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## **African-American College Student Attitudes Toward Physics and Their Effect on Achievement**

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The University of Southern Mississippi

AFRICAN-AMERICAN COLLEGE STUDENT ATTITUDES TOWARD PHYSICS  
AND THEIR EFFECT ON ACHIEVEMENT

by

Carl Timothy Drake

Abstract of 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

May 2009

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## ABSTRACT

### AFRICAN-AMERICAN COLLEGE STUDENTS ATTITUDES TOWARD PHYSICS AND THEIR EFFECT ON ACHIEVEMENT

by Carl Timothy Drake

May 2009

The purpose of this study was to investigate factors affecting the attitudes that African-American college students have towards introductory college physics. The population targeted for this study consisted of African-American males and females enrolled in introductory college physics classes at an urban public historical black college or university (HBCU) located in the southeastern United States. Nine of the Fennema-Sherman Mathematics Attitude Scales, modified for physics, were used to analyze the attitudes of the 135 participants enrolled in an introductory college physics class. The nine scales used to measure the students' attitudes were Attitude Toward Success in Physics Scale (AS), The Physics as a Male Domain Scale (MD), The Mother Scale (M), The Father Scale (F), The Teacher Scale (T), The Confidence in Learning Physics Scale (C), The Physics Anxiety Scale (A), The Effectance Motivation Scale in Physics (E), and The Physics Usefulness Scale (U). Hypothesis I states that there is a significant difference in the domain scores of African-American college students in the Fennema-Sherman Math Attitudes Scales adapted for physics. It was found using a repeated measures ANOVA that there was a significant difference between the attitudes of African-Americans on the nine attitude scales of the Fennema-Sherman Math Attitude Scales,  $F(8,992) = 43.09, p < .001$ . Hypothesis II states that there is a statistically significant difference in domain scores between African-American males and African-American

females in the Fennema-Sherman Attitude Scales. It was found using a MANOVA that there was not a significant difference between the domain scores of African-American males and African-American females,  $F(8, 116) = .38, p > .05$ . Hypothesis III states that there is a statistically significant relationship between attitude towards physics and achievement for African-American students. The students with good attitudes toward physics would have a higher level of achievement. The multiple linear regression analysis revealed that there was a significant relationship between a good attitude toward physics and achievement in the class. The result of the analysis implied that 18.9% of the grade could be explained by the domain scales.

## ACKNOWLEDGEMENTS

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## CHAPTER I

### INTRODUCTION

Introductory physics is a required course for many science and engineering majors. There are two levels of introductory physics courses at the research institution, the algebra-based Basic Physics (201 and 202) and the calculus-based General Physics (211 and 212). Basic physics requires algebra as a prerequisite and is required for pre-health majors and some liberal arts majors. General physics requires calculus as a prerequisite and is required for “hard” science majors such as engineering, chemistry, mathematics, and of course, physics. Both levels of introductory physics require a laboratory to accompany the lecture sequence. Both levels of introductory physics also use the same syllabi (see appendix A and appendix B), common tests, and a common final exam. Students traditionally have difficulty with physics courses (Byun, Ha & Lee, 2008; Raw, 1999). As a result, many students change their major after failing physics several times (Tuminaro & Redish, 2004). The United States performs an injustice to our American youths by failing to create programs that capture the interest of young people who could one day become mathematicians, scientists, engineers, and technologists (Children's Defense Fund, 2008; Mallory, 2004; Welzel, 1999). This crisis is a reflection of a more global crisis faced by society as a whole. American schools are not succeeding in preparing youth for academic success. This holds true on all levels of academia from elementary through college. Thus, the critical shortages of school teachers, college professors, and health careers specialists, to cite three examples, are just as severe and adverse as those of scientists, mathematicians, and technologists (Children's Defense Fund, 2008; Darling-Hammond, 1998; "Tapping America's potential: The education for

innovation initiative," 2005). The general goal of science educators is to enable more African-American students to progress smoothly through successive courses in mathematics, science, and technology. Too few are succeeding despite their interest in those subjects (Bailey, 1990). Our society is becoming increasingly complex. Integrating all members of the population is an elusive goal as long as there are low levels of achievement and high dropout rates among minority youths. It is imperative to investigate why African-American children and youths are failing to achieve in school (Guess, 2007; Stevenson, Chen, & Uttal, 1990). A large amount of research has been conducted over the last thirty years concerning the importance of various attitudes toward science and the relationship that exists between these attitudes and achievement in science (Moore & Foy, 1998; Papanastasiou & Zembylas, 2002). Attitude is a key concept in psychology. An attitude can be defined as a predisposition to respond in a positive or negative manner to a particular object or class of objects. Attitudes have been studied with several independent approaches: description, measurement, polls, theories, and experiments (Oskamp & Schultz, 2004).

There is considerable interest in the science achievement of American high school and college students and in predictors of achievement. Student achievement in introductory college level science courses is important. It is important because satisfactory grades are required to enroll in more advanced courses in the basic sciences, engineering, and health sciences. Little is known about the factors that predict college science achievement (Gustafsson & Balke, 1993; House, 1996; Lawson, 1983).

### Statement of the Problem

According to a study conducted by the Trends in International Mathematics and Science Study (TIMSS, formