for accuracy by viewing the district-level data. Information was recorded into an Excel spreadsheet for future use and reference. Recorded information included: high school, region, and county, ninth grade enrollment, twelfth grade enrollment, and academic ratings. The spreadsheet calculated total schools in the state, total schools in each region, total ninth and twelfth graders in each region, and percentage of schools, as well as percentage of ninth and twelfth grade students.

*Stage Two: Random Sampling.*

Once the total percentage of ninth and twelfth grade students comprising each geographical area was determined, high schools were randomly selected from the seven regions to represent the corresponding percentage of total students in each area. Each

high school in each geographical area had a one in ten chance of being selected for the study. The developed spreadsheet was used to assist in the selection process. Schools were reviewed by total ninth and twelfth grade enrollment as well as academic rating. A balance of ninth and twelfth grade enrollment was desired for each of the seven geographical areas. Additionally, a balance of students attending schools with academic ratings of "Level 2, 3, 4, and 5" was desired for the total sample. Therefore, as every tenth school appeared in the sampling pool, the researcher reviewed this criterion. If the criterion was achieved across all levels (a balance of desired schools was achieved by geographical region, academic rating, and ninth and twelfth grade enrollment proportionate to each region) schools were selected for the sample. School selection continued in each geographical area until the percentage of students which were representative of each area was achieved.

*Stage Three: Inclusive Sampling.*

At the final stage of sampling, all ninth and twelfth grade students from the randomly-selected schools were included in the sample.

## *Data Collection*

### *Sample One*

The principal at the local private school was contacted prior to administering the questionnaires. Passive parental consent forms were provided to the students. Each student was assumed to have consent if the parental consent form was not signed, dated, and returned to the teacher prior to study implementation. Additionally, students provided assent for participation before completing the instruments.

Upon subjectively reviewing students' ease or difficulty of understanding the questionnaires and examining the *ASK PE: EXP,* modifications were made. Modifications included item revisions to the *ASK PE: EXP* (See Table 1). Modifications resulted in a 38 item questionnaire. Revised *ASK PE: EXP* questionnaires were printed, packaged, and mailed to the second sample. See Table 2 and Table 3.

*Sample Two*

Selected schools were informed via fax and email that they had been randomly selected to participate in a study. All study materials were mailed in boxes. Information was clearly labeled for all recipients. A date of completion was provided to administrators and teachers, but within this time period, each school and teacher had the choice of the actual implementation date. All schools were allotted six weeks to complete the study. Passive parental consent forms were provided to the students. Each student was assumed to have consent if the parental consent form was not signed, dated, and returned to the teacher prior to study implementation. Additionally, students provided assent for participation before completing the instruments. Actions were taken to minimize non-response bias.

*Data Screening Procedures*

Prior to analyzing data, the incorrect and correct responses to the *ASK PE: EXP* had to be coded where "0=incorrect" and "1=correct". Also, data formulas were computed to determine percent of accuracy on the *ASK PE: EXP.*

*Sample One*

*Internal Consistency.*

Descriptive statistics and frequencies were used to detail demographic information on the sample and provide detail to each *ASK PE: EXP* question. Prior to other statistical tests, the homogeneity of the *ASK PE: EXP* items was examined. A Kuder-Richardson 20 (KR20) reliability analysis with corrected item to total correlations was analyzed. Based on the corrected item-total correlations, as well as subjective review of questions, items not performing strongly were deleted from the reliability analysis and reevaluated in two other examination scenarios.

*Item Discrimination Analysis.*

Additionally, item discrimination was conducted to determine how the items differentiated between the high scoring and low scoring respondents (Crocker & Algina, 1986). Prior to conducting the item discrimination, respondents' z-scores were obtained for the *ASK PE: EXP* percent of accuracy. Obtaining the z-scores allowed the data to easily be sorted in SPSS by low scoring respondents to high scoring respondents. Three groups emerged from viewing the sorted z-scores: 1) respondents who performed above the mean, 2) respondents who performed at the mean, and 3) respondents who performed below the mean. Of these three groups, the mean group was excluded from the item discrimination, and those who performed above and below the mean, were used for the analysis.

Once the two groups for item discrimination were selected, their coded correct or incorrect responses for each of the 42 questions (0=incorrect, and 1=correct) was transferred into Excel. The two data groups (those who performed above the mean and

those who performed below the mean) were separated in one Excel database. For each of the two groups, the sum of each question's correct responses was determined. For each of the groups (those who performed above the mean and those who performed below the mean), each question's total correct responses, was divided by the number of individuals in that group to provide an overall proportion of correct responses from low-scoring respondents and from high-scoring respondents. As a final step in the item discrimination analysis, the difference in high-scoring respondents' proportion of correct responses and low-scoring respondents' proportion of correct responses was determined to provide an overall discrimination value (D). Items performed at one of four D value ranges: 1) D was less than or equal to .19, indicating the item should be eliminated or completely revised, 2) D was within a range of .2 to .29 indicating the item is marginal and needs revision, 3) D was within a range of .3 to .39 indicating the item needs little or no revision, and 4) D was .4 or greater indicating the item is functioning quite satisfactorily (Crocker & Algina,1986, p. 313).

*Item Analysis.*

Each item was analyzed with descriptive statistics and frequencies. Items were evaluated to determine what percentage of correct responses was located in "A", "B", "C", or "D" positions. Also, items were evaluated to determine a level of response diversion. More specifically, all responses to all questions were evaluated to determine the percentage of students selecting option "A", "B", "C", or "D". This enabled poor response options based on their level of distraction to be analyzed.

Mean comparisons and independent t-tests helped to further analyze how the *ASK PE: EXP* differentiated between high and low-scoring respondents. Mean comparisons

were conducted on the three groups:1) respondents who performed above the mean, 2) respondents who performed at the mean, and 3) respondents who performed below the mean. All groups were evaluated to determine how their performances differed when poor questions based on corrected item-total correlations were deleted. Two versions (with removed questions: version one had 37 questions and version two had 25 questions) were examined and compared to performances with all 42 questions. Independent t-tests were used to determine if differences existed among sex on any of the three versions of the test (42 items, 37 items, or 25 items).

*Sample Two*

Procedures for Sample Two repeat steps from Sample One. However, Sample Two was evaluated on responses obtained from the adapted, 38 item *ASK PE: EXP.*

# Results

## *Sampling Results*

The psychometric properties of the *ASK PE: EXP* were evaluated on two different samples.

### *Sample One*

A convenient sample of 74 Mississippi private high school students (females = 32 and males = 42) in grades nine (n=40) and twelve (n=31) participated in the study. The sample's race demographics included 64 or 86.5% Caucasian (Mississippi = 61.2% Caucasian), 5 or 6.8% African American (Mississippi = 36.9% African American), 1 or 1.4% Asian (Mississippi = .7% Asian), 2 or 2.7% American Indian (Mississippi = .4% American Indian), and no other ethnic groups were represented.

Students attending the local private school score an average of 24.8 on the ACT, and in the last graduating class, 14 students scored a 30 or higher. In just 5 years, the private school has had 14 National Merit Finalists, 1 National Merit Semi-finalist, 2 National Merit Commended Scholars, and 1 National Achievement Award Winner. The last graduating class was awarded over three million dollars in scholarships, which was an average of $47,968 per graduating student. Nearly all students in the past three years have attended college (141/142), with one student going into a family business. The current school curriculum is Christian-based, College Preparatory Academic Curriculum. The school is accredited by the Mississippi Private School Association and the Southern Association of Colleges and Schools.

*Sample Two*

A total of 390 Mississippi public high school students (females = 198 and males = 188) in grades nine (n=224) and twelve (n=147) participated in the study. The sample was representative of five geographical regions throughout Mississippi including: North East (24.7%), North Central (22.6%), East Central (5.9%), South East (25.4%) and South West (21.3%). (The North West and West Central regions of the state are not included in the sample). Also, six different high schools were represented in the sample. Of the participants, 22.6% attend "Level 2 or under-performing" schools, 5.9% attend "Level 3 or successful" schools, 24.6% attend "Level 4 or exemplary" schools, and 46.7% attend "Level 5 or superior" schools. (No "Level 1" schools were included in the sampling frame). The sample included race demographics similar to the state's census demographics with majority of the sample 263 or 68.3% Caucasian (Mississippi = 61.2% Caucasian), 103 or 26.8% African American (Mississippi = 36.9% African American), 7 or 1.8% Asian (Mississippi = .7% Asian), 5 or 1.3% American Indian (Mississippi = .4% American Indian), 4 or 1.0% Hispanic (Mississippi = 1.7% Hispanic), 2 or .5% Pacific Islander (no comparable Mississippi data), and 1 or .3% other (no comparable Mississippi data).

*Internal Consistency*

*Sample One*

A KR20 reliability analysis of the 42 items from the *ASK PE: EXP* indicated that test items functioned at a level of .731. Therefore, the *ASK PE: EXP* served as a reliable indicator of Exercise Physiology content knowledge for this particular population.

*Sample Two*

Internal consistency for the entire 38 Exercise Physiology test items was .896, a similar result to Ayers (2004) consistency value of .9 for selected test items. Compared results of sample one, an improvement of .165 was achieved. Of the 38 revised items ($N_2$), only one item, compared to a previous ($N_1$) six items, had a negative corrected item-total correlation, indicating that it was not functioning well with the other 37 items to assess Exercise Physiology desired content. See Table 4.

*Item Discrimination Analysis*

*Sample One*

The KR20 analysis was followed with an item discrimination analysis, which highlighted the degree of difference between high-scoring respondents and low-scoring respondents on the 42 items of the *ASK PE: EXP*. Item discrimination values suggested that 21 items (50%) needed to be eliminated or completely revised, $D \leq .19$. Another 12 items (29%) were marginal and needed revision, $.2 \leq D \leq .29$. Five items (12%) needed little or no revision, $.3 \leq D \leq .39$. Four remaining items (10%) functioned quite satisfactorily, $D \geq .4$.

*Sample Two*

The item discrimination analysis yielded overall positive results. In the previous ($N_1$) item discrimination analysis, it was suggested that 78% of questions were not differentiating between individuals who knew the Exercise Physiology content (high scorers) and individuals who did not know the Exercise Physiology content (low scorers). New results ($N_2$) indicated that overall 77% of the 38 revised items were, in fact, distinguishing between those who knew the Exercise Physiology content (high scorers)

and individuals who did not know the Exercise Physiology content (low scorers). See Table 5 and Table 6.

*Item Analysis*

*Sample One*

Descriptive statistics and frequencies were employed to analyze correct response positions and response options. Correct "A" response positions comprised 12% of exam answers. Correct "B" response positions comprised 21.5% of exam answers. Correct "C" response positions comprised 21.5% of exam answers. Correct "D" response positions comprised 45% of exam answers. Review of descriptive statistics suggested that 26 items (62%) had one or more responses that were not selected by any student. Additionally, numerous responses had low choice selection. See Table 6.

In evaluating mean comparisons across three variations of the *ASK PE: EXP* (42 items, 38 items, and 25 items), it was noted that majority of students who performed above the mean (42 items – 85%, 38 items – 87%, and 25 items 88%) or at the mean (42 items – 78%, 38 items – 80%, and 25 items – 81%) respectively remained at that level or better across all variations of the exam. While students, who performed below the mean, performed similarly on the 38 item version and lower on the 25 item version of the exam (42 items – 66%, 38 items – 67%, and 25 items 62%).

No statistically significant differences existed between sex and *ASK PE: EXP* score on any version of the test.

*Sample Two*

An item analysis was used to determine if students were more likely to select distracter options, indicating the choices were more equally attractive compared to non-

revised options. Modifications which included balancing out the representation of correct response positions and altering selected distracter responses may have impacted student choices. Descriptive statistics and frequencies indicated the original *ASK PE: EXP* had 62% of test items in which one or more responses were not selected by any student, compared to 0% of revised test items indicating that the revised diversion options might have been more appealing to students who did not know the exam content.

*Limitations*

1.) This study was limited to Mississippi high school students in grades nine and twelve.

2.) The *ASK PE: EXP* instruments were provided to students in two different manners.

*3.)* This study only evaluated the Exercise Physiology subsection of the *ASK PE Battery.*

## Discussion

### *Internal Consistency*

Though the internal consistency rating of the *ASK PE: EXP* had a reported KR20 value of .9 (Ayers, 2004), results from sample one provided slightly different and less dependable results, KR20=.73. Reasons for this difference might be attributed to differences in sample size and student demographics. Though there was a slight difference among Ayers' results and results of the observed first sample, Ayers' (2004) reported KR20 value of .9 compares closely to the observed KR20 value of .89 (.9) of sample two. Though all KR20 values are deemed statistically acceptable, two values yield a much higher value for reliability. Differences might be explained by disparity between sample sizes, selected test items, and/or school setting (public versus private).

### *Item Discrimination Analysis*

After reviewing the KR20 analysis ($N_1$) objectively and subjectively, further analyses were used to determine other areas of interest regarding the *ASK PE: EXP*. The item discrimination analysis allowed for each question to be evaluated, and further, assisted in determining if, in fact, it distinguished between those who scored high and those who scored low. Only nine items (22%) needed little or no revision. The item discrimination analysis suggested that the remaining 33 items (78%) be eliminated or revised to better distinguish between those who knew the physical education content and those who did not know physical education content. Review of the item discrimination provided justification to modify items that were not distinguishing between those who knew (high scorers) and those who did not know (low scorers) the Exercise Physiology content. Specifically when compared to the non-revised questionnaire ($N_1$) , the revised

questionnaire ($N_2$) had: 3 items (8%) that needed to be completely revised or eliminated compared to a previous 21 items (50%); 6 items (16%) that were marginal and needed revision compared to a previous 12 items (29%); 9 items (24%) that needed little or no revision compared to a previous 5 items (12%); and, 20 items (53%) that were functioning quite satisfactorily compared to a previous 4 items (10%).

*Item Analysis*

An item analysis comparing descriptive statistics and frequencies of the two samples yielded more justification for modifications of the *ASK PE: EXP*. Findings ($N_1$) suggested an imbalance of correct responses, particularly in the "D" position which is consistent with research suggesting that most educators do not assign correct choices in the "A" position, but instead default to a "C" or "D" position (McDonald, 2002). McDonald suggests that "there should be an equal number of correct responses in the A, B, C, and D positions" (p.105). Therefore, modifications in correct response positions were made to accommodate more of a balance. Corrected response position modifications included: 1) placing 26% (N2) compared to 12% (N1) of the correct responses in the "A" position, 2) placing 24% (N2) compared to 21.5% (N1) of the correct responses in the "B" position, 3) placing 21% (N1) compared to 21.5% (N2) of the correct responses in the "C" position, and 4) placing 29% (N1) compared to 45% (N2) of the correct responses in the "D" position.

Further analysis of each of the 42 items ($N_1$) suggested that some questions had poor distracter responses. For instance, 62% of the questions had one or more responses that were not selected by any student, while multiple responses had low choice selection. Analysis of the revised 38 items ($N_2$) revealed that all responses were at least selected by

some individual, indicating that the revised diversion options might have been more appealing to students who did not know the exam content. This is aligned with researchers who claim that all choices should be equally attractive for individuals who do not know the content (Cohen & Wollack, 2008; McDonald, 2002). Additionally, "all of the above" and "none of the above" choices should be avoided (Cohen & Wollack, 2008; Harasym, Leong, Violato, Brant & Lorscheider, 1998; McDonald, 2002).

See Table 7.

## Conclusions and Recommendations

Collectively, the reliability analysis, corrected item-total correlations, item discrimination analysis, and the individual item analyses of correct response position and distracter options, offered an objective basis for specific questions that needed modifications. Further examination of these questions provided performance explanations. For example, some questions were double-barreled. Researchers suggest that questions should be clear, simple, and focused (Converse & Presser, 1986; Devellis, 2003). Additionally, some questions were lengthy. Devellis notes that "length increases complexity and diminishes clarity" and further asserts that questions should be written in simple, straightforward language (2003). After a detailed analysis of the 42 items, suggested modifications for most questions fell into one or more of five categories: 1) The question's responses needed to be moved to another position; 2) The question needed better distracter options (included "all of the above" or "none of the above" responses); 3) The question was double-barreled; 4) The question was lengthy; and/or, 5) The question functioned poorly for overall content assessment. A thorough objective and subjective analysis of the *ASK PE: EXP* revealed that multiple questions needed revisions. A total of 16 out of a possible 42 items were modified, and five items were completely eliminated.

Overall, it was noted that the internal consistency level of the *ASK PE: EXP* remained at a .731 or higher level across two observed samples (.731, $N_1$ and .89, $N_2$) and one reported sample (.9) (Ayers, 2004). Though the questions collectively function to assess desired Exercise Physiology content, an item discrimination analysis ($N_1$) suggested that multiple questions (33/42) did not distinguish between those who knew

and those who did not know the content. Therefore, modifications were made to select questions and item discrimination results ($N_2$) indicated improvements in all but 1/15 revised question's performances. A final detailed item analysis, using descriptive statistics and frequencies, suggested that improvements could be made in the level of difficulty of distracter options and the placement of correct responses. Select distracter responses were modified, so that the provided choices would be as equally attractive as the correct response for those who did not know the content.

As more participants complete the *ASK PE: EXP* recommendations can be made to improve the instrument's performance based on subjective and objective observations. Overall, the *ASK PE: EXP's* items functioned collectively to assess Exercise Physiology content for two observed samples and one reported sample (Ayers, 2004). However, simple modifications allowed for an improved instrument with clearer, more challenging questions and answers. Therefore, an initial recommendation for use of the *ASK PE: EXP* in research is to conduct a pilot study, for additional review of items. Also, this recommendation is made for other sections of the *ASK PE Battery.* As the *Assessment of Sub-disciplinary Knowledge in Physical Education: Exercise Physiology* and the *ASK PE Battery* as a whole becomes more widely used as research instruments and observed psychometric properties are reported, the longevity and reliability of these measures can be more accurately determined. With cumulating research that supports Ayers' *ASK PE: EXP Battery* (2004), this physical education measure could potentially become the premiere cognitive measure of physical education knowledge.

Table 1. Selected Original and Revised Questions from the *ASK PE: EXP*

| Original | Revised |
|---|---|
| *What principle(s) is/are related to improving fitness?*<br>*A.) how hard you exercise*<br>*B.) how long you exercise*<br>*C.) how often you exercise*<br>*D.) all of the above* | What principle is <u>not</u> related to improving fitness?<br>A.) what time of day you exercise<br>B.) how hard you exercise<br>C.) how often you exercise<br>D.) how long you exercise |
| *Which of the following is most likely to contribute to good physical and mental health?*<br>*A.) working out at a gym once a week*<br>*B.) shopping regularly in a large mall*<br>*C.) regular moderate to vigorous physical activity*<br>*D.) all of the above* | Which of the following is most likely to contribute to good physical health?<br>A.) working out at a gym once a week<br>B.) shopping regularly in a large mall<br>C.) regular moderate to vigorous physical activity<br>D.) reading current information on exercise trends |
| *Which exercises could be included in a safe stretching and strengthening program?*<br>*A.) fast head circles*<br>*B.) fast deep knee bends*<br>*C.) slow crunches/curl-downs*<br>*D.) slow straight-legged toe touches* | What exercises could be included in a safe stretching program?<br>A.) fast head circles<br>B.) fast deep knee bends<br>C.) slow crunches/curl-downs<br>D.) slow straight-legged toe touches |
| *Which exercises could be included in a safe stretching and strengthening program?*<br>*A.) fast head circles*<br>*B.) fast deep knee bends*<br>*C.) slow crunches/curl-downs*<br>*D.) slow straight-legged toe touches* | What exercises could be included in a safe strengthening program?<br>A.) fast head circles<br>B.) fast deep knee bends<br>C.) slow crunches/curl-downs<br>D.) slow straight-legged toe touches |
| *Which of the following activities contributes to fitness?*<br>*A.) strength training*<br>*B.) flexibility training*<br>*C.) cardiorespiratory training*<br>*D.) all of the above* | Which of the following activities <u>does not</u> contribute to health-related fitness?<br>A.) strength training<br>B.) agility training<br>C.) cardiorespiratory training<br>D.) flexibility training |
| *Nikki has never done cardiorespiratory exercise or lifted weights before, but she stretches twice a week. She is going to try out for her high school track team next semester, so as part of her training, she has asked* | Nikki has asked a friend to teach her how to lift weights correctly. When Nikki adds more weight to her exercises as she gets stronger she is _____. |

Table 1. Selected Original and Revised Questions from the *ASK PE: EXP* Continued

| | |
|---|---|
| a *friend to teach her how to lift weights correctly. When Nikki adds more weight to her exercises as she gets stronger she is _____.*<br>*A.) risking injury*<br>*B.) using the principle of specificity*<br>*C.) using the principle of progression*<br>*D.) ignoring a major principle of lifting* | A.) risking injury<br>B.) using the principle of specificity<br>C.) using the principle of progression<br>D.) ignoring a major principle of lifting |
| *Nikki has never done cardiorespiratory exercise or lifted weights before, but she stretches twice a week. She is going to try out for her high school track team next semester, so as part of her training, she has asked friend to teach her how to lift weights correctly. Nikki's strength-training program should be set up _____.*<br>*A.) based on her starting abilities*<br>*B.) based on the fitness scores for her age group*<br>*C.) differently than a boy who has never lifted before*<br>*D.) according to the work-out Muscle and Fitness magazine recommends for the women's national body building champion* | Nikki's strength-training program should be set up _____.<br>A.) based on her starting abilities<br>B.) based on the fitness scores for her *a* age group<br>C.) differently than a boy who has never lifted before<br>D.) according to the work-out Muscle and Fitness magazine recommends for the women's national body building champion |
| *Consuela has been riding the stationary bike for eight weeks in an effort to improve her cardiorespiratory fitness. She started riding at level one, and is still riding at that level. Which fitness principle is she ignoring?*<br>*A.) interest*<br>*B.) progression*<br>*C.) regularity*<br>*D.) specificity* | Consuela started a stationary bike program beginning at level one, and is still riding at that level. Which fitness principle is she ignoring?<br>A.) interest<br>B.) progression<br>C.) regularity<br>D.) specificity |
| *What do you need for both normal daily activities and hard physical activity?*<br>*A.) endurance*<br>*B.) power*<br>*C.) basic strength*<br>*D.) all of the above* | What do you need for hard physical activity?<br>A.) endurance, power, basic strength<br>B.) an exercise coach or instructor<br>C.) a workout facility<br>D.) A and B only |
| *Muscles that are not used for a long time usually _____.*<br>*A.) are stronger*<br>*B.) become longer*<br>*C.) get weaker*<br>*D.) stay firm* | Muscles that are not used for a long time usually _____.<br>A.) maintain their strength<br>B.) become longer<br>C.) get weaker<br>D.) stay firm |

Table 1. Selected Original and Revised Questions from the *ASK PE: EXP* Continued

| | |
|---|---|
| *Wade is 16 years old and wants to lose weight and improve his cardiorespiratory fitness. He has never played organized sports and he works after school, so he will have to exercise before school and in his should Wade do the first few weeks of his fitness program?*<br>*A.) stretching*<br>*B.) brisk walking*<br>*C.) lifting weights*<br>*D.) gradually include all of the above* | Wade is beginning a fitness program. What type of exercise(s) should Wade do the first few weeks of his fitness program?<br>A.) stretching<br>B.) brisk walking<br>C.) lifting weights<br>D.) gradually include all of the above |
| *Wade is 16 years old and wants to lose weight and improve his cardiorespiratory fitness. He has never played organized sports and he works after school, so he will have to exercise before school and in his physical education class. After Wade has been exercising for several months, how often should he be exercising?*<br>*A.) once a week*<br>*B.) twice a week*<br>*C.) three times a week*<br>*D.) most days of the week* | After Wade has been exercising for several months, how often should he be exercising?<br>A.) once a week<br>B.) twice a week<br>C.) three times a week<br>D.) most days of the week |
| *Wade is 16 years old and wants to lose weight and improve his cardiorespiratory fitness. He has never played organized sports and he works after school, so he will have to exercise before school and in his physical education class. When Wade first begins his program, what would be an appropriate training heart rate?*<br>*A.) in his target heart rate range*<br>hard<br>*B.) as high as he can possibly get it*<br>*C.) the same as his resting heart rate*<br>*D.) low enough so he does not breathe hard* | When Wade first begins his program, what would be an appropriate training heart rate?<br>A.) in his target heart rate range<br>B.) as high as he can possibly get it<br>C.) the same as his resting heart<br>D.) low enough so he does not breathe |
| *Which activity will produce the greatest increase in overall muscle size (hypertrophy)?*<br>*A.) downhill skiing*<br>*B.) playing tennis*<br>*C.) skateboarding*<br>*D.) weight lifting* | Which activity will produce the greatest increase in overall muscle size (hypertrophy)?<br>A.) running daily<br>B.) playing tennis<br>C.) playing football<br>D.) weight lifting |

Table 1. Selected Original and Revised Questions from the *ASK PE: EXP* Continued

| | |
|---|---|
| *What is one way to overcome barriers to a regular stretching and strengthening program?*<br>*A.) set goals based on your own patterns of physical activity.*<br>*B.) challenge yourself to do things you see other people doing.*<br>C.) *avoid record keeping to limit your frustration with slow progress.*<br>*D.) just don't worry about things that make it hard to stretch or strength train regularly.* | What is one way to overcome barriers to a regular strengthening program?<br>A.) set goals based on your own patterns of physical activity<br>B.) challenge yourself to do things you see other people doing<br>C.) avoid record keeping to limit your frustration with slow progress<br>D.) just don't worry about things that make it hard to stretch or strength train regularly |

Table 2. Summary of Revisions

| | Original *ASK PE: EXP* | Adapted *ASK PE: EXP* |
|---|---|---|
| Total Items | 42 | 38 |
| No Action On Items | 21 | |
| Revised Items | 16 | |
| Deleted Items | 5 | |
| KR20 Value | .73 | .89 |

* Note that Original Item #5 was developed into two questions.

Table 3. Results of Instrument Evaluation: Adapted *ASK PE: EXP*

| Original Item # | Action Taken on Original *ASK PE: EXP* Items |
|---|---|
| 1 | No action |
| 2 | No action |
| 3 | Revised |
| 4 | Revised |
| 5 | Revised |
| 6 | No action |
| 7 | Revised |
| 8 | Revised |
| 9 | Deleted |
| 10 | Revised |
| 11 | Deleted |
| 12 | Revised |
| 13 | Deleted |
| 14 | Revised |
| 15 | Revised |
| 16 | No action |
| 17 | No action |
| 18 | Deleted |
| 19 | Revised |
| 20 | Revised |
| 21 | Revised |
| 22 | No action |
| 23 | No action |
| 24 | No action |
| 25 | No action |
| 26 | Revision |
| 27 | Revision |
| 28 | No action |
| 29 | Deleted |
| 30 | No action |
| 31 | No action |
| 32 | No action |
| 33 | No action |
| 34 | No action |
| 35 | No action |
| 36 | No action |
| 37 | Revision |
| 38 | No action |
| 39 | No action |
| 40 | Revision |
| 41 | No action |
| 42 | No action |

Table 4. Observed Reliability Analysis of *ASK PE: EXP*

| Original Item # | Reliability Analysis by Item to Total Correlation for Original Items | Reliability Analysis by Item to Total Correlation for Adapted Items | Reliability Analysis Results for Adapted Items Correspond with Original Item #, and Original Item to Total Correlation |
|---|---|---|---|
| 1 | .161 | .208 | 1, .161 |
| 2 | .380 | .267 | 2, .380 |
| 3 | .170 | .356 | 3, .170 |
| 4 | -.085 | .318 | 4, -.085 |
| 5 | -.144 | -.191 | 5,-.144 |
| 6 | .299 | .260 | 5,-.144 |
| 7 | .015 | .360 | 6, .299 |
| 8 | .357 | .153 | 7, .015 |
| 9 | -.033 | .438 | 8, .357 |
| 10 | .357 | .404 | 10, .357 |
| 11 | .090 | .586 | 12, .414 |
| 12 | .414 | .294 | 14, -.103 |
| 13 | -.044 | .491 | 15, .109 |
| 14 | -.103 | .561 | 16, .314 |
| 15 | .109 | .453 | 17, .176 |
| 16 | .314 | .506 | 19, .345 |
| 17 | .176 | .344 | 21, .239 |
| 18 | -.064 | .443 | 20, .093 |
| 19 | .345 | .337 | 22, .246 |
| 20 | .093 | .447 | 23, .284 |
| 21 | .239 | .404 | 24, .338 |
| 22 | .246 | .187 | 25, .214 |
| 23 | .284 | .494 | 26, .088 |
| 24 | .338 | .537 | 27, .436 |
| 25 | .214 | .481 | 28, .401 |
| 26 | .088 | .212 | 30, .424 |
| 27 | .436 | .553 | 31, .625 |
| 28 | .401 | .361 | 32, .180 |
| 29 | .063 | .452 | 33, .270 |
| 30 | .424 | .372 | 34, .386 |
| 31 | .625 | .605 | 35, .429 |
| 32 | .180 | .510 | 36, .451 |
| 33 | .270 | .524 | 37, .379 |
| 34 | .386 | .405 | 38, .180 |

| | | | |
|---|---|---|---|
| 35 | .429 | .522 | 39, .251 |
| 36 | .451 | .515 | 40, .326 |
| 37 | .379 | .632 | 41, .075 |
| 38 | .180 | .522 | 42, .388 |
| 39 | .251 | | |
| 40 | .326 | | |
| 41 | .075 | | |
| 42 | .388 | | |
| Total KR20 | .73 | .89 | |

Table 5. Index of Discrimination Analysis Results

| Item | N1 Index of Discrimination Performance | Item Revised for N2 Yes or No | N2 Index of Discrimination Performance |
|---|---|---|---|
| 1 | .18 | No | .22 |
| 2 | .37 | No | .25 |
| 3 | .06 | Yes | .28 |
| 4 | -.04 | Yes | .30 |
| 5 | -.06 | Yes | -.16 |
| 6 | -.06 | Yes | .26 |
| 7 | .18 | No | .32 |
| 8 | .08 | Yes | .14 |
| 9 | .14 | Yes | .40 |
| 10 | .21 | Yes | .33 |
| 11 | .08 | Yes | .55 |
| 12 | .01 | Yes | .27 |
| 13 | .10 | Yes | .38 |
| 14 | .04 | No | .45 |
| 15 | .06 | No | .42 |
| 16 | .08 | Yes | .57 |
| 17 | .29 | Yes | .38 |
| 18 | .21 | Yes | .45 |
| 19 | .18 | No | .34 |
| 20 | .29 | No | .47 |
| 21 | .33 | No | .38 |
| 22 | .44 | No | .17 |
| 23 | .06 | Yes | .50 |
| 24 | .44 | Yes | .54 |
| 25 | .25 | No | .47 |
| 26 | .53 | No | .22 |
| 27 | .27 | No | .57 |
| 28 | .12 | No | .39 |
| 29 | .26 | No | .45 |
| 30 | .31 | No | .39 |
| 31 | .42 | No | .61 |
| 32 | .39 | No | .52 |
| 33 | .27 | No | .52 |
| 34 | .22 | No | 41 |
| 35 | .33 | No | .53 |
| 36 | .22 | Yes | .50 |
| 37 | .08 | No | .63 |
| 38 | .20 | No | .52 |

Table 6. Summary of Results by Index of Discrimination Values

| D-Value Classification | D-Value Ranges | N1 D-Values by Range and Classification # and % of Total Items | N2 D-Values by Range and Classification # and % of Total Items |
|---|---|---|---|
| *Needs Complete Revision or Elimination* | D≤.19 | 21 items 50% | 3 items 8% |
| *Marginal and Needs Revision* | .2≤D≤.29 | 12 items 29% | 6 items 6% |
| *Needs Little or No Revision* | .3≤D≤.39 | 5 items 12% | 9 items 24% |
| *Item Functions Satisfactorily* | D≥.4 | 4 items 10% | 20 items 53% |

Table 7. Summary of Correct Response Representations

| Correct Response Positions | Original *ASK PE: EXP* Correct Responses by Position and % of Total Items | Revised *ASK PE: EXP* Correct Responses by Position and % of Total Items |
|---|---|---|
| A | 12% | 26% |
| B | 21.5% | 24% |
| C | 21.5% | 21% |
| D | 45% | 29% |

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# CHAPTER V

## MANUSCRIPT II

## Physical Education Content Knowledge and Physical Activity Behaviors of Mississippi High School Students

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Running head: PE Content Knowledge and Physical Activity

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# Physical Education Content Knowledge and Physical Activity Behaviors of Mississippi High School Students

Running head: PE Content Knowledge and Physical Activity

KEY WORDS: Cognitive Knowledge, Physical Education, Physical Activity, and BMI

## Abstract

This study investigated physical education content knowledge, physical activity behaviors, and body mass indexes of 386 Mississippi ninth (n=236 ) and twelfth (n=150) grade students with a goal of establishing evidence-based needs to modify physical education curricula. Results of this study suggested that a significant, direct relationship did exist in the *Assessment of Sub-disciplinary Knowledge in Physical Education: Exercise Physiology* (*ASK PE: EXP*);(Ayers, 2004) scores and scores from the *Modifiable Activity Questionnaire for Adolescents* (*MAQ-A*);(Aaron & Kriska, 1997) for both ninth and twelfth grade students. Findings also suggested that physical education content knowledge (exercise physiology) is more likely to contribute to twelfth grade reported physical activity scores than ninth grade reported physical activity scores. However, ninth graders were more active than twelfth graders. This is possibly explained by the small difference (5%) in *ASK PE: EXP* scores between ninth (M *ASK PE: EXP* score = 52%, SD=.22) and twelfth graders (M *ASK PE: EXP* score = 57%, SD = .21). As a whole, results indicated that Mississippi ninth and twelfth grade students' average *ASK PE: EXP* score was lower (M = 53%, SD = .22) than students in 16 other states (M = 62%, SD = 7.65). Further, majority of Mississippi high school students performed

significantly below the established, research-based cutoff score of 62% (observed *N* below 62% = 236 and observed *N* above 62% = 150). This was notable, because findings also suggested that students who scored higher (M knowledge = 76%, SD = .08);(M activity = 8.6 hours/week, SD = 9.7) or above 62% on the *ASK PE: EXP* were more likely to be active during a weekly basis compared to those who scored lower (M knowledge = 39%, SD = .14);(M activity = 5.8 hours/week, SD = 9.8) or below a 62% on the *ASK PE: EXP*. With this noted, it was recommended that Mississippi high schools evaluate the current physical education programs. It is suggested that particular attention be given to the inclusion of accountability measures for physical education teachers and students. Additionally, Mississippi high schools should formally evaluate and document changes in knowledge and physical activity behaviors over time.

## Introduction

Obesity is a disease that is plaguing people of each gender, all ages, races, and socioeconomic statuses within this nation (Dietz, Lee, Wechsler, Malepati, & Sherry, 2007). In a recent poll conducted by the Trust for America's Health Foundation (TFAH), 85 % of Americans believe obesity is an epidemic (Levi, Segal & Gadola, 2007). Increasing prevalence rates, which can be defined as ratios representative of the number of occurrences of a disease at a given time period or event to the number of units at risk in the population (Webster-Online, 2007), have helped to justify an obesity "epidemic" label. According to the Center for Disease Control and Prevention (CDC, 2007), the obesity trend from 1985 to 2005 has increased dramatically. For example, the CDC reported that in 1991 four states, Louisiana, Michigan, Mississippi, and West Virginia, had obesity prevalence rates of 15 to 19% and no states had rates at or above 20% (¶1). As of 2005, the CDC reported that four states had obesity prevalence rates less than 20%, while 17 states had prevalence rates equal to or greater than 25%, with three of those states, Louisiana, Mississippi, and West Virginia, having prevalence rates equal to or greater than 30% (¶3). In 2005 and 2006, the state of Mississippi was named at the bottom of the healthiest states, ranking 49$^{th}$ and 50$^{th}$ respectively (Infoplease, 2007; Levi et al., 2007). In addition to this title, Mississippi has also been labeled as the "fattest state" (CDC, 2007; Levi et al., 2007). Mississippi currently has the eighth highest rate, 17.8%, for overweight adolescents, but is the first state to acquire an adult obesity prevalence rate of 30.6% (Segal, 2007).

In an attempt to combat health issues among Mississippi adolescents, Governor Haley Barbour passed Senate Bill 2369, the "Mississippi Healthy Students Act"

(Barbour, 2007). This has paved the way for more time in physical education beginning in the fall of 2007. Specifically, the bill requires schools to provide at least 150 minutes of physical activity-based instruction as well as 45 minutes of health education per week for students in kindergarten through eighth grade (¶4). Additionally, the bill requires that students in ninth through twelfth grades complete one-half of a Carnegie unit, or approximately 60 hours, of physical education or related activity to meet graduation criterion (¶4).

Though the Mississippi Healthy Students Act is movement in the right direction to contend with health issues in Mississippi, there is one major gap with the plan. Students in grades nine through twelve are only required to take one-half of a Carnegie unit in physical education, or complete 60 hours of physical education from the time they enter ninth grade through the final semester of their twelfth grade year, in order to be eligible for graduation. Beyond this requirement, high school students have no physical education obligation. This is problematic because research suggests that physically active adolescents are more likely to remain physically active into adulthood (CDC, 2007; Telama, Yang, Hirvensalo, & Raitakari, 2006). Additionally, some studies show that there is a correlation among fitness knowledge and physically active individuals (Adams, Graves & Adams, 2006; Cason & Logan, 2006; DiLorenzo, Stuckey-Ropp, Vander & Gotham, 1998; Lubans & Sylva, 2006; Roberts, Evans & Ormond, 2006). Therefore, if educators can expose students to physical education concepts and practices through their high school careers, with the goal of providing students a broader knowledge base of physical education, students may make healthier lifestyle choices.

Efforts to increase physical activity among youth have led the CDC, the National Association for Sport and Physical Education (NASPE), and the American Heart Association (AHA) to propose comprehensive daily physical education for children K-12 (Summerfield, 2008). For many youth the only preparation for active lifestyles stems from the promotion of physical activity and fitness through physical education. Therefore, emphasis for physical education should be placed on preparing youth to make healthy choices, thereby providing students the necessary knowledge and skills to make such decisions. In accordance with this belief, NASPE has a fundamental goal to teach quality physical education that focuses on teaching skills and concepts to make lifelong healthy choices (NASPE, 2007). Expanding on this idea, NASPE defines a physically educated person as: "1) one who has learned necessary skills to perform a variety of physical activities; 2) one who is physically fit; 3) one who participates regularly in physical activity; 4) one who knows the implications and benefits of involvement in physical activity; and, 5) one who values physical activity and its contribution to a healthful lifestyle" (NASPE, 2007).

Much of the literature focused on quality physical education emphasizes the "education" aspect of physical education with a goal of preparing students to make lifelong healthy choices (Ayers, 2001; Ayers, 2004; Mohnsen, 2003; NASPE, 2007). Mississippi Governor Haley Barbour agrees, and in 2007 stated that, "By teaching our children the importance of good nutrition and physical activity, we are taking the necessary actions to ensure the benefits of a healthier lifestyle—lower costs, more job creation, mental clarity, and a longer and better quality of life" (Barbour, 2007, ¶5). In line with this statement is the mission of the Council on Physical Education for Children

(COPEC): "COPEC is committed to helping children develop motor skills, healthy lifestyles, and positive attitudes for lifelong physical activity through the development, review, and dissemination of information that enhances and promotes quality physical education" (NASPE, 2007, ¶1). Numerous articles support this notion (Irwin, Symons, & Kerr, 2003; Ayers, 2004; Wallhead & Buckworth, 2004), and some studies make the link between knowledge and behaviors (Adams et al., 2006; Cason & Logan, 2006; DiLorenzo et al., 1998; Lubans & Sylva, 2006; Roberts et al., 2006). However, no studies report what students actually know relative to the field of physical education and the impact of such knowledge on physical activity (Ayers, 2004) and obesity. Furthermore, Ayers suggests that no research exists on whether or not physical educators are teaching the essential physical education concepts that students should know upon graduating.

With developed physical education philosophies, one would think that students would be progressing towards healthy lifestyles. However, inactivity and obesity trends are escalating and accounting for a nation that is approximately two-thirds overweight (Levi et al., 2007). Though numerous genetic, environmental, and behavioral factors contribute to being overweight and obese (CDC, 2007; Hill & Donahoo, 2002; Wing et al., 2001; Wing & Tate, 2002) the focus for this research project is centered on the cognitive domain of physical education and physical activity behaviors, both of which can be considered as behavioral factors of obesity. Therefore, the purpose of this study was to investigate physical education content knowledge, physical activity behaviors, and body mass indexes of Mississippi high school students with a goal of establishing evidence-based needs to modify physical education curricula. Specifically, the study

sought to determine if Mississippi schools were teaching quality physical education by: 1) determining if a relationship existed between physical education content knowledge and physical activity behaviors of ninth and twelfth grade Mississippi high school students, 2) examining if differences existed in the level of physical education content knowledge between ninth and twelfth grade students as well as between high schools classified by academic rating, 3) investigating body mass indexes of Mississippi high school students to determine if relationships existed between self-reported BMI and level of physical education content knowledge and, also, level of physical activity, and 4) exploring the overall proportion of students in Mississippi schools who completed the *Assessment of Sub-disciplinary Knowledge in Physical Education Battery: Exercise Physiology* (*ASK PE: EXP*) with a $\geq$ 62% of accuracy, a research-based cutoff passing score. Ultimately, the study sought to identify physical "education" in combination with physical activity, as key components related to physical activity behaviors, thus having the possibility of attacking the obesity epidemic. The status of Mississippi high schools in teaching this information was addressed.

# Methods

Prior to the research study, approval was received from The University of Southern Mississippi's Institutional Review Borard (IRB).

## *Research Design*

A non-experimental, exploratory design was selected for this study, so that the scope of selected Mississippi high school students' physical education content knowledge and its impact on activity levels and body mass indexes could be evaluated. By implementing this design, the strength and direction of relationships among selected variables were determined. Though these findings added value to the existing research and assisted in providing areas for future research, a limitation with its use was the lack of manipulation and control of the independent variables, thereby not allowing for cause and effect findings to be made.

## *Sample Size Determination*

A software program, G-Power, was downloaded from the internet (http://www.psycho.uni-duesseldorf.de/aap/projects/gpower/) and employed to generate the recommended sample sizes for each hypothesis based on alpha level, power, effect size, and type of statistical test. The alpha and power levels were aligned with social science convention and set at .05 and .80 respectively for all hypotheses. Due to limited research in the area of physical education curricular movements, the effect sizes were subjectively determined by the researcher. It was determined that medium group differences would be strong enough to warrant actions or recommendations. See Table 1.

Expected response rate was determined by considering the selected sampling procedures as well as project implementation plans. A state-wide sample was desired,

and therefore, schools were randomly selected throughout Mississippi. Hence, there was no control over the schools which were included in the sample, and no incentives were given for participation. Additionally, the chosen methods of project implementation required that multiple individuals (high school principals, school nurses, other assigned personnel, and teachers) assist in administering data, collecting data, and retuning data. Therefore, the final response rate was expected to be lower than observed comparable research studies. The expected response rate was 10%. Estimating that 10% of the sample would return the study's instruments, 3,560 Mississippi high school ninth and twelfth grade students were targeted for the project (3,560 subjects x .10 = 356 participants).

*Sampling Procedures*

The sampling frame for this study included all ninth and twelfth grade students attending public high schools in Mississippi. A multi-stage sampling technique was employed to obtain a random sample of ninth and twelfth grade Mississippi public high school students with an approximate age range of 14-20. Three stages were utilized to ensure that schools from all areas of the state had an equal chance of being selected for representation based on the percentage of ninth and twelfth grade students in each geographical area. Additionally, the academic ratings of each school were considered. Schools with an academic rating of "Level 2, 3, 4, or 5" (Level 1 schools are the worst performing schools academically and Level 5 schools are the best performing schools academically) were included in the sample. No "Level 1" schools were represented in the sampling frame because few Mississippi schools have this rating. Only students

attending public high schools, not including vocational or alternative schools, were included in the sample.

*Stage One: Stratified Sampling*

The initial sampling procedure involved dividing the state of Mississippi into seven geographic regions to ensure that schools from all areas of the state had an equal chance of being selected for representation based on the percentage of ninth and twelfth grade students in each geographic area. The seven geographic regions included in the sampling frame were the North East, North Central, North West, East Central, West Central, South East and South West. Information obtained via the Mississippi Department of Education's (MDE) website, http://www.mde.k12.ms.us/ allowed each region to be dissected to determine the number of high schools and the number of ninth and twelfth grade students that comprised each area. Information regarding high schools and ninth and twelfth grade enrollment was collected by examining county information via the MDE website (http://www.mde.k12.ms.us/Districts/msmap2.htm). (The MDE website allows users to link to every Mississippi County and obtain information regarding which school districts and schools are located in each county. Furthermore, the website offers links from districts and schools to view enrollment numbers by state or district level http://orsap.mde.k12.ms.us:8080/MAARS/index.jsp).

Thus, the state was divided by the seven geographical regions, and then each region was examined by the counties comprising each area. Once information was examined at a county level, it was then checked for accuracy by viewing the district-level data. Information was recorded into an Excel spreadsheet for future use and reference. Recorded information included: high school, region and county, ninth grade enrollment,

twelfth grade enrollment, and academic ratings. The spreadsheet calculated total schools in the state, total schools in each region, total ninth and twelfth graders in each region, and percentage of schools, as well as percentage of ninth and twelfth grade students that comprise each region.

*Stage Two: Cluster Sampling*

Once the total percentage of ninth and twelfth grade students comprising each geographical area was determined, high schools were randomly selected from the seven regions to represent the complimentary percentage of total students in each area. Each high school in each geographical area had a one in ten chance of being selected for the study. The developed spreadsheet was used to assist in the selection process. Schools were reviewed by total ninth and twelfth grade enrollment as well as academic rating. A balance of ninth and twelfth grade enrollment was desired for each of the seven geographical areas. Additionally, a balance of students attending schools with academic ratings of "Level 2, 3, 4, and 5" was desired for the total sample. Therefore, as every tenth school appeared in the sampling pool, the researcher reviewed this criterion. If the criterion was achieved across all levels (a balance of desired schools was achieved by geographical region, academic rating, and ninth and twelfth grade enrollment proportionate to each region) schools were selected for the sample. School selection, every one out of ten schools, continued in each geographical area until the percentage of students which were representative of each area was achieved.

*Stage Three: Inclusive Sampling*

At the final stage of sampling, all ninth and twelfth grade students from the randomly-selected schools were included in the sample. See Table 2.

## *Instrumentation*

### *The Assessment of Sub-disciplinary Knowledge in Physical Education Battery*

The *ASK PE Battery* measures the physical education content knowledge of students at the kindergarten level through grade twelve (Ayers, 2004). Developed by multiple physical educators, the *ASK PE Battery* assesses knowledge in the following areas: motor learning, motor development, biomechanics, exercise physiology, historical perspectives, social psychology, and aesthetic experiences. Though utilizing questions from all sub-disciplinary sections would provide a more accurate examination of total physical education content knowledge, this study only included 38 adapted questions from the *ASK PE: EXP* which yielded a KR20 reliability value of .89. Specifically, this study emphasized the Exercise Physiology sub-disciplinary area due to its relevance with physical activity. No other section from the *ASK PE Battery* was used. The *ASK PE Battery* may be taken either as a computer-based exam or with pencil-and-paper. For the purpose of this project, all tests were printed out for students. Ayers (2004) developed *ASK PE: EXP Battery* through systematic test item development and analysis, including multiple stages for review, revision, and pilot testing. Additionally, tests were issued to 3,200 high school students in 16 states (not including the state of Mississippi). Ayers reported a KR20 value of .91 for the Exercise Physiology sub-disciplinary section of the *ASK PE: EXP Battery*.

### *The Modifiable Activity Questionnaire for Adolescents*

*The Modifiable Activity Questionnaire for Adolescents* measures past-year physical activity levels of adolescents (Aaron & Kriska, 1997). Reliability and validity were tested on a sample of 100 female and male junior high school students between the

ages of 15 and 18. Reliability and validity were tested on three levels of activity output: hours per week (h/wk), met hours per week (met-h/wk), and vigorous hours per week (v-h/wk). Reliability and validity measures were tested using Spearman correlations, with significance set at the .05 level. Reliability for both males and females, across all measures of activity, from the first test one-month/one-year retests display significance, indicating that the test was a good predictor of average weekly physical activity. Additionally, measurements showed significant correlations among the past-year questionnaire and an average of four past-week questionnaires.

The *MAQ-A* assesses past-year activity behaviors, specific to type of activity or activities, as well as the time spent partaking in each activity, by asking students to provide details of activities over the past year. Formulas are provided to account for physical activity in hours per week, MET hours per week, and vigorous hours per week. For the purpose of this study, calculations for hours per week and total hours per week were utilized.

*H/week = (Past year/mo) x (4.3wk/mo) x (days/wk) x (min/day) / (60 min/h) / (52wk/yr)*

The hours for all activities are summed to determine the total past-year activity levels of adolescents (Aaron and Kriska, 1997). Permission to use the *MAQ-A* was provided to the researcher.

### *Data Collection*

All schools were contacted via fax two weeks prior to questionnaires being mailed-out. Schools were informed they had been randomly-selected to participate in a state-wide research study. Information in the fax included: purpose of study, date to expect materials, materials to expect, brief explanation of process, statement of IRB

approval, and the researcher's contact information. Also, prior to questionnaires being mailed, follow-up phone calls were made to all randomly-selected schools to ensure that the fax was received.

All materials were filed in folders, and labeled on the outside by recipient and content. Instructions and high school demographic forms for principals and/or school nurses were labeled in a colored folder (red or green) and distinguishable from materials to be distributed into the classroom. This instruction sheet provided detailed instructions to the administrators. Separate from the colored folder, were sets of two folders, which were held together by rubber-bands. One folder contained 25 passive parental consent forms, and the other folder contained 25 student assent forms and questionnaires. Principals, school nurses, or other assigned individuals were asked to provide each first-period ninth and twelfth-grade classroom teacher with the appropriate number of pre-organized folders. The teachers' instructions were stapled inside the folder, so that they were distinguishable from the student materials. In order to maintain student anonymity, all participants were asked to tear the student assent form away from the questionnaire and return it to the classroom teacher.

Prior to any student participating in the study, teachers were asked to send home the passive parental consent form. With the use of the passive consent form, students were considered to have parental consent, as long as they did not return the form by the teacher's requested date. Students who returned the passive parental consent form did not have parental consent to participate. These students were assigned another project by their teacher during the time period of study implementation.

Teachers were asked to collect any returned passive parental consent forms, and all student assent forms prior to the actual study implementation. Once students provided assent to participate and teachers had collected all assent forms, the teachers were asked to read student instructions aloud.

Once students had completed instruments, they were asked to turn materials into their teachers. Teachers were then asked to return instruments to their administrative office. High school administrators or other assigned personnel were asked to place completed passive parental consent forms, student assent forms, demographic information (high school and student), and questionnaires in the provided pre-addressed, pre-paid package. Once study materials were received by the researcher, a numeric code was assigned to each school and case. After all data had assigned numeric codes, it was keyed into SPSS software.

A date of completion was provided to administrators and teachers, but within this time period, each school and teacher had the choice of the actual implementation date. All schools were allotted six weeks to complete the materials. Study materials received after this date were not included in the results.

Actions were taken to minimize non-response bias.

## *Analyses*

### *Data Screening Procedures*

Prior to data analysis, data was checked for missing values. Due to computational formulas being applied to data, all missing data for the *MAQ-A* and *ASK PE: EXP* were assigned values of zero. Other data fields remained as provided by the participants. Distributions were checked for normality by viewing histogram charts. Histogram charts

with the applied normal curve, revealed that most variables (i.e. grade, sex, race, *ASK PE: EXP* scores) were normally distributed but average weekly physical activity was skewed. Therefore, modifications were made in data analyses to compensate for the skewed distributions of average weekly physical activity scores. For example, non parametric analog was used to the violation of normal distribution of physical activity scores. Therefore, Spearman's correlations were used instead of Pearson's correlations for all relationship-testing hypotheses containing average weekly physical activity as a variable. Additionally, a Games Howell post hoc analysis was employed to account for the violation of homogeneity of variance for the representation of Mississippi high schools based on academic ratings.

Demographic information on schools and students, individual accuracy scores for total concept knowledge, student responses from the *ASK PE: EXP*, and total averaged activity hours per week from *MAQ-A* were entered into SPSS. Spearman's correlation analysis was employed to determine if a relationship existed between physical education concept knowledge scores and physical activity behavior scores as well as physical activity behavior scores and BMI scores. Additionally, Pearson's Correlation was used to determine if a relationship existed between physical education content knowledge and BMI. Independent t-tests were used to establish if differences in physical education content knowledge scores and physical activity behavior scores existed between selected Mississippi ninth and twelfth grade students. Also, differences in students' physical education content knowledge were examined by each school's academic rating. A Chi Square – Goodness of Fit analysis was used to explain the proportion of selected Mississippi high school students who performed above or below a 62 % of accuracy on

the *ASK PE: EXP*. Descriptive statistics were used to further explain and support any notable findings. Only group data was reported for all statistical analyses.

Raw data from the *ASK PE: EXP* and *MAQ-A* were input into the statistical analysis software program, SPSS. Codes were assigned for incorrect and correct responses, "0=incorrect" and "1=correct". Formulas generated through SPSS software were used to compute *ASK PE: EXP Test* percent of accuracy (0 to 100%), total average weekly activity, and body mass index percentile.

# Results

## *Sampling Results*

### *Participants*

A total of 386 Mississippi public high school students (females = 198 and males = 188) in grades nine (n=224) and twelve (n=147) participated in the study. The sample was representative of five geographical regions throughout Mississippi including: North East (24.7%), North Central (22.6%), East Central (5.9%), South East (25.4%) and South West (21.3%). (The North West and West Central regions of the state were not included in the sample). Also, six different high schools were represented in the sample. Of the participants, 22.6% attend "Level 2" schools, 5.9% attend "Level 3" schools, 24.6% attend "Level 4" schools, and 46.7% attend "Level 5" schools. (No "Level 1" schools were included in the sampling frame). The sample included race demographics similar to the state's census demographics with majority of the sample 263 or 68.3% Caucasian (Mississippi = 61.2% Caucasian), 103 or 26.8% African American (Mississippi = 36.9% African American), 7 or 1.8% Asian (Mississippi = .7% Asian), 5 or 1.3% American Indian (Mississippi = .4% American Indian), 4 or 1.0% Hispanic (Mississippi = 1.7% Hispanic), 2 or .5% Pacific Islander (no comparable Mississippi data), and 1 or .3% other (no comparable Mississippi data).

#### *Response Rate.*

The actual response rate obtained from selected Mississippi ninth and twelfth grade students was 11% (386/3,560). Additionally, of 19 randomly selected schools, two schools withdrew prior to data collection. So, of 17 schools included in the mail-out of

instruments, six returned completed instruments. Thus, school response rate was 35% (6/17).

*Data Screening Results*

A Spearman Rank-order Correlation Coefficient was calculated for the relationship between participants' physical education content knowledge score and average total weekly activity behavior score. Moderate positive correlations existed for ninth grade students ($r_s$ (203) = .237, p<.01, *Cohen's q* =.06) and twelfth grade students ($r_s$ (136) = .415, p<.01, *Cohen's q* =.17), indicating a significant, direct relationship between the two variables. Therefore, the null hypotheses ($H_{O1}$ and $H_{O2}$) were rejected, and results suggest that individuals who score higher on the *ASK PE: EXP* tend to be more active on a weekly basis. Though significant results were found, the level of meaningfulness of these results is minimized due to the small effect sizes. Physical education content knowledge accounts for about 6% of physical activity scores for ninth graders and about 17% of physical activity scores in twelfth graders.

An independent-samples t-test was employed to determine if differences existed between Mississippi ninth and twelfth grade participants' physical education content knowledge scores. Results indicated no significant difference between the means of ninth and twelfth grade students' scores on the *ASK PE: EXP* ($t$(369) = -1.774, p=.077). Though no difference existed between these two levels, it was notable that on average twelfth grade students (M= .57 SD = .21) score slightly higher than ninth grade students (M = .52, SD = .27) on the *ASK PE: EXP*. The null hypothesis ($H_{O3}$) was accepted, and no significant differences in physical education conceptual knowledge of ninth and

twelfth grade students existed. It is important to note, that due to an imbalance of groups, power was decreased, and the chance for a Type II error did exist, $\beta = .95$.

An independent-samples t-test was employed to determine if differences existed between Mississippi ninth and twelfth grade participants' physical activity behavior scores. Results indicated that no significant difference existed between ninth and twelfth grade activity scores ($t(369) = 1.557$, p=.12). Although, no significant findings were revealed, it was noted that the mean physical activity score for ninth grade students was higher (M = 7.7, SD = 10.21) than the mean score for twelfth grade students (M = 6.06, SD = 9.45). The null hypothesis ($H_{O4}$) was accepted, and no significant differences in physical activity behavior scores of ninth and twelfth grade students existed. It is important to note, that due to an imbalance of groups, power was decreased, and the chance for a Type II error did exist, $\beta = .86$.

A one-way ANOVA was employed to determine if differences in physical education concept knowledge scores existed between Mississippi high schools based on academic ratings. Results indicated significant results did exist ($F(3, 382) = 10.83$, $p<.01$, $d=.085$). Also, a significant Levene's statistic, $p<.01$, supported the use of a Games-Howell post hoc analysis. A Games-Howell analysis revealed differences existed between Level 3 schools and all other levels. Level 3 schools had a significantly lower average *ASK PE: EXP* Score (M = .29, SD = .15) than Level 2 schools (M = .56, SD = .19), Level 4 schools (M = .58, SD= .21), and Level 5 schools (M = .53, SD= .22). Therefore, the null hypothesis was rejected, and significant differences in students' scores from the *ASK PE: EXP Test* did exist based on the academic rating of high schools. Although the result was significant, it was deemed not meaningful due its small effect.

School attended only accounted for 8% of *ASK PE: EXP* score. Also, although a Games-Howell post hoc analysis was selected to accommodate for the imbalance of groups, Level three participants made up 5% of the sample compared to 23% (Level 2), 25% (Level 3), and 47% (Level 5) of other schools, and this potentially impacted findings.

A Pearson correlation was calculated examining the relationship between participants' physical education content knowledge scores and self-reported body mass index score. It was determined that no statistically significant relationship existed for ninth grade students ($r$ (203) = -.03, p=.7) and twelfth grade students ($r$ (136) = .03, p=.7). Therefore, the null hypotheses ($H_{O6}$ and $H_{O7}$) are accepted, and results suggest *ASK PE: EXP Score* has no relationship with reported body mass index score. Though no significant results existed, it was noted that a high probability for a Type II error could have occurred for ninth graders, $\beta$ = .95, and twelfth graders, $\beta$ = .44.

A Spearman Rank-order Correlation Coefficient was calculated to examine the relationship between participants' average physical activity behavior scores and self-reported body mass index scores. An insignificant correlation was determined for ninth grade students ($r_s$ (203) = -.01, p=.9) while a significant, but weak, inverse correlation, p=.034, existed for twelfth grade students ($r_s$ (136) = -.181, p<.05, *Cohen's q*=.033). Therefore, the null hypothesis ($H_{O8}$) is accepted for ninth grade students, indicated that no relationship existed between physical activity behavior scores and self-reported body mass index scores, $\beta$ = .80. However, the null hypothesis ($H_{O9}$) is rejected for twelfth grade students, suggesting that twelfth graders who are more active on a weekly basis tend to have lower body mass index scores. Though this result was deemed significant, it

was important to note that physical activity scores only accounted for 3% of body mass index classifications of twelfth grade students.

A Chi-Square Goodness of Fit test was calculated comparing the observed distribution of *ASK PE: EXP* Scores above and below 62%, a research-based, cutoff value. It was hypothesized that an equal distribution of scores would be greater than and less than 62%. Significant deviations from the hypothesized values were determined, ($x^2(1) = 19.16$, $p < .01$, $w = .223$). The analysis further revealed that 236 participants performed below the cutoff while 150 participants performed above the cutoff. Grade specific analyses revealed that ninth grade students significantly deviated from the hypothesized value ($x^2(1) = 17.16$, $p < .01$) with 143 students performing below 62% and 81 students performing above 62% while no significant deviations existed for twelfth grade students ($x^2(1) = 1.53$, $p = .22$), 81 with students performed below 62% and 66 students performed above 62%. Each of these analyses revealed that majority of ninth and twelfth grade students were performing below the established, research-based passing cutoff score of 62%.

*Limitations*

1.) The *ASK PE: EXP* and the *MAQ-A* were given by numerous principals and teachers.

2.) Students' recall of past year's physical activity were not controllable.

3.) Students' self-report of BMI were not controllable.

4.) Response rate was not controllable.

5.) Total physical education knowledge was not addressed.

6.) Only the Exercise Physiology subsection of the *ASK PE Battery* was used to assess physical education knowledge.

## Discussion

Results from this study sought to identify physical education in combination with physical activity, as key components related to physical activity behaviors, thus having the possibility of attacking the obesity epidemic, particularly in Mississippi. The ninth and twelfth grade populations were identified to explore gaps among the groups in physical education knowledge scores and physical activity behavior scores. These two grades were emphasized due to Mississippi's past and present physical education requirements. Additional areas included examining physical education content knowledge, physical activity behaviors, and body mass indexes with a goal of establishing evidence-based needs to modify physical education curricula.

Overall, it appears that Mississippi students are performing lower than students in 16 other states on the Exercise Physiology sub-disciplinary section of the *ASK PE: EXP.* Further, the majority of Mississippi high school students are performing significantly below the established, research-based cutoff score of 62%. This is notable, because findings also suggested that students who scored higher (M knowledge = 76%, SD = .08);(M activity = 8.6 hours/week, SD = 9.7) or above 62% on the *ASK PE: EXP* were more likely to be active during a weekly basis compared to those who scored lower (M knowledge = 39%, SD = .14);(M activity = 5.8 hours/week, SD = 9.8) or below a 62% on the *ASK PE: EXP*. This is consistent with research findings which suggest that physical education knowledge or fitness knowledge can influence physical activity behaviors (Cason & Logan, 2006; DiLorenzo et al., 1998).

Currently the Mississippi physical education guidelines require that students in grades nine through twelve earn ½ of a Carnegie unit, equivalent to 60 hours of physical

or health education, subsequent to graduation (Barbour, 2007). The requirements do not hold students accountable throughout their high school careers, nor do they necessarily require physical education, but instead recommend it or a "related" activity. Therefore, some students are not being exposed to cognitive principles of physical education after their eighth grade years. This was evident in findings from this study which suggested no significant differences in the amount of physical education (exercise physiology) knowledge between ninth and twelfth grade students existed. Twelfth grade students only scored an average of 5% higher on the *ASK PE: EXP* when compared to ninth grade students. Of particular interest was that Mississippi ninth and twelfth grade students performed lower than the research-based, cutoff passing score of 62% which was established by student in 16 other states.

Considering these findings, Mississippi twelfth graders are not graduating high school with much more physical education (exercise physiology) knowledge than Mississippi ninth grade students. This is interesting given that physical education (exercise physiology) knowledge can help account for 17% of physical activity in twelfth grade students. Knowing that there was only a 5% difference in *ASK PE: EXP* scores between ninth and twelfth grade students and, also, that twelfth grade physical activity scores were impacted more by physical education (exercise physiology) knowledge scores, might explain why Mississippi twelfth graders ($M = 6.06$, $SD = 9.45$) were less active than Mississippi ninth graders ($M = 7.7$, $SD = 10.21$) by an average of one hour per week.

Though results for this study indicated that physical education (exercise physiology) knowledge had a significant relationship with physical activity for both ninth

and twelfth grade students, neither group had a significant relationship with *ASK PE: EXP* scores and self-reported body mass index scores. Additionally, reported physical activity score had no significant relationship with reported body mass index score for ninth grade students. This is aligned with research findings which suggested that physical education active time does not affect body mass index or weight classification in high school students (Cawley, Meyerhoefer, & Newhouse, 2005). However, a significant, inverse relationship did exist among twelfth grade students physical activity score and self-reported body mass index score. Though, the result was significant, it had a small effect indicating that physical activity accounted for 3% of body mass index score for Mississippi twelfth graders. For both ninth and twelfth grade students, the lack of relationship or weak relationship can possibly be explained by Kolbo et al. (2006), who suggested that self-reported body mass index scores can be misleading. Kolbo et al. (2006) found self-reported body assessment measures to be more conservative when compared to actual assessments. Also, for the purpose of this project, activity levels were not defined by levels of intensity (low, moderate, or vigorous). So, though *ASK PE: EXP* score did have a relationship with physical activity score, indicating students who had more knowledge were more likely to be active, knowledge did not correlate with body mass index scores. This might be explained by further examining intensity levels of physical activity.

A final finding from this study was that there were significant differences in students' *ASK PE: EXP* Scores of Mississippi high schools based on academic ratings. Results indicated that Level 3 schools or "successful" schools had a significantly lower average *ASK PE: EXP* Score than Level 2 or "underperforming" schools, Level 4 or

"exemplary" schools, and Level 5 or "superior" schools. Additionally, the difference in *ASK PE: EXP* scores had a small effect indicating school attended accounted for 8% of physical education (exercise physiology) score.

## Conclusions and Recommendations

In a time where youth obesity and physical inactivity are escalating, attention should be given to possible interventions, particularly in school environments, and more specifically in physical education. However, due to the implementation No Child Left Behind, many physical education environments have been hindered. This has advanced physical education challenges, and in some cases caused the elimination of such programs, thus limiting the possible avenues for which students have to gain necessary knowledge to make lifelong, healthy decisions.

In the face of physical education obstacles, some programs are striving to become better. Particularly, in the state of Mississippi, "The Healthy Students Act" has been passed in an effort to promote lifelong skills to make healthy decisions. In theory, this is a great concept; however, there are many limiting issues with the current plan. For instance, Mississippi high school students are required to take 60 hours of physical education prior to graduation; therefore, students may enroll at any point during their high school careers. Furthermore, Mississippi physical education requirements can be achieved via extracurricular participation in athletic sports, band, and JROTC clubs. With this noted some students are not receiving cognitive components of physical education on any level after their eighth grade year. This may assist in explaining two findings of this study: 1) Mississippi ninth and twelfth grade students on average score a 53% on the *ASK PE: EXP*, compared to students in 16 other states who scored an average of 62%; and, 2) there is a small difference of 5% in physical education conceptual knowledge scores between ninth and twelfth grade students.

Findings from this study did suggest a direct, relationship between physical education (exercise physiology) knowledge scores and physical activity levels. Additionally, results indicated that physical education knowledge is more closely correlated with twelfth grade likelihood of physical activity. This is notable, because as previously noted, twelfth grade students only score an average of 5% higher than ninth graders on the *ASK PE: EXP*. Twelfth grade students were also found to be less active than ninth grade students. However, for those twelfth grade students who are physically active, a significant, inverse relationship existed with their body mass index scores. Therefore, if students in grades nine through twelve experience progressive knowledge on physical education components, they may tend to be more active, and possibly at intensity levels that positively impact body mass index. The high school career is seemingly a critical point for Mississippi youth, because for many, approximately 71%, this is their final opportunity to gain valuable knowledge to make healthy lifestyle decisions. (Only about 29% of Mississippians between the ages of 18 and 24 were reported to have been enrolled in college during 2006 (Mississippi Report Card, 2006)).

Therefore, in conclusion, Mississippi should evaluate their physical education programs on a more stringent level, and provide students more time to acquire knowledge that could contribute to healthy lifestyle decisions. For example, Mississippi high schools should require that all students participate in a comprehensive health and physical education program throughout their high school careers, learning cognitive and practical components that could contribute to healthier lifestyles. Additionally, students, physical educators, and administrators should be held accountable for physical education knowledge. With developments in physical education curricula, particularly cognitive

components, Mississippi schools can help provide students with the necessary knowledge and skills to make lifelong healthy decisions. This may ultimately lead to a healthier Mississippi.

Multiple recommendations have developed based on the findings of this study. Mississippi schools should formulate an intervention to focus on cognitive components of physical education with a goal of improving *ASK PE: EXP* scores and additionally, evaluating the relationship of the knowledge component on physical activity and body mass indexes. Also, due to *ASK PE: EXP* scores relating directly, but weakly to physical activity scores, the total *ASK PE* Battery should be used in future studies, to determine what other sub-disciplinary areas, if any, account for variance in the physical activity relationship. Another factor that should be accounted for is the intensity level of activity. Students' activity levels should be analyzed to determine if physical education (exercise physiology or total discipline) knowledge has any relationship with the intensity level of activity (low, moderate, or vigorous).

Table 1. Hypothesis Testing Procedures

| Hypothesis | Statistical Test<br>Alpha, Effect Size, Power<br>Suggested Sample Size |
|---|---|
| *$H_{O1}$: No relationship will exist between Mississippi ninth grade physical education content knowledge scores and Mississippi ninth grade average weekly physical activity behavior scores.* | Spearman's Rank Order, two-tailed<br>$\alpha$=.05, *Cohen's q* =.3, 80% power<br>Suggested N=356 |
| *$H_{O2}$: No relationship will exist between Mississippi twelfth grade physical education content knowledge scores and Mississippi twelfth grade average weekly physical activity behavior scores.* | Spearman's Rank Order, two-tailed<br>$\alpha$=.05, *Cohen's q* =.3, 80% power<br>Suggested N=356 |
| *$H_{O3}$: No differences will exist between Mississippi ninth grade physical education content knowledge scores and Mississippi twelfth grade physical education content knowledge scores.* | Independent t-test<br>$\alpha$=.05, d=.5, 80% power<br>Suggested N=128 |
| *$H_{O4}$: No differences will exist between Mississippi ninth grade physical activity behavior scores and Mississippi twelfth grade physical activity behavior scores.* | Independent t-test<br>$\alpha$=.05, d=.5, 80% power<br>Suggested N=128 |
| *$H_{O5}$: Differences in physical education content knowledge scores will exist between selected Mississippi high schools based on academic ratings.* | ANOVA<br>$\alpha$=.05, d=.25, 80% power<br>Suggested N=180 |
| *$H_{O6}$: No relationship will exist between Mississippi ninth grade physical education content knowledge scores and Mississippi ninth grade high school students' BMI.* | Pearson's Correlation, two-tailed<br>$\alpha$=.05, $r^2$=.3, 80% power<br>Suggested N=356 |
| *$H_{O7}$: No relationship will exist between Mississippi twelfth grade physical education content knowledge scores and Mississippi twelfth grade high school students' BMI.* | Pearson's Correlation, two-tailed<br>$\alpha$=.05, $r^2$=.3, 80% power<br>Suggested N=356 |
| *$H_{O8}$: No relationship will exist between Mississippi ninth grade average weekly physical activity behavior scores and Mississippi ninth grade high school students' BMI.* | Spearman's Rank Order, two-tailed<br>$\alpha$=.05, *Cohen's q* =.3, 80% power<br>Suggested N=356 |

Table1. Hypothesis Testing Procedures Continued

| Hypothesis | Statistical Test<br>Alpha, Effect Size, Power<br>Suggested Sample Size |
|---|---|
| *$H_{O9}$: No relationship will exist between Mississippi twelfth grade average weekly physical activity behavior scores and Mississippi twelfth grade high school students' BMI.* | Spearman's Rank Order, two-tailed<br>α=.05, *Cohen's q* =.3, 80% power<br>Suggested N=356 |
| *$H_{O10}$: The proportion of selected Mississippi high school ninth graders who complete the ASK PE: EXP will be equally distributed above and below a research-based, cutoff score of 62%.* | Chi Square/Goodness of Fit<br>α=.05, w=.3, 80% power<br>Suggested N=88 |
| *$H_{O11}$: The proportion of selected Mississippi high school twelfth graders who complete the ASK PE: EXP will be equally distributed above and below a research-based, cutoff score of 62%.* | Chi Square/Goodness of Fit<br>α=.05, w=.3, 80% power<br>Suggested N=88 |

Table 2. Mississippi High School Sampling Frame

| Regions | 9th Graders | 12th Graders | 9th and 12th Graders | # of Schools | % of Students |
|---|---|---|---|---|---|
| North West | 2924 | 1931 | 4855 | 24 | 7% |
| North Central | 6755 | 4023 | 10,778 | 39 | 16% |
| North East | 6626 | 4351 | 10,977 | 51 | 16% |
| West Central | 8728 | 5214 | 13,942 | 34 | 20% |
| East Central | 5142 | 3493 | 8635 | 40 | 13% |
| South West | 2034 | 1253 | 3287 | 12 | 5% |
| South East | 9633 | 6186 | 15,819 | 43 | 23% |
| Totals | 41842 | 26451 | 68293 | 243 | 100% |

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| Hypothesis | Statistical Test<br>Alpha, Effect Size, Power<br>Suggested Sample Size |
|---|---|
| *$H_{O1}$: No relationship will exist between Mississippi ninth grade physical education content knowledge scores and Mississippi ninth grade average weekly physical activity behavior scores.* | Spearman's Rank Order, two-tailed<br>$\alpha$=.05, *Cohen's q* =.3, 80% power<br>Suggested N=356 |
| *$H_{O2}$: No relationship will exist between Mississippi twelfth grade physical education content knowledge scores and Mississippi twelfth grade average weekly physical activity behavior scores.* | Spearman's Rank Order, two-tailed<br>$\alpha$=.05, *Cohen's q* =.3, 80% power<br>Suggested N=356 |
| *$H_{O3}$: No differences will exist between Mississippi ninth grade physical education content knowledge scores and Mississippi twelfth grade physical education content knowledge scores.* | Independent t-test<br>$\alpha$=.05, d=.5, 80% power<br>Suggested N=128 |
| *$H_{O4}$: No differences will exist between Mississippi ninth grade physical activity behavior scores and Mississippi twelfth grade physical activity behavior scores.* | Independent t-test<br>$\alpha$=.05, d=.5, 80% power<br>Suggested N=128 |
| *$H_{O5}$: Differences in physical education content knowledge scores will exist between selected Mississippi high schools based on academic ratings.* | ANOVA<br>$\alpha$=.05, d=.25, 80% power<br>Suggested N=180 |
| *$H_{O6}$: No relationship will exist between Mississippi ninth grade physical education content knowledge scores and Mississippi ninth grade high school students' BMI.* | Pearson's Correlation, two-tailed<br>$\alpha$=.05, $r^2$=.3, 80% power<br>Suggested N=356 |
| *$H_{O7}$: No relationship will exist between Mississippi twelfth grade physical education content knowledge scores and Mississippi twelfth grade high school students' BMI.* | Pearson's Correlation, two-tailed<br>$\alpha$=.05, $r^2$=.3, 80% power<br>Suggested N=356 |
| *$H_{O8}$: No relationship will exist between Mississippi ninth grade average weekly physical activity behavior scores and Mississippi ninth grade high school students' BMI.* | Spearman's Rank Order, two-tailed<br>$\alpha$=.05, *Cohen's q* =.3, 80% power<br>Suggested N=356 |

Table1. Hypothesis Testing Procedures Continued

| Hypothesis | Statistical Test<br>Alpha, Effect Size, Power<br>Suggested Sample Size |
|---|---|
| *$H_{O9}$: No relationship will exist between Mississippi twelfth grade average weekly physical activity behavior scores and Mississippi twelfth grade high school students' BMI.* | Spearman's Rank Order, two-tailed<br>α=.05, *Cohen's q* =.3, 80% power<br>Suggested N=356 |
| *$H_{O10}$: The proportion of selected Mississippi high school ninth graders who complete the ASK PE: EXP will be equally distributed above and below a research-based, cutoff score of 62%.* | Chi Square/Goodness of Fit<br>α=.05, w=.3, 80% power<br>Suggested N=88 |
| *$H_{O11}$: The proportion of selected Mississippi high school twelfth graders who complete the ASK PE: EXP will be equally distributed above and below a research-based, cutoff score of 62%.* | Chi Square/Goodness of Fit<br>α=.05, w=.3, 80% power<br>Suggested N=88 |

Table 2. Mississippi High School Sampling Frame

| Regions | 9th Graders | 12th Graders | 9th and 12th Graders | # of Schools | % of Students |
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| North East | 6626 | 4351 | 10,977 | 51 | 16% |
| West Central | 8728 | 5214 | 13,942 | 34 | 20% |
| East Central | 5142 | 3493 | 8635 | 40 | 13% |
| South West | 2034 | 1253 | 3287 | 12 | 5% |
| South East | 9633 | 6186 | 15,819 | 43 | 23% |
| Totals | 41842 | 26451 | 68293 | 243 | 100% |

Table 3. Reliability and Validity Measures of the *MAQ-A*

| | Reliability | | | | Validity | |
|---|---|---|---|---|---|---|
| Sex | Males | | Females | | Males | Females |
| Testing Period | 1mth | 1yr | 1mth | 1yr | | |
| Hours/ Week | .78* | .54* | .75* | .65* | .55* | .82* |
| Met Hours/ Week | .78* | .54* | .79* | .71* | .57* | .83* |
| Vigorous Hours/ Week | .73* | .48* | .48 | .61* | .67* | .73* |

Table 4. Selected Original and Revised Questions from the *ASK PE: EXP*

| Original | Revised |
|---|---|
| *What principle(s) is/are related to improving fitness?*<br>*A.) how hard you exercise*<br>*B.) how long you exercise*<br>*C.) how often you exercise*<br>*D.) all of the above* | What principle is <u>not</u> related to improving fitness?<br>A.) what time of day you exercise<br>B.) how hard you exercise<br>C.) how often you exercise<br>D.) how long you exercise |
| *Which of the following is most likely to contribute to good physical and mental health?*<br>*A.) working out at a gym once a week*<br>*B.) shopping regularly in a large mall*<br>*C.) regular moderate to vigorous physical activity*<br>*D.) all of the above* | Which of the following is most likely to contribute to good physical health?<br>A.) working out at a gym once a week<br>B.) shopping regularly in a large mall<br>C.) regular moderate to vigorous physical activity<br>D.) reading current information on exercise trends |
| *Which exercises could be included in a safe stretching and strengthening program?*<br>*A.) fast head circles*<br>*B.) fast deep knee bends*<br>*C.) slow crunches/curl-downs*<br>*D.) slow straight-legged toe touches* | What exercises could be included in a safe stretching program?<br>A.) fast head circles<br>B.) fast deep knee bends<br>C.) slow crunches/curl-downs<br>D.) slow straight-legged toe touches |
| *Which exercises could be included in a safe stretching and strengthening program?*<br>*A.) fast head circles*<br>*B.) fast deep knee bends*<br>*C.) slow crunches/curl-downs*<br>*D.) slow straight-legged toe touches* | What exercises could be included in a safe strengthening program?<br>A.) fast head circles<br>B.) fast deep knee bends<br>C.) slow crunches/curl-downs<br>D.) slow straight-legged toe touches |
| *Which of the following activities contributes to fitness?*<br>*A.) strength training*<br>*B.) flexibility training*<br>*C.) cardiorespiratory training*<br>*D.) all of the above* | Which of the following activities <u>does not</u> Contribute to health-related fitness?<br>A.) strength training<br>B.) agility training<br>C.) cardiorespiratory training<br>D.) flexibility training |
| *Nikki has never done cardiorespiratory exercise or lifted weights before, but she stretches twice a week. She is going to try out for her high school track team next semester, so as part of her training, she has asked* | Nikki has asked a friend to teach her how to lift weights correctly. When Nikki adds more weight to her exercises as she gets stronger she is _____. |

Table 4. Selected Original and Revised Questions from the *ASK PE: EXP* Continued

| | |
|---|---|
| A *friend to teach her how to lift weights correctly. When Nikki adds more weight to her exercises as she gets stronger she is _____.*<br>*A.) risking injury*<br>*B.) using the principle of specificity*<br>*C.) using the principle of progression*<br>*D.) ignoring a major principle of lifting* | A.) risking injury<br>B.) using the principle of specificity<br>C.) using the principle of progression<br>D.) ignoring a major principle of lifting |
| *Nikki has never done cardiorespiratory exercise or lifted weights before, but she stretches twice a week. She is going to try out for her high school track team next semester, so as part of her training, she has asked a friend to teach her how to lift weights correctly. Nikki's strength-training program should be set up _____.*<br>*A.) based on her starting abilities*<br>*B.) based on the fitness scores for her age group*<br>*C.) differently than a boy who has never lifted before*<br>*D.) according to the work-out Muscle and Fitness magazine recommends for the women's national body building champion* | Nikki's strength-training program should be set up _____.<br>A.) based on her starting abilities<br>B.) based on the fitness scores for her age group<br>C.) differently than a boy who has never lifted Before<br>D.) according to the work-out Muscle and Fitness magazine recommends for the women's national body building champion |
| *Consuela has been riding the stationary bike for eight weeks in an effort to improve her cardiorespiratory fitness. She started riding at level one, and is still riding at that level. Which fitness principle is she ignoring?*<br>*A.) interest*<br>*B.) progression*<br>*C.) regularity*<br>*D.) specificity* | Consuela started a stationary bike program beginning at level one, and is still riding at that level. Which fitness principle is she ignoring?<br>A.) interest<br>B.) progression<br>C.) regularity<br>D.) specificity |
| *What do you need for both normal daily activities and hard physical activity?*<br>*A.) endurance*<br>*B.) power*<br>*C.) basic strength*<br>*D.) all of the above* | What do you need for hard physical activity?<br>A.) endurance, power, basic strength<br>B.) an exercise coach or instructor<br>C.) a workout facility<br>D.) A and B only |
| *Muscles that are not used for a long time usually _____.*<br>*A.) are stronger*<br>*B.) become longer*<br>*C.) get weaker*<br>*D.) stay firm* | Muscles that are not used for a long time Usually _____.<br>A.) maintain their strength<br>B.) become longer<br>C.) get weaker<br>D.) stay firm |

Table 4. Selected Original and Revised Questions from the *ASK PE: EXP* Continued

| | |
|---|---|
| *Wade is 16 years old and wants to lose weight and improve his cardiorespiratory fitness. He has never played organized sports and he works after school, so he will have to exercise before school and in his physical education class. What type of exercise(s) should Wade do the first few weeks of his fitness program?*<br>*A.) stretching*<br>*B.) brisk walking*<br>*C.) lifting weights*<br>*D.) gradually include all of the above* | Wade is beginning a fitness program. What type of exercise(s) should Wade do the first few weeks of his fitness program?<br>A.) stretching<br>B.) brisk walking<br>C.) lifting weights<br>D.) gradually include all of the above |
| *Wade is 16 years old and wants to lose weight and improve his cardiorespiratory fitness. He has never played organized sports and he works after school, so He will have to exercise before school and in his physical education class. After Wade has been exercising for several months, how often should he be exercising?*<br>*A.) once a week*<br>*B.) twice a week*<br>*C.) three times a week*<br>*D.) most days of the week* | After Wade has been exercising for several months, how often should he be exercising?<br>A.) once a week<br>B.) twice a week<br>C.) three times a week<br>D.) most days of the week |
| *Wade is 16 years old and wants to lose weight and improve his cardiorespiratory fitness. He has never played organized sports and he works after school, so he will have to exercise before school and in his physical education class. When Wade first begins his program, what would be an appropriate training heart rate?*<br>*A.) in his target heart rate range*<br>*B.) as high as he can possibly get it*<br>*C.) the same as his resting heart rate*<br>*D.) low enough so he does not breathe hard* | When Wade first begins his program, what would be an appropriate training heart rate?<br>A.) in his target heart rate range<br>B.) as high as he can possibly can get it<br>C.) the same as his resting heart rate<br>D.) low enough so he does not breathe hard |
| *Which activity will produce the greatest increase in overall muscle size (hypertrophy)?*<br>*A.) downhill skiing*<br>*B.) playing tennis*<br>*C.) skateboarding*<br>*D.) weight lifting* | Which activity will produce the greatest increase in overall muscle size (hypertrophy)?<br>A.) running daily<br>B.) playing tennis<br>C.) playing football<br>D.) weight lifting |

Table 4. Selected Original and Revised Questions from the *ASK PE: EXP* Continued

| | |
|---|---|
| *What is one way to overcome barriers to a regular stretching and strengthening program?* | What is one way to overcome barriers to a regular strengthening program? |
| *A.) set goals based on your own patterns of physical activity.* | A.) set goals based on your own patterns of physical activity |
| *B.) challenge yourself to do things you see other people doing.* | B.) challenge yourself to do things you see other people doing |
| C.) *avoid record keeping to limit your frustration with slow progress.* | C.) avoid record keeping to limit your frustration with slow progress |
| *D.) just don't worry about things that make it hard to stretch or strength train regularly.* | D.) just don't worry about things that make it hard to stretch or strength train regularly |

Table 5. Summary of Revisions

| | Original *ASK PE: EXP* | Adapted *ASK PE: EXP* |
|---|---|---|
| Total Items | 42 | 38 |
| No Action On Items | 21 | |
| Revised Items | 16 | |
| Deleted Items | 5 | |
| KR20 Value | .73 | .89 |

* Note that Original Item #5 was developed into two questions.

Table 6. Results of Instrument Evaluation: Adapted *ASK PE: EXP*

| Original Item # | Action Taken on Original *ASK PE: EXP* Items |
|---|---|
| 1 | No action |
| 2 | No action |
| 3 | Revised |
| 4 | Revised |
| 5 | Revised |
| 6 | No action |
| 7 | Revised |
| 8 | Revised |
| 9 | Deleted |
| 10 | Revised |
| 11 | Deleted |
| 12 | Revised |
| 13 | Deleted |
| 14 | Revised |
| 15 | Revised |
| 16 | No action |
| 17 | No action |
| 18 | Deleted |
| 19 | Revised |
| 20 | Revised |
| 21 | Revised |
| 22 | No action |
| 23 | No action |
| 24 | No action |
| 25 | No action |
| 26 | Revision |
| 27 | Revision |
| 28 | No action |
| 29 | Deleted |
| 30 | No action |
| 31 | No action |
| 32 | No action |
| 33 | No action |
| 34 | No action |
| 35 | No action |
| 36 | No action |
| 37 | Revision |
| 38 | No action |
| 39 | No action |
| 40 | Revision |
| 41 | No action |
| 42 | No action |

Table 7. Observed Reliability Analysis of *ASK PE: EXP*

| Original Item # | Reliability Analysis by Item to Total Correlation for Original Items | Reliability Analysis by Item to Total Correlation for Adapted Items | Reliability Analysis Results for Adapted Items Correspond with Original Item #, and Original Item to Total Correlation |
|---|---|---|---|
| 1 | .161 | .208 | 1, .161 |
| 2 | .380 | .267 | 2, .380 |
| 3 | .170 | .356 | 3, .170 |
| 4 | -.085 | .318 | 4, -.085 |
| 5 | -.144 | -.191 | 5,-.144 |
| 6 | .299 | .260 | 5,-.144 |
| 7 | .015 | .360 | 6, .299 |
| 8 | .357 | .153 | 7, .015 |
| 9 | -.033 | .438 | 8, .357 |
| 10 | .357 | .404 | 10, .357 |
| 11 | .090 | .586 | 12, .414 |
| 12 | .414 | .294 | 14, -.103 |
| 13 | -.044 | .491 | 15, .109 |
| 14 | -.103 | .561 | 16, .314 |
| 15 | .109 | .453 | 17, .176 |
| 16 | .314 | .506 | 19, .345 |
| 17 | .176 | .344 | 21, .239 |
| 18 | -.064 | .443 | 20, .093 |
| 19 | .345 | .337 | 22, .246 |
| 20 | .093 | .447 | 23, .284 |
| 21 | .239 | .404 | 24, .338 |
| 22 | .246 | .187 | 25, .214 |
| 23 | .284 | .494 | 26, .088 |
| 24 | .338 | .537 | 27, .436 |
| 25 | .214 | .481 | 28, .401 |
| 26 | .088 | .212 | 30, .424 |
| 27 | .436 | .553 | 31, .625 |
| 28 | .401 | .361 | 32, .180 |
| 29 | .063 | .452 | 33, .270 |
| 30 | .424 | .372 | 34, .386 |
| 31 | .625 | .605 | 35, .429 |
| 32 | .180 | .510 | 36, .451 |
| 33 | .270 | .524 | 37, .379 |
| 34 | .386 | .405 | 38, .180 |

| | | | |
|---|---|---|---|
| 35 | .429 | .522 | 39, .251 |
| 36 | .451 | .515 | 40, .326 |
| 37 | .379 | .632 | 41, .075 |
| 38 | .180 | .522 | 42, .388 |
| 39 | .251 | | |
| 40 | .326 | | |
| 41 | .075 | | |
| 42 | .388 | | |
| Total KR20 | .73 | .89 | |

Table 8. Index of Discrimination Analysis Results

| Item | N1 Index of Discrimination Performance | Item Revised for N2 Yes or No | N2 Index of Discrimination Performance |
|---|---|---|---|
| 1 | .18 | No | .22 |
| 2 | .37 | No | .25 |
| 3 | .06 | Yes | .28 |
| 4 | -.04 | Yes | .30 |
| 5 | -.06 | Yes | -.16 |
| 6 | -.06 | Yes | .26 |
| 7 | .18 | No | .32 |
| 8 | .08 | Yes | .14 |
| 9 | .14 | Yes | .40 |
| 10 | .21 | Yes | .33 |
| 11 | .08 | Yes | .55 |
| 12 | .01 | Yes | .27 |
| 13 | .10 | Yes | .38 |
| 14 | .04 | No | .45 |
| 15 | .06 | No | .42 |
| 16 | .08 | Yes | .57 |
| 17 | .29 | Yes | .38 |
| 18 | .21 | Yes | .45 |
| 19 | .18 | No | .34 |
| 20 | .29 | No | .47 |
| 21 | .33 | No | .38 |
| 22 | .44 | No | .17 |
| 23 | .06 | Yes | .50 |
| 24 | .44 | Yes | .54 |
| 25 | .25 | No | .47 |
| 26 | .53 | No | .22 |
| 27 | .27 | No | .57 |
| 28 | .12 | No | .39 |
| 29 | .26 | No | .45 |
| 30 | .31 | No | .39 |
| 31 | .42 | No | .61 |
| 32 | .39 | No | .52 |
| 33 | .27 | No | .52 |
| 34 | .22 | No | 41 |
| 35 | .33 | No | .53 |
| 36 | .22 | Yes | .50 |
| 37 | .08 | No | .63 |
| 38 | .20 | No | .52 |

Table 9. Summary of Results by Index of Discrimination Values

| D-Value Classification | D-Value Ranges | N1 D-Values by Range and Classification # and % of Total Items | N2 D-Values by Range and Classification # and % of Total Items |
|---|---|---|---|
| *Needs Complete Revision or Elimination* | D≤.19 | 21 items 50% | 3 items 8% |
| *Marginal and Needs Revision* | .2≤D≤.29 | 12 items 29% | 6 items 6% |
| *Needs Little or No Revision* | .3≤D≤.39 | 5 items 12% | 9 items 24% |
| *Item Functions Satisfactorily* | D≥.4 | 4 items 10% | 20 items 53% |

Table 10. Summary of Correct Response Representations

| Correct Response Positions | Original *ASK PE: EXP* Correct Responses by Position and % of Total Items | Revised *ASK PE: EXP* Correct Responses by Position and % of Total Items |
|---|---|---|
| A | 12% | 26% |
| B | 21.5% | 24% |
| C | 21.5% | 21% |
| D | 45% | 29% |

# APPENDIX A

## INSTITUTIONAL REVIEW BOARD APPROVAL

THE UNIVERSITY OF SOUTHERN MISSISSIPPI

Institutional Review Board

118 College Drive #5147
Hattiesburg, MS 39406-0001
Tel: 601.266.6820
Fax: 601.266.5509
www.usm.edu/irb

**HUMAN SUBJECTS PROTECTION REVIEW COMMITTEE**
**NOTICE OF COMMITTEE ACTION**

The project has been reviewed by The University of Southern Mississippi Human Subjects Protection Review Committee in accordance with Federal Drug Administration regulations (21 CFR 26, 111), Department of Health and Human Services (45 CFR Part 46), and university guidelines to ensure adherence to the following criteria:

- The risks to subjects are minimized.
- The risks to subjects are reasonable in relation to the anticipated benefits.
- The selection of subjects is equitable.
- Informed consent is adequate and appropriately documented.
- Where appropriate, the research plan makes adequate provisions for monitoring the data collected to ensure the safety of the subjects.
- Where appropriate, there are adequate provisions to protect the privacy of subjects and to maintain the confidentiality of all data.
- Appropriate additional safeguards have been included to protect vulnerable subjects.
- Any unanticipated, serious, or continuing problems encountered regarding risks to subjects must be reported immediately, but not later than 10 days following the event. This should be reported to the IRB Office via the "Adverse Effect Report Form".
- If approved, the maximum period of approval is limited to twelve months. Projects that exceed this period must submit an application for renewal or continuation.

PROTOCOL NUMBER: **27112603**
PROJECT TITLE: **Physical Education Content Knowledge and Physical Activity Behaviors of Ninth and Twelfth Grade Mississippi High School Students**
PROPOSED PROJECT DATES: **01/01/07 to 01/01/09**
PROJECT TYPE: **Dissertation or Thesis**
PRINCIPAL INVESTIGATORS: **Christina L. L. Martin**
COLLEGE/DIVISION: **College of Health**
DEPARTMENT: **Human Performance and Recreation**
FUNDING AGENCY: **USM Dissertation Grant**
HSPRC COMMITTEE ACTION: **Expedited Review Approval**
PERIOD OF APPROVAL: **12/12/07 to 12/11/08**

Lawrence A. Hosman — 1-09-08

Lawrence A. Hosman, Ph.D.
HSPRC Chair

Date

# APPENDIX B

## PERMISSION TO USE THE *ASK PE: EXP*

**ASK –PE**

Ask-PE is the time-saving tool that every physical education teacher should have to assess the basic, physical education content knowledge of students from 8th grade through freshman year in college.

Developed using the NASPE publication, Concepts of Physical Education: What Every Student Should Know (Bonnie Mohnsen, editor), Ask-PE now features over 250 questions that allow teachers to select and create comprehensive tests that easily evaluate their students' knowledge of these seven important areas:

- Motor learning
- Motor development
- Biomechanics
- Exercise physiology
- Historical perspectives
- Social psychology
- Aesthetic experience

Teachers can administer the tests as they are, or can very easily edit, delete or add their own questions. Now with new and improved navigational tools, Ask-PE lets teachers view questions and students' responses, change students' passwords, import students with all their information and export test scores.

Another new benefit of Ask-PE is the improved item analysis tool. Easy-to-use and accurate, it allows teachers who administer the test online to monitor their students' test results.

Tests can also be printed out and taken on paper, so teachers can use this tool even if their students' don't have online access.

The cognitive test items contained on this CD-ROM were created through systematic test item development and analysis, including several stages of review, revision, and pilot testing. In order to assure validity and reliability, the tests were then administered to over 3,200 high school students in 16 different states.

Ask-PE works on both Mac and PC.

Save 10% when you add the Concepts and Principles of Physical Education: What Every Student Should Know, 2nd Edition

# APPENDIX C

## PERMISSION TO USE THE *MAQ-A*

RE: MAQ-A permission
From: **Aaron, Deborah** (debaaron@education.pitt.edu)
Sent: Thu 6/14/07 3:24 PM
To: Christina Martin (christinallmartin@hotmail.com); aky@pitt.edu; debaaron@pitt.edu

Christina,
Yes, you may use the questionnaire. You do not need to purchase, but can make copies from the MSSE supplement. You should review the list of activities and make sure that the list is inclusive of activities that are common among your population.

Deborah Aaron

---

Deborah J. Aaron, PhD, FACSM
Associate Professor
Department of Health & Physical Activity
155 Trees Hall
University of Pittsburgh
Pittsburgh, PA 15261
Voice: 412.648.8272
FAX: 412.648.7092

---

**From:** Christina Martin [mailto:christinallmartin@hotmail.com]
**Sent:** Thu 6/14/2007 2:09 PM
**To:** aky@pitt.edu; debaaron@pitt.edu
**Subject:** MAQ-A permission

Dr. Kriska and Dr. Aaron,

I am hoping to use the Modifiable Activity Questionnaire for Adolescents as a measure in my dissertation project. I would like your permission to use the questionnaire.

Please let me know if permission is granted, and also, if the questionnaire should be purchased or copied.

Thank you for your time!
Christina L. L. Martin,
Doctoral Student, The University of Southern Mississippi

RE: MAQ-A permission
From: **Kriska, Andrea** (KriskaA@edc.pitt.edu)
You may not know this sender.Mark as safe|Mark as unsafe
Sent: Fri 6/15/07 7:56 AM
To: Aaron, Deborah (debaaron@education.pitt.edu); Christina Martin (christinallmartin@hotmail.com); aky@pitt.edu; debaaron@pitt.edu
Security scan upon download TREND MICRO
MAQ-Adole...wpd (44.2 KB)

HI Christina,

As Deborah said, you need not purchase it, just reference it.

I have attached an electronic copy ( in word perfect) for you to use.

Good luck in your project.

Sincerely,

andrea

# APPENDIX D

## E-MAIL AND FAX LETTER FOR HIGH SCHOOL ADMINISTRATORS

February 5, 2008

Dear Mississippi High School Administrator:

I am writing you to inform you that your school has been randomly-selected for a current research project which will seek to investigate physical education content knowledge, physical activity behaviors, and body mass indexes of Mississippi high school students with a goal of establishing evidence-based needs to modify physical education curricula. I hope that you will please consider letting your students participate in this study, as it will be influential in developing physical education curricula that is beneficial to Mississippi schools and students.

Please note that the study will be voluntary for administrators, teachers, and students, and additionally, only group data will be reported. Therefore, no individual school, teacher, or student data will be used in interpreting or recording results.

Within the next few weeks, I will be mailing a packet to your school which will include: a letter and demographics form for high school administrators (principals, guidance counselors, or nurses), a letter of instructions for teachers, and a three-part instrument (demographics, a physical activity recall log, and a physical education content exam) for your ninth and twelfth grade students. The high school demographics form to be completed by a principal, guidance counselor, school nurse, etc. will take no longer than 5-minutes. Additionally, the three part instrument to be completed by students will take on average 30 minutes. I am asking that the study take place in the homeroom or first period for all ninth and twelfth grade students at your school. This will ensure that participating students only complete one instrument packet.

In an effort to make this process very smooth for you and your students, I would like to know the best method of contact for you (e-mail, phone, or fax). Also, it will be helpful if you can provide me contact information on anyone other than yourself who will serve as the contact for this project (other principals, guidance counselors, or school nurses). In addition, the following information will aid me in organizing your school's packet:
1) The number of ninth and twelfth grade homeroom classes or first period classes at your school;
2) The average class size at your school.

I will be contacting you to ensure an efficient research process at your high school. If you have questions, please feel free to contact me via e-mail at Christina.Martin@usm.edu .

# APPENDIX E

## COVER LETTTER FOR HIGH SCHOOL ADMINISTRATORS

February 18, 2008
RE: "Physical Education Content Knowledge and Physical Activity Behaviors of Mississippi High School Students"

To: High School Administrators

I am currently working on a research study which will seek to investigate physical education content knowledge, physical activity behaviors, and body mass indexes of Mississippi high school students with a goal of establishing evidence-based needs to modify physical education curricula. The ultimate goal for this study is to provide information that can be influential in developing physical education curricula that is beneficial to Mississippi students. Surveys are being distributed to approximately 2,790 ninth and twelfth grade students. Additionally, 19 high school administrators throughout the state will be asked to complete a school demographics sheet which will help to further explain findings.

The state of Mississippi has been purposefully divided into seven regions to ensure that schools, from all areas of the state have an equal chance of being selected for representation based on the percentage of ninth and twelfth grade students that each area is accountable. Nineteen schools have been randomly selected to participate in this study. The study will require participation from the school administration, teachers, and students to be successful!

I am asking you to assist with the management of this study. Particularly, I would like to ask your help in four areas: 1) please complete the provided high school demographics sheet; 2) please encourage your faculty to participate in this project, as its primary purpose is to better Mississippi schools; 3) please provide your **ninth and twelfth grade** homeroom teachers with the teacher instruction sheet, the legal guardian forms, student assent forms, and the three-part instruments; 4) once you have received the legal guardian forms, student assent forms and the three part instruments from all of your ninth and twelfth grade teachers, please use the pre-paid, mail packages and return the study material to the provided address by **March 21, 2008.**

I am asking for your voluntary participation in a project that will take place in a four-week time period. There is no penalty if you choose not to complete the study. Please note, that only group data, (no individual student or school data) will be reported. Furthermore, data will be stored and locked in the principal investigator's office files. At the completion of the study, data will be shredded and purged.

I understand you are extremely busy but would greatly appreciate your assistance. Also, **by completing the attached high school demographics sheet, you have voluntarily participated in the research study with informed consent.** If you have any questions or comments please contact: Christina L. L. Martin, M.S. (601)-266-5943 or Christina.Martin@usm.edu

Thank you for your time and consideration.

Sincerely,

Christina L. L. Martin,
Doctoral Candidate,
The University of Southern Mississippi

"This project has been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the chair of the Institutional Review Board, The University of Southern Mississippi, 118

# APPENDIX F

## COVER LETTER AND INSTRUCTIONS FOR HIGH SCHOOL TEACHERS

January 1, 2008

Dear Mississippi High School Teachers:

I am currently working on a research study which will seek to investigate physical education content knowledge, physical activity behaviors, and body mass indexes of Mississippi high school students with a goal of establishing evidence-based needs to modify physical education curricula. The ultimate goal for this study is to provide information that can be influential in developing physical education curricula that is beneficial to Mississippi students. Surveys are being distributed to approximately 2,790 ninth and twelfth grade students. Additionally, 19 high school administrators throughout the state will be asked to complete a school demographics sheet which will help to further explain findings.

I am asking for your voluntary participation in a project that will take place in a four-week time period. I am requesting that all information be mailed back to me by your high school administrators by **March 7, 2008**. Therefore, you may choose within this time period, the best day to implement this study.

The success of this project requires support from school administrators, classroom teachers, and students. Thank you for taking time out of your classes to allow the implementation of this project. Your contribution is greatly appreciated.

Please follow the directions to ensure complete and accurate results.

**Directions**

1. Please give a two-day time period for students and their legal guardians to review all information pertaining to this study. Legal guardians are asked to sign, date, and return the letter if they wish their ninth or twelfth grader NOT participate. If you receive a letter from the parent or guardian asking that their child does not participate, please keep the letter on file, and return it with the student assent forms and the three-part instruments.
2. Students who do not return the legal guardian letter are considered to have "consent" to participate in the study.
3. PLEASE ENCOURAGE STUDENTS TO PARTICIPATE.
4. Any student who chooses to participate in this study MUST sign and date a student assent form, acknowledging that they understand the risks and benefits of this study.
5. Students will fill the assent form out just prior to participating in the three-part instrument.
6. The student assent forms are to be collected separately from the three-part instruments so that the students' results can remain anonymous.
7. Once you have received the assent forms, please check them for completeness. Each form MUST have the participating student's signature and date.
8. Please keep all legal guardian singed letters and student assent forms in one stack. Do not turn them in with the corresponding student's instrument packet. **(There should be no way of knowing which responses belong to each student.)**
9. **Please have a scheduled activity for students who do not return a complete consent/assent form).
10. Please pass out the instrument packets to all students who are choosing to participate.
11. Please read the directions listed below **aloud** for all students.
    1. *Do not write your name on any of the forms.*
    2. *Please read the directions for each section.*
    3. *Please respond to ALL questions.*
    4. *Please list or circle your responses on the provided forms.*
    5. *Answer the questions to the BEST OF YOUR ABILITY. You can not get help with any of the questions.*
    6. *If you need help with understanding any directions, you may ask your teacher for assistance.*

7. *Once you are finished, please check to make sure you did not miss any section.*
8. *Once you have checked your sections, please turn in your packet to your teacher.*

12. Once all students have completed and turned in their three-part instrument, please organize all three-part instruments in one stack, and completed consent/assent forms in another stack.
13. Please turn both the three-part instruments and any legal guardian letters, and student assent forms into your school's administrative office.

Thank you again for your cooperation! If you have any questions, please feel free to contact me at 601-266-5943 or Christina.Martin@usm.edu.

Sincerely,

Christina L. L. Martin,
Doctoral Candidate
The University of Southern Mississippi

# APPENDIX G

## PASSIVE PARENTAL CONSENT FORM

RE: "Physical Education Content Knowledge and Physical Activity Behaviors of Mississippi High School Students"

To: Mississippi High School Students and Legal Guardians

I am currently working on a research study which will seek to investigate physical education content knowledge, physical activity behaviors, and body mass indexes of Mississippi high school students with a goal of establishing evidence-based needs to modify physical education curricula. The ultimate goal for this study is to provide information that can be influential in developing physical education curricula that is beneficial to Mississippi students. Surveys are being distributed to approximately 2,790 ninth and twelfth grade students. Additionally, 19 high school administrators throughout the state will be asked to complete a school demographics sheet which will help to further explain findings.

The state of Mississippi has been purposefully divided into seven regions to ensure that schools, from all areas of the state have an equal chance of being selected for representation based on the percentage of ninth and twelfth grade students that each area is accountable. Nineteen schools have been randomly selected to participate in this study. The study will require participation from the school administration, teachers, and students to be successful!

I am asking you to please consider allowing your ninth or twelfth grade student to participate. The three-part instrument each participating student is asked to complete will take approximately 30 minutes. There are minimal risks for students choosing to participate. The results of this study will have no impact on a student's grade.

I am asking permission for your child to voluntarily participate in a project that will take place during each participating student's homeroom class period. There is no penalty if your ninth or twelfth grade student chooses not to complete the study, and they may discontinue the study at any time without penalty or prejudice. Please note, that only group data, (no individual student or school data) will be reported. Furthermore, data will be stored and locked in the principal investigator's office files. At the completion of the study, data will be shredded and purged.

I am attaching a letter to be signed and dated by the parent or legal guardian only if you choose NOT to have your ninth or twelfth grade student participate. By not returning the attached letter, and by each participant signing the student assent form (to be signed at the time of participation), and completing the three-part instrument packet, you ninth or twelfth grade student willl have voluntarily participated in the research study with informed parental consent and student assent. Please note that any returned letters as well as signed student assent forms will be collected separately from the three-part instrument. Though students who choose to participate must sign and date an assent letter, identification information collected on the three-part instrument will be minimal and will maintain anonymity.

If you have any questions or comments please contact: Christina L. L. Martin, M.S. (601)-266-5943 or Christina.Martin@usm.edu

Thank you for your time and consideration.

Sincerely,

Christina L. L. Martin,
Doctoral Candidate,
The University of Southern Mississippi

"This project has been reviewed by the Human Subjects Protection Review Committee, which ensures that research projects involving human subjects follow federal regulations. Any questions or concerns about rights as a research subject should be directed to the chair of the Institutional Review Board, The University of Southern Mississippi, 118

*ONLY SIGN, DATE, AND RETURN IF YOU CHOOSE NOT TO PARTICIPATE IN THE STUDY DESCRIBED ABOVE.

PARENT or LEGAL GUARDIAN:
By signing and dating this form, I am choosing for my ninth or twelfth grade student NOT to participate in the above listed study.

_____ _____
(Parent's Name: First and Last) (Date)
Dear Mississippi High School Students:

# APPENDIX H

## STUDENT ASSENT FORM

To: Mississippi High School Student

Thank you for voluntarily participating in this study. Your contribution is greatly appreciated. Before you get started, please read the purpose, risks and benefits of this study. After reading the purpose, risks and benefits, **please sign and date the student assent form, stating that you fully understand the risks and benefits.**

I am currently working on a research study which will seek to investigate physical education content knowledge, physical activity behaviors, and body mass indexes of Mississippi high school students with a goal of establishing evidence-based needs to modify physical education curricula.

Risks and Benefits:

1) There are no harmful risks for participating in this study.
2) This questionnaire is not related to your class grade.
3) If you choose to participate, it will take approximately 30 minutes of your classroom time.
4) Participation is voluntary.
5) There is no penalty if you choose not to complete the study.
6) You may discontinue the study at any time without penalty or prejudice.
7) Please note, that only group data, (no individual student or school data) will be reported.
8) Data will be stored and locked in the principal investigator's office files.
9) At the completion of the study, data will be shredded and purged.
10) The ultimate goal for this study is to provide information that can be influential in developing physical education curricula that is beneficial to Mississippi students.

Thank you for your time and consideration.

Yours Sincerely,

Christina L. L. Martin

**STUDENT ASSENT:**

By signing and dating this form, I am assenting to participate in the above listed study and fully understand the risks and benefits of the study. I also understand that I can discontinue participation in this study at any time without penalty or prejudice.

_____ _____

(Student's Name: First and Last) (Date)

*****ONCE YOU HAVE SIGNED AND DATED THIS FORM, PLEASE TEAR AT THE STAPLED CORNER AND TURN IT IN TO YOUR TEACHER.*****

APPENDIX I

HIGH SCHOOL DEMOGRAPHIC FORM

***High School Demographics***

***Please list the most appropriate response.***

**AA.** What is the total student enrollment for your high school? (Only include grades nine through twelve).

_____ (number of total students)

**AB.** What is the racial/ethnic breakdown at your high school? Please provide the number and percentage of each group in the following table. (Only include grades nine through twelve).

| **African-American** | | **American-Indian** | | **Asian** | | **Caucasian** | | **Hispanic** | | **Pacific Islander** | | **Other** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| # | % | # | % | # | % | # | % | # | % | # | % | # | % |
| | | | | | | | | | | | | | |

**AC.** How many ninth through twelfth grade students are male? _____

**AD.** How many ninth through twelfth grade students are female? _____

**AE.** How many ninth through twelfth grade students are receiving free or reduced lunch?

_____

**AF.** How many Physical Education teachers do you have on your staff? _____

.....

***Please circle the most appropriate response.***

**AG.** Is your school location considered to be rural?

YES NO Do not know

**AH.** Is your school location considered to be urban?

YES NO Do not know

**AI.** Do all of your Physical Education teachers meet the requirements set forth by the Mississippi Department of Education?

YES NO

**AJ.** Are you pleased with the performance of your Physical Education staff?

YES NO

**AK.** Overall, how would you rank the Physical Education program(s) at your high school?

Very Poor Poor Fair Good Excellent

**AL.** Would you support a more regimented Physical Education program(s) at your high school which would include?

1. Mandatory PE for ninth through twelfth grade?

YES NO Only with governmental support

2. Mandatory "dress-out" requirements for students?

YES NO Only with governmental support

3. More class-room time for students to focus on concepts of physical education?

YES NO Only with governmental support

# APPENDIX J

## STUDENT DEMOGRAPHIC FORM

***Student Demographics***

***Please circle the most appropriate response.***

**A. Sex:** Female Male

**B. Race:** African-American American-Indian Asian Caucasian Hispanic

Pacific-Islander Other *(Please List):* _____

**C. Year in school:** Ninth grade Tenth grade Eleventh grade Twelfth grade

***Please write your birthday in month, day, and year format.***

**D. Birthday (month/day/year):** _____

**E. What is your current height?** _____ **feet** _____ **inches**

**F. What is your current weight?** _____ **pounds**

***Please circle the most appropriate response.***

**G.** Are you currently enrolled in a Physical Education class that **is not** part of an interscholastic-athletic program
(basketball, football, baseball, softball, cheerleading, etc.)?
YES NO

**H.** Are you currently enrolled in a Physical Education class that **is** part of an interscholastic-athletic program
(basketball, football, baseball, softball, cheerleading, etc.)?
YES NO

**I.** What grade were you in when you last enrolled in a Physical Education class that **is not** part of an
interscholastic-athletic program (basketball, football, baseball, softball, cheerleading, etc.)?
Eighth grade or lower Ninth Tenth Eleventh Twelfth

**J.** Overall, how would you classify your fitness level?
Very poor Poor Fair Good Excellent

**K.** Overall, how would you classify your fitness knowledge?
Very poor Poor Fair Good Excellent

**L.** Overall, how would you classify your Physical Education learning experiences? Consider all grades in which
you have been enrolled in Physical Education.
Very poor Poor Fair Good Excellent

**M.** Overall, do you feel that your Physical Education classes have given you the skills needed to perform a variety of physical activities?
YES NO

**N.** Overall, do you value physical activity and its contribution to a healthful lifestyle?
YES NO

**O.** What is the lowest grade you can recall receiving in any Physical Education class?
A B C D F

# APPENDIX K

## ORIGINAL *ASK PE: EXP* 42-ITEMS

***Please completely circle the correct answer.***

1. What is the minimum number of days per week should you exercise within your target heart rate range to develop cardiorespiratory fitness?
   A.) 1
   B.) 3
   C.) 5
   D.) 7

2. What does the acronym F.I.T.T., as it refers to fitness, stand for?
   A.) fun, interest, tension and tone
   B.) frequency, intensity, time and type
   C.) fatness, isolation, thinness and technique
   D.) flexibility, intuition, tightness and thought

3. What principle(s) is/are related to improving fitness?
   A.) how hard you exercise
   B.) how long you exercise
   C.) how often you exercise
   D.) all of the above

4. Which of the following is most likely to contribute to good physical and mental health?
   A.) working out at a gym once a week
   B.) shopping regularly in a large mall
   C.) regular moderate to vigorous physical activity
   D.) all of the above

5. Which exercises could be included in a safe stretching and strengthening program?
   A.) fast head circles
   B.) fast deep knee bends
   C.) slow crunches/curl-downs
   D.) slow straight-legged toe touches

6. Which activity will result in the biggest improvement in cardiorespiratory fitness?
   A.) archery
   B.) bowling
   C.) walking
   D.) weight lifting

7. Which of the following activities contributes to fitness?
   A.) strength training
   B.) flexibility training
   C.) cardiorespiratory training
   D.) all of the above

8. Nikki has never done cardiorespiratory exercise or lifted weights before, but she stretches twice a week. She is going to try out for her high school track team next semester, so as part of her training, she has asked a friend to teach her how to lift weights correctly. When Nikki adds more weight to her exercises as she gets stronger she is _____.
   A.) risking injury
   B.) using the principle of specificity

C.) using the principle of progression
D.) ignoring a major principle of lifting

9. Nikki has never done cardiorespiratory exercise or lifted weights before, but she stretches twice a week. She is going to try out for her high school track team next semester, so as part of her training, she has asked a friend to teach her how to lift weights correctly. What should Nikki always do when lifting weights?
A.) lock her elbows and knees at the end of a lift
B.) limit her range of motion to avoid getting hurt
C.) move weights rapidly through her full range of motion
D.) stretch the muscles she strengthens before and after each session

10. Nikki has never done cardiorespiratory exercise or lifted weights before, but she stretches twice a week. She is going to try out for her high school track team next semester, so as part of her training, she has asked a friend to teach her how to lift weights correctly. Nikki's strength-training program should be set up _____.
A.) based on her starting abilities
B.) based on the fitness scores for her age group
C.) differently than a boy who has never lifted before
D.) according to the work-out Muscle and Fitness magazine recommends for the women's national body building champion

11. Nikki has never done cardiorespiratory exercise or lifted weights before, but she stretches twice a week. She is going to try out for her high school track team next semester, so as part of her training, she has asked a friend to teach her how to lift weights correctly. When stretching the major muscle groups, Nikki should hold all stretches for _____ seconds.
A.) 1-5
B.) 10-15
C.) 20-25
D.) 30-60+

12. Consuela has been riding the stationary bike for eight weeks in an effort to improve her cardiorespiratory fitness. She started riding at level one, and is still riding at that level. Which fitness principle is she ignoring?
A.) interest
B.) progression
C.) regularity
D.) specificity

13. The muscles and joints of the elbows function similarly to those of the _____.
A.) ankles
B.) knees
C.) shoulders
D.) wrists

14. What do you need for both normal daily activities and hard physical activity?
A.) endurance
B.) power
C.) basic strength
D.) all of the above

15. Muscles that are not used for a long time usually _____.
A.) are stronger
B.) become longer
C.) get weaker
D.) stay firm

16. The best way to know when you should add weight to an exercise is when _____.

A.) you cannot complete one full lift
B.) your lifting partner adds more weight
C.) you can complete the exercise with little effort
D.) the weight you started with is lighter than everyone else's

17. Intensity refers to _____.

A.) how hard you exercise
B.) how long you exercise
C.) how often you exercise
D.) what kind of exercise you do

18. What helps motivate people to maintain a regular fitness program? Opportunities to _____?

A.) participate with people they like
B.) see regular changes in their physical abilities
C.) participate with people different than themselves
D.) all of the above

19. Wade is 16 years old and wants to lose weight and improve his cardiorespiratory fitness. He has never played organized sports and he works after school, so he will have to exercise before school and in his physical education class. What type of exercise(s) should Wade do the first few weeks of his fitness program?

A.) stretching
B.) brisk walking
C.) lifting weights
D.) gradually include all of the above

20. Wade is 16 years old and wants to lose weight and improve his cardiorespiratory fitness. He has never played organized sports and he works after school, so he will have to exercise before school and in his physical education class. After Wade has been exercising for several months, how often should he be exercising?

A.) once a week
B.) twice a week
C.) three times a week
D.) most days of the week

21. Wade is 16 years old and wants to lose weight and improve his cardiorespiratory fitness. He has never played organized sports and he works after school, so he will have to exercise before school and in his physical education class. When Wade first begins his program, what would be an appropriate training heart rate?

A.) in his target heart rate range
B.) as high as he can possibly get it
C.) the same as his resting heart rate
D.) low enough so he does not breathe hard

22. Which of the following is true about muscles? They usually _____.

A.) attach directly to bones
B.) work individually to move bones
C.) prevent ligaments from working properly
D.) contract and relax in opposite sets around joints

23. How often should you lift weights to improve your strength?

A.) twice daily
B.) every two days

C.) once a week
D.) every other week

24. As you age, you should _____.
A.) limit your participation in physical activity to weekends
B.) increase the difficulty of your participation in physical activity
C.) adapt your fitness needs to the changes in your physical ability and interests
D.) all of the above

25. To improve your cardiorespiratory fitness, what is the minimum number of minutes you must keep your heart rate increased?
A.) 10
B.) 20
C.) 35
D.) 50

26. Which activity will produce the greatest increase in overall muscle size (hypertrophy)?
A.) downhill skiing
B.) playing tennis
C.) skateboarding
D.) weight lifting

27. Target heart rate is the range _____.
A.) in which you should start exercising
B.) that is the same for all high school students
C.) that you should avoid reaching during exercise
D.) in which it is ideal for you to reach and stay in during exercise

28. What is true regarding the joints in your body?
A.) most are protected by muscles.
B.) their size determines their function.
C.) they allow different types of movement.
D.) most of them work in the exact same ways.

29.) How can reading current information about fitness help you the most? It tells you _____.
A.) the latest trends
B.) how to break records
C.) how to apply research to everyday needs
D.) about unusual injuries that can happen when exercising

30. Regular cardiorespiratory exercise releases brain chemicals that _____.
A.) help you feel good during and after exercise
B.) cause increased muscle damage and soreness
C.) can be harmful if allowed to build up over time
D.) cause your heart rate to get faster during exercise

31. Whose attitudes can help you remain commitment to staying physically active?
A.) your family
B.) your friends
C.) people in the community
D.) all of the above

32. Nerve cells send and receive messages to and from _____.
A.) lungs
B.) muscles
C.) skin

D.) all of the above

33. What is one way to overcome barriers to a regular stretching and strengthening program?
A.) set goals based on your own patterns of physical activity.
B.) challenge yourself to do things you see other people doing.
C.) avoid record keeping to limit your frustration with slow progress.
D.) just don't worry about things that make it hard to stretch or strength train regularly.

34. Sherry plays soccer for her school. She is trying to increase her muscle strength and flexibility but is having trouble finding time to do this. What can she do?
A.) accept that playing soccer is enough physical activity.
B.) set a goal to stretch or strength train for 30+ minutes before or after soccer practice.
C.) add a 4-5 days/week strengthening/stretching program to her current schedule.
D.) skip soccer practice and work on stretching and strengthening activities at home.

35. How are body composition and nutrition related?
A.) what you eat does not influence how much body fat you have.
B.) your level of physical activity is unrelated to your body composition.
C.) things you do after school usually do not influence your body composition.
D.) food and activity patterns change over time but both influence body composition.

36. Which of the following is true about body composition and nutritional needs?
A.) nutrition has nothing to do with body composition.
B.) nutrition and body composition interact and change as you age.
C.) body composition and nutrition interact but they stay stable as you age.
D.) your body composition will always be the same no matter how old you get.

37. What is the most efficient way for Juan to lose body fat? He should gradually eat _____ calories while becoming _____ physically active.
A.) more, less
B.) fewer, less
C.) more, more
D.) fewer, more

38. Nutritional and exercise needs change and people must adapt them to various stages of life. What factors might cause a change in diet and exercise needs as you get older?
A.) injury
B.) where you live
C.) type of job you have
D.) all of the above

39. The most realistic statement about diet and exercise needs is that _____.
A.) changing diet and exercise behaviors as you age is not recommended
B.) diet and exercise needs change as you age and should be modified accordingly
C.) the diet and exercise behaviors you have now will work for the rest of your life
D.) diet and exercise needs change but your body needs consistency, so avoid change

40. After graduating from college, Lamont decided to lose the weight he had gained in college. What is his best choice to achieve this goal?
A.) eat less junk food.
B.) walk to work every day.

C.) eat only two meals a day.
D.) work up to being physically active for 30+ minutes a day several times a week.

41. Eating disorders are considered diseases. For this reason, people with disorders like anorexia nervosa or bulimia should seek help from a _____,
A.) friend
B.) parent
C.) pastor
D.) medical professional

42. If a friend has stopped eating regular meals and/or exercises for several hours a day, who is the best resource to ask for help?
A.) police
B.) a teacher
C.) other friends
D.) medical professional (ex. School nurse)

# APPENDIX L

## REVISED *ASK PE: EXP* 38-ITEMS

*ASK PE: EXP Test: Exercise Physiology*
***Please completely circle the correct answer.***

1. What is the minimum number of days per week should you exercise within your target heart rate range to develop cardiorespiratory fitness?
   A.) 1
   B.) 3
   C.) 5
   D.) 7

2. What does the acronym F.I.T.T., as it refers to fitness, stand for?
   A.) fun, interest, tension and tone
   B.) frequency, intensity, time and type
   C.) fatness, isolation, thinness and technique
   D.) flexibility, intuition, tightness and thought

3. What principle is <u>not</u> related to improving fitness?
   A.) what time of day you exercise
   B.) how hard you exercise
   C.) how often you exercise
   D.) how long you exercise

4. Which of the following is most likely to contribute to good physical health?
   A.) working out at a gym once a week
   B.) shopping regularly in a large mall
   C.) regular moderate to vigorous physical activity
   D.) reading current information on exercise trends

5. Which exercises could be included in a safe stretching program?
   A.) fast head circles
   B.) fast deep knel bends
   C.) slow crunches/curl-downs
   D.) slow straight-legged toe touches

6. Which exercises could be included in a safe strengthening program?
   A.) fast head circles
   B.) fast deep knee bends
   C.) slow crunches/curl-downs
   D.) slow straight-legged toe touches

7. Which activity will result in the biggest improvement in cardiorespiratory fitness?
   A.) archery
   B.) bowling
   C.) walking
   D.) weight lifting

8. Which of the following activities <u>does not</u> contribute to health-related fitness?
   A.) strength training
   B.) agility training
   C.) cardiorespiratory training
   D.) flexibility training

9. Nikki has asked a friend to teach her how to lift weights correctly. When Nikki adds more weight to her exercises as she gets stronger she is _____.
   A.) risking injury
   B.) using the principle of specificity
   C.) using the principle of progression
   D.) ignoring a major principle of lifting

10. Nikki's strength-training program should be set up _____.
   A.) based on her starting abilities
   B.) based on the fitness scores for her age group
   C.) differently than a boy who has never lifted before
   D.) according to the work-out Muscle and Fitness magazine recommends for the women's national body building champion

11. Consuela started a stationary bike program beginning at level one, and is still riding at that level. Which fitness principle is she ignoring?
   A.) interest
   B.) progression
   C.) regularity
   D.) specificity

12. What do you need for hard physical activity?
   A.) endurance, power, basic strength
   B.) an exercise coach or instructor
   C.) a workout facility
   D.) A and B only

13. Muscles that are not used for a long time usually_____.
   A.) maintain their strength
   B.) become longer
   C.) get weaker
   D.) stay firm

14. The best way to know when you should add weight to an exercise is when _____.
   A.) you cannot complete one full lift
   B.) your lifting partner adds more weight
   C.) you can complete the exercise with little effort
   D.) the weight you started with is lighter than everyone else's

15. Intensity refers to _____.
   A.) how hard you exercise
   B.) how long you exercise
   C.) how often you exercise
   D.) what kind of exercise you do

16. Wade is beginning a fitness program. What type of exercise(s) should Wade do the first few weeks of his fitness program?
   A.) stretching
   B.) brisk walking
   C.) lifting weights
   D.) gradually include all of the above

17. When Wade first begins his program, what would be an appropriate training heart rate?
   A.) in his target heart rate range
   B.) as high as he can possibly get it

C.) the same as his resting heart rate
D.) low enough so he does not breathe hard

18. After Wade has been exercising for several months, how often should he be exercising?
A.) once a week
B.) twice a week
C.) three days a week
D.) seven days a week

19. Which of the following is true about muscles? They usually _____.
A.) attach directly to bones
B.) work individually to move bones
C.) prevent ligaments from working properly
D.) contract and relax in opposite sets around joints

20. How often should you lift weights to improve your strength?
A.) twice daily
B.) every two days
C.) once a week
D.) every other week

21. As you age, you should _____.
A.) limit your participation in physical activity to weekends
B.) increase the difficulty of your participation in physical activity
C.) adapt your fitness needs to the changes in your physical ability and interests
D.) all of the above

22. To improve your cardiorespiratory fitness, what is the minimum number of minutes you must keep your heart rate increased?
A.) 10
B.) 20
C.) 35
D.) 50

23. Which activity will produce the greatest increase in overall muscle size (hypertrophy)?
A.) running daily
B.) playing tennis
C.) playing football
D.) lifting weights

24. Target heart rate is the range _____.
A.) in which it is ideal for you to reach and stay in during exercise
B.) that you should avoid reaching during exercise
C.) that is the same for all high school students
D.) in which you should start exercising

25. What is true regarding the joints in your body?
A.) most are protected by muscles.
B.) their size determines their function.
C.) they allow different types of movement.
D.) most of them work in the exact same ways.

26. Regular cardiorespiratory exercise releases brain chemicals that _____.
    A.) help you feel good during and after exercise
    B.) cause increased muscle damage and soreness
    C.) can be harmful if allowed to build up over time
    D.) cause your heart rate to get faster during exercise

27. Whose attitudes can help you remain commitment to staying physically active?
    A.) your family
    B.) your friends
    C.) people in the community
    D.) all of the above

28. Nerve cells send and receive messages to and from _____.
    A.) lungs
    B.) muscles
    C.) skin
    D.) all of the above

29. What is one way to overcome barriers to a regular strengthening program?
    A.) set goals based on your own patterns of physical activity.
    B.) challenge yourself to do things you see other people doing.
    C.) avoid record keeping to limit your frustration with slow progress.
    D.) just don't worry about things that make it hard to stretch or strength train regularly.

30. Sherry plays soccer for her school. She is trying to increase her muscle strength and flexibility but is having trouble finding time to do this. What can she do?
    A.) accept that playing soccer is enough physical activity.
    B.) set a goal to stretch or strength train for 30+ minutes before or after soccer practice.
    C.) add a 4-5 days/week strengthening/stretching program to her current schedule.
    D.) skip soccer practice and work on stretching and strengthening activities at home.

31. How are body composition and nutrition related?
    A.) what you eat does not influence how much body fat you have.
    B.) your level of physical activity is unrelated to your body composition.
    C.) things you do after school usually do not influence your body composition.
    D.) food and activity patterns change over time but both influence body composition.

32. Which of the following is true about body composition and nutritional needs?
    A.) nutrition has nothing to do with body composition.
    B.) nutrition and body composition interact and change as you age.
    C.) body composition and nutrition interact but they stay stable as you age.
    D.) your body composition will always be the same no matter how old you get.

33. What is the most efficient way for Juan to lose body fat? He should gradually eat _____ calories while becoming _____ physically active.
    A.) fewer, more
    B.) fewer, less
    C.) more, more
    D.) more, less

34. Nutritional and exercise needs change and people must adapt them to various stages of life. What factors might cause a change in diet and exercise needs as you get older?
    A.) injury

B.) where you live
C.) type of job you have
D.) all of the above

35. The most realistic statement about diet and exercise needs is that
    A.) changing diet and exercise behaviors as you age is not recommended
    B.) diet and exercise needs change as you age and should be modified accordingly
    C.) the diet and exercise behaviors you have now will work for the rest of your life
    D.) diet and exercise needs change but your body needs consistency, so avoid change

36. After graduating from college, Lamont decided to lose the weight he had gained in college. What is his best choice to achieve this goal?
    A.) work up to being physically active for 30+ minutes a day several times a week.
    B.) eat only two meals a day
    C.) walk to work every day.
    D.) eat less junk food.

37. Eating disorders are considered diseases. For this reason, people with disorders like anorexia nervosa or bulimia should seek help from a _____,
    A.) friend
    B.) parent
    C.) pastor
    D.) medical professional

38. If a friend has stopped eating regular meals and/or exercises for several hours a day, who is the best resource to ask for help?
    A.) police
    B.) a teacher
    C.) other friends
    D.) medical professional (ex. School nurse)

# APPENDIX M

## *MAQ-A*

Modifiable Activity Questionnaire for Adolescents

***Please list a response that most appropriately describes your activity levels.***

1.) How many **days** in the past two weeks (14 days) have you done at least 20 minutes of exercise hard enough to make you breathe heavily and make your heart beat fast? (Hard exercise includes, for example, playing basketball, jogging, or fast bicycling; include time in physical education class).

_____ Days

2.) How many **days** in the past two weeks (14 days) have you done at least 20 minutes of light exercise that was not hard enough to make you breathe heavily and make your heart beat fast? (Light exercise includes shooting free-throws, walking, or slow bicycling; include time in physical education class).

_____ Days

3.) During a normal week, how many **hours a day**, do you watch television and videos, or play computer/video games? (Do not include watching television and videos or computer usage at school)

_____ Hours a day

4a.) During the past 12 months, how many team or individual sports or activities did you participate in on a competitive level, such as varsity or junior varsity sports, intramurals, or out-of-school programs?

_____ (Total # of team/individual sports/activities you have participated in during the past 12 months)

4b.) Please provide the team or individual sports or activities that you participated in on a competitive level during the past 12 months (include varsity or junior varsity sports, intramurals, or out-of-school programs)?

_____
_____
_____
_____
_____
_____
_____

***Please circle the activity or activities that you participated in over the past <u>12 months.</u> If you have participated in an activity that is not listed, please record it in the provided blanks.***

| | | |
|---|---|---|
| Aerobics | Gymnastics | Street Hockey |
| Band/Drill Team | Hiking | Tennis |
| Baseball | Ice Skating | Track and Field |
| Basketball | Roller Skating | Volleyball |
| Bicycling | Running for Exercise (not track and field) | Water Skiing |
| Bowling | Skateboarding | Wrestling |
| Cheerleading | Snow Skiing | Walking for Exercise |
| Dance class | Soccer | Others: |
| Football | Softball | _____ |
| Garden/Yard Work | Swimming | _____ |
| | | _____ |
| | | _____ |
| | | _____ |

***List each activity that you circled above in the "activity box" below. Check the months you did each activity and then estimate the amount of time you spent in each activity by months per year, days per week, and minutes per day.***

***An example is provided for an individual who participated in gymnastics for 8 months out of the year, 4 days a week, and 60 minutes a day.***

| Activity | January | February | March | April | May | June | July | August | September | October | November | December | months per Year | days per Week | minutes per Day |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Example: Gymnastics** | x | x | x | x | | | | | x | x | x | x | 8 | 4 | 60 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
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# APPENDIX N

## DATA OUTPUTS

1. Ninth Grade Pearson and Spearman's Correlations

**Correlations**

| | | bmi | askpe | wth |
|---|---|---|---|---|
| bmi | Pearson Correlation | 1 | -.027 | .032 |
| | Sig. (2-tailed) | | .699 | .653 |
| | N | 205 | 205 | 205 |
| askpe | Pearson Correlation | -.027 | 1 | .076 |
| | Sig. (2-tailed) | .699 | | .252 |
| | N | 205 | 228 | 228 |
| wth | Pearson Correlation | .032 | .076 | 1 |
| | Sig. (2-tailed) | .653 | .252 | |
| | N | 205 | 228 | 228 |

**Correlations**

| | | | bmi | askpe | wth |
|---|---|---|---|---|---|
| Spearman's rho | bmi | Correlation Coefficient | 1.000 | -.046 | -.006 |
| | | Sig. (2-tailed) | . | .511 | .927 |
| | | N | 205 | 205 | 205 |
| | askpe | Correlation Coefficient | -.046 | 1.000 | .237* |
| | | Sig. (2-tailed) | .511 | . | .000 |
| | | N | 205 | 228 | 228 |
| | wth | Correlation Coefficient | -.006 | .237* | 1.000 |
| | | Sig. (2-tailed) | .927 | .000 | . |
| | | N | 205 | 228 | 228 |

**. Correlation is significant at the 0.01 level (2-tailed).

2. Twelfth Grade Pearson and Spearman's Correlations

**Correlations**

| | | bmi | askpe.score | wth |
|---|---|---|---|---|
| bmi | Pearson Correlation | 1 | .032 | -.014 |
| | Sig. (2-tailed) | | .712 | .873 |
| | N | 138 | 138 | 138 |
| askpe.score | Pearson Correlation | .032 | 1 | .301* |
| | Sig. (2-tailed) | .712 | | .000 |
| | N | 138 | 147 | 147 |
| wth | Pearson Correlation | -.014 | .301* | 1 |
| | Sig. (2-tailed) | .873 | .000 | |
| | N | 138 | 147 | 147 |

**. Correlation is significant at the 0.01 level (2-tailed).

**Correlations**

| | | | bmi | askpe.score | wth |
|---|---|---|---|---|---|
| Spearman's rho | bmi | Correlation Coefficient | 1.000 | .024 | -.181* |
| | | Sig. (2-tailed) | . | .779 | .034 |
| | | N | 138 | 138 | 138 |
| | askpe.score | Correlation Coefficient | .024 | 1.000 | .415* |
| | | Sig. (2-tailed) | .779 | . | .000 |
| | | N | 138 | 147 | 147 |
| | wth | Correlation Coefficient | -.181* | .415* | 1.000 |
| | | Sig. (2-tailed) | .034 | .000 | . |
| | | N | 138 | 147 | 147 |

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

3. Independent T-Tests: Grade and *ASK PE* Score

**Group Statistics**

| | C.Grade | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| ASKPE.Score | Ninth Grade | 224 | .5246 | .21662 | .01447 |
| | Twelfth | 147 | .5652 | .21406 | .01766 |

**Independent Samples Test**

| | | | ASKPE.Score | |
|---|---|---|---|---|
| | | | Equal variances assumed | Equal variances not assumed |
| Levene's Test for Equality of Variances | F | | .465 | |
| | Sig. | | .495 | |
| t-test for Equality of Means | t | | -1.774 | -1.779 |
| | df | | 369 | 315.020 |
| | Sig. (2-tailed) | | .077 | .076 |
| | Mean Difference | | -.04061 | -.04061 |
| | Std. Error Difference | | .02289 | .02283 |
| | 80% Confidence Interva of the Difference | Lower | -.06999 | -.06993 |
| | | Upper | -.01123 | -.01129 |

4. Independent T-Tests: Grade and Physical Activity

**Group Statistics**

| | C.Grade | N | Mean | Std. Deviation | Std. Error Mean |
|---|---|---|---|---|---|
| WeeklyTH | Ninth Grade | 224 | 7.6970 | 10.20565 | .68189 |
| | Twelfth | 147 | 6.0579 | 9.45491 | .77983 |

**Independent Samples Test**

| | | | WeeklyTH | |
|---|---|---|---|---|
| | | | Equal variances assumed | Equal variances not assumed |
| Levene's Test for Equality of Variances | F | | .396 | |
| | Sig. | | .530 | |
| t-test for Equality of Means | t | | 1.557 | 1.582 |
| | df | | 369 | 328.777 |
| | Sig. (2-tailed) | | .120 | .115 |
| | Mean Difference | | 1.63903 | 1.63903 |
| | Std. Error Difference | | 1.05248 | 1.03591 |
| | 80% Confidence Interva of the Difference | Lower | .28780 | .30879 |
| | | Upper | 2.99026 | 2.96928 |

5. ANOVA

**Test of Homogeneity of Variances**

ASKPE.Score

| Levene Statistic | df1 | df2 | Sig. |
|---|---|---|---|
| 4.317 | 3 | 382 | .005 |

**ANOVA**

ASKPE.Score

| | Sum of Squares | df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Between Groups | 1.441 | 3 | .480 | 10.830 | .000 |
| Within Groups | 16.947 | 382 | .044 | | |
| Total | 18.388 | 385 | | | |

**Robust Tests of Equality of Means**

ASKPE.Score

| | Statistic[a] | df1 | df2 | Sig. |
|---|---|---|---|---|
| Welch | 20.093 | 3 | 88.180 | .000 |
| Brown-Forsythe | 13.213 | 3 | 255.134 | .000 |

a. Asymptotically F distributed.

5. Chi Square/Goodness of Fit

**Chi_Square**

| | Observed N | Expected N | Residual |
|---|---|---|---|
| Performed below 62% | 236 | 193.0 | 43.0 |
| Performed above 62% | 150 | 193.0 | -43.0 |
| Total | 386 | | |

**Test Statistics**

| | Chi_Square |
|---|---|
| Chi-Square[a] | 19.161 |
| df | 1 |
| Asymp. Sig. | .000 |

a. 0 cells (.0%) have expected frequencies less than 5. The minimum expected cell frequency is 193.0.

**Descriptive Statistics**

| | | C.Grade | | | | |
|---|---|---|---|---|---|---|
| | | . | Ninth Grade | Tenth | Eleventh | Twelfth |
| | | Chi_Square | Chi_Square | Chi_Square | Chi_Square | Chi_Square |
| N | | 2 | 224 | 10 | 3 | 147 |
| Mean | | 1.0000 | 1.7232 | 1.2000 | 2.3333 | 1.8980 |
| Std. Deviation | | .00000 | .96308 | .63246 | 1.15470 | .99818 |
| Minimum | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Maximum | | 1.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Percentiles | 25th | .7500 | 1.0000 | 1.0000 | 1.0000 | 1.0000 |
| | 50th (Median) | 1.0000 | 1.0000 | 1.0000 | 3.0000 | 1.0000 |
| | 75th | .7500 | 3.0000 | 1.0000 | 3.0000 | 3.0000 |

**Chi_Square**

| C.Grade | | Observed N | Expected N | Residual |
|---|---|---|---|---|
| . | Performed below 62% | 2 | 2.0 | .0 |
| | Total | 2[a] | | |
| | Performed above 62% | | | |
| Ninth Grade | Performed below 62% | 143 | 112.0 | 31.0 |
| | Total | 224 | | |
| | Performed above 62% | 81 | 112.0 | -31.0 |
| Tenth | Performed below 62% | 9 | 5.0 | 4.0 |
| | Total | 10 | | |
| | Performed above 62% | 1 | 5.0 | -4.0 |
| Eleventh | Performed below 62% | 1 | 1.5 | -.5 |
| | Total | 3 | | |
| | Performed above 62% | 2 | 1.5 | .5 |
| Twelfth | Performed below 62% | 81 | 73.5 | 7.5 |
| | Total | 147 | | |
| | Performed above 62% | 66 | 73.5 | -7.5 |

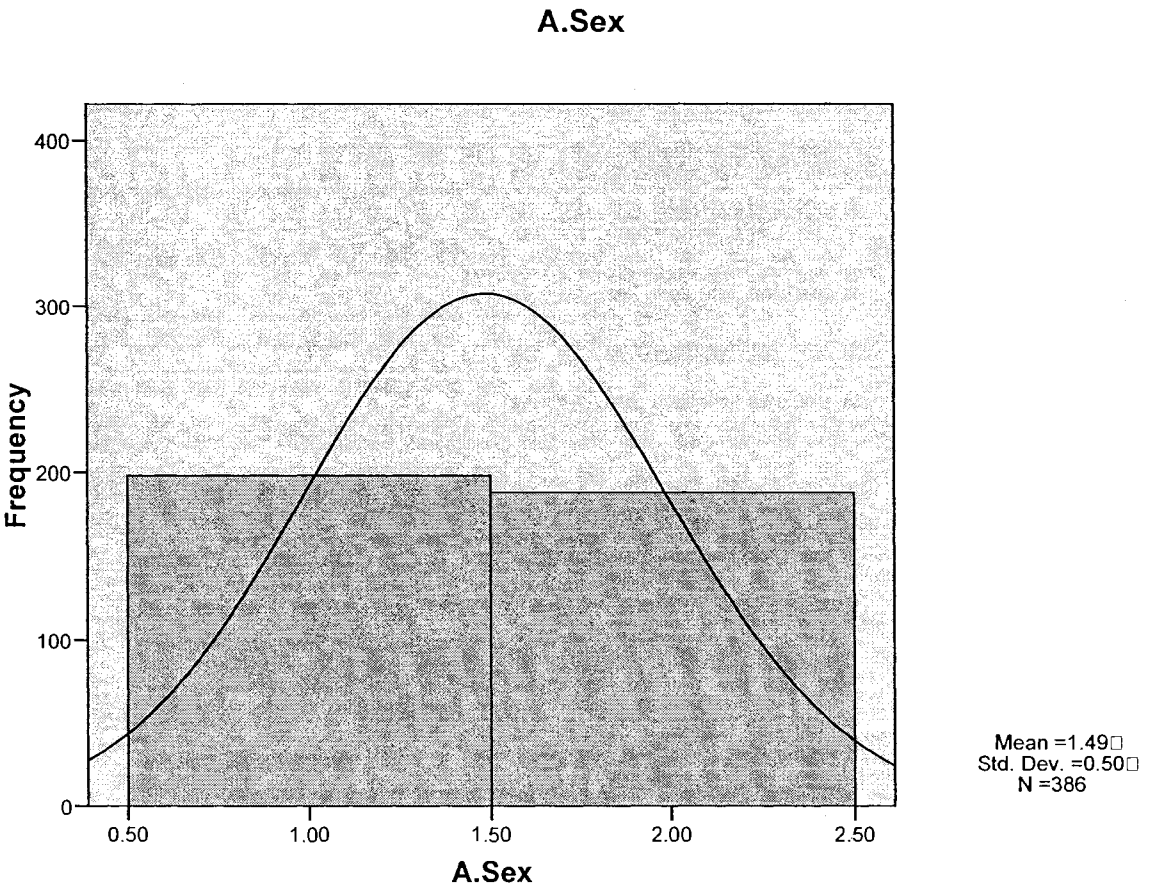
a. This variable is constant. Chi-Square Test cannot be performed.

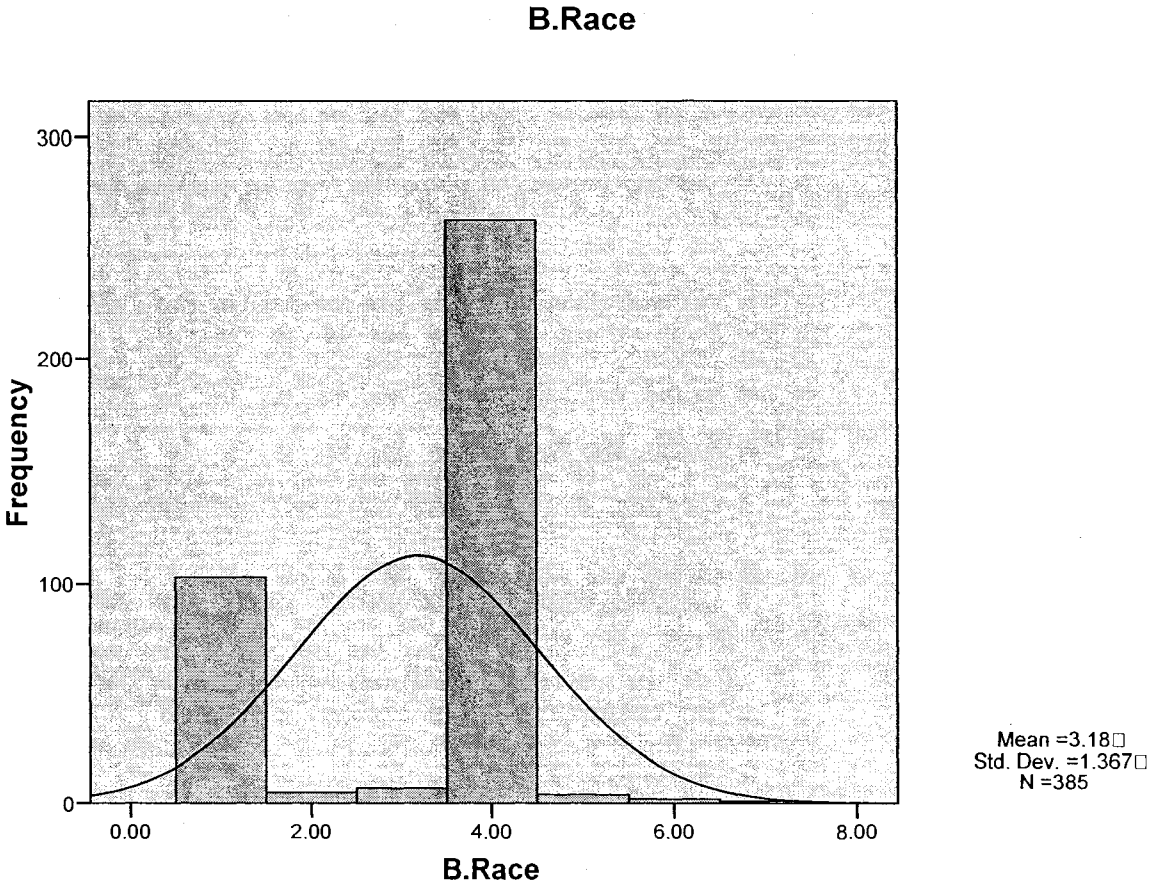
**Test Statistics**

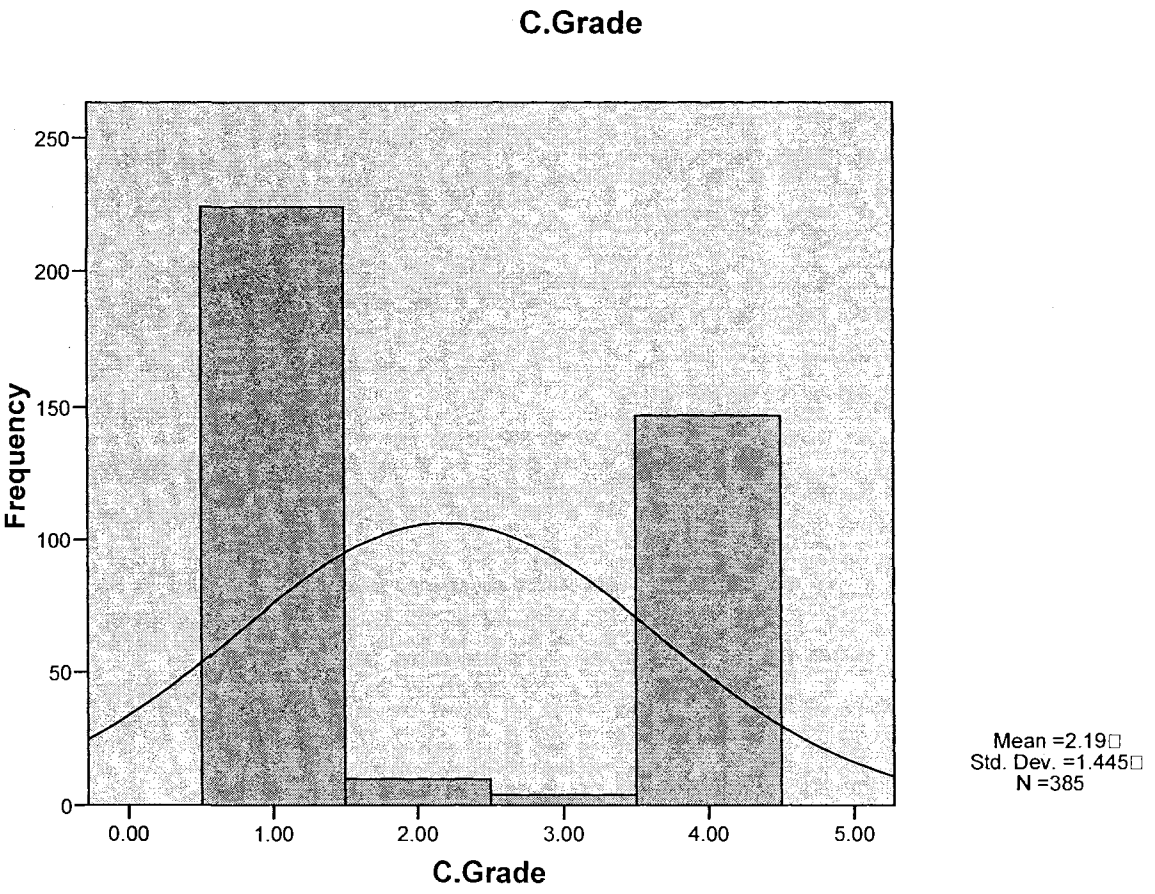
| C.Grade | | Chi_Square |
|---|---|---|
| . | Chi-Square | |
| | df | |
| | Asymp. Sig. | |
| Ninth Grade | Chi-Square | 17.161 |
| | df | 1 |
| | Asymp. Sig. | .000 |
| Tenth | Chi-Square | 6.400 |
| | df | 1 |
| | Asymp. Sig. | .011 |
| Eleventh | Chi-Square | .333 |
| | df | 1 |
| | Asymp. Sig. | .564 |
| Twelfth | Chi-Square | 1.531 |
| | df | 1 |
| | Asymp. Sig. | .216 |

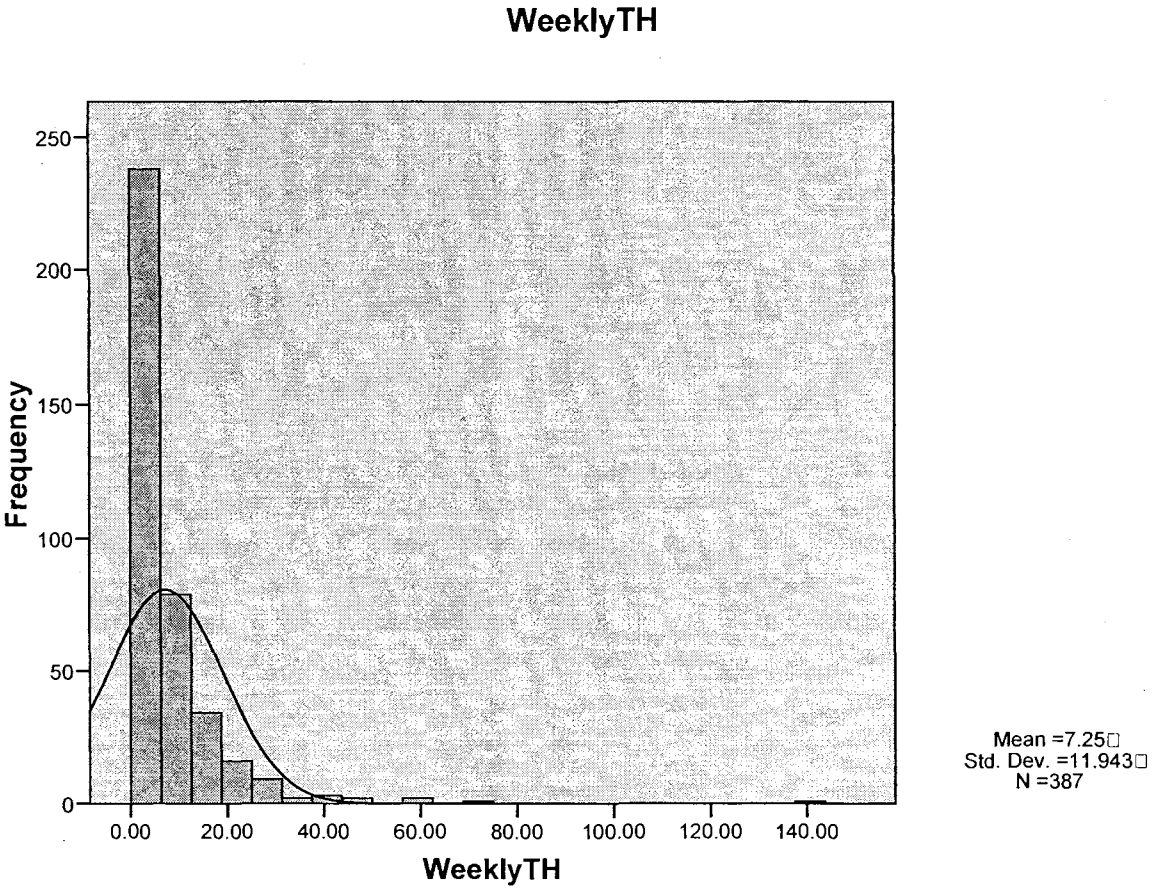
# APPENDIX O

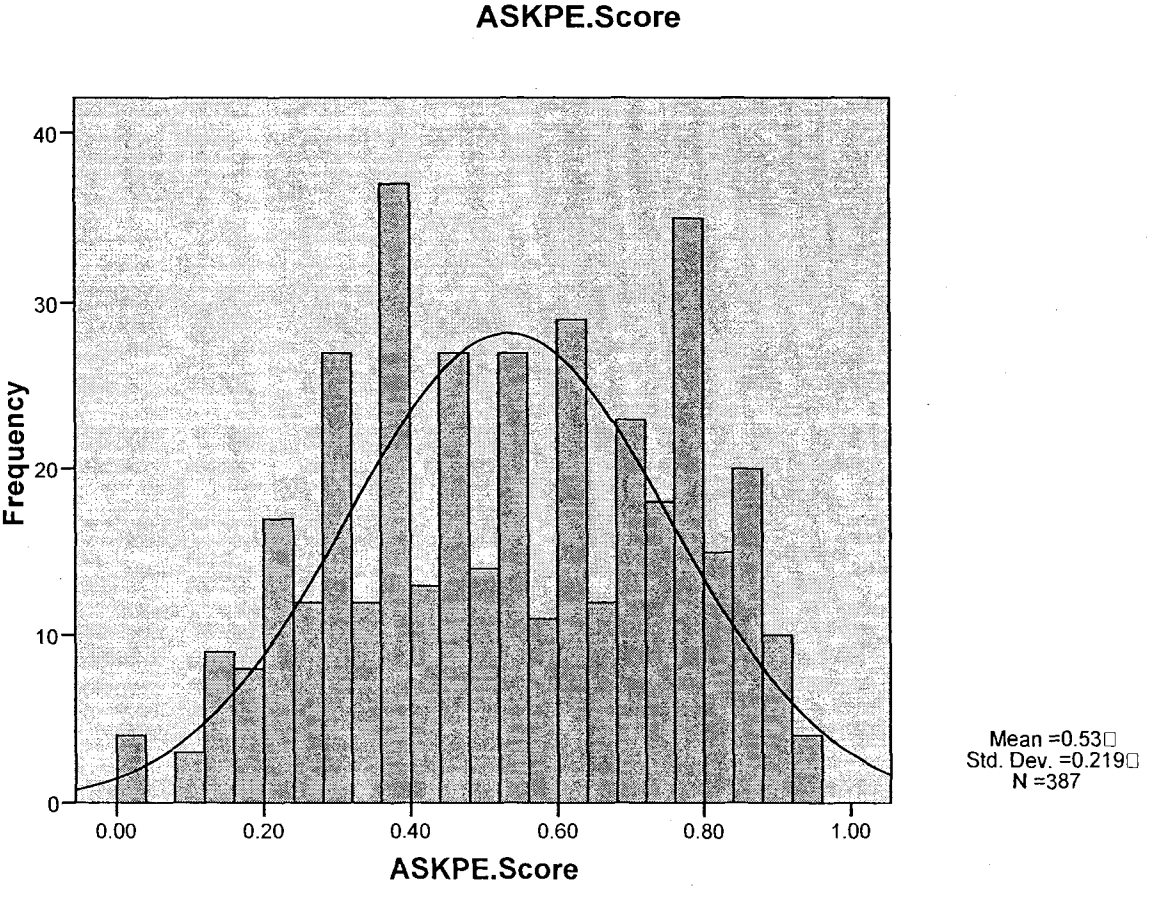
## DATA HISTOGRAMS




B.Race
300
200
100
0
Frequency
0.00
2.00
4.00
6.00
8.00
B.Race
Mean =3.18
Std. Dev. =1.367
N =385


C.Grade
Frequency
250
200
150
100
50
0
0.00
1.00
2.00
3.00
4.00
5.00
C.Grade
Mean =2.19
Std. Dev. =1.445
N =385


WeeklyTH
Frequency
250
200
150
100
50
0
0.00
20.00
40.00
60.00
80.00
100.00
120.00
140.00
WeeklyTH
Mean =7.25
Std. Dev. =11.943
N =387


ASKPE.Score
Frequency
40
30
20
10
0
0.00
0.20
0.40
0.60
0.80
1.00
ASKPE.Score
Mean =0.53
Std. Dev. =0.219
N =387

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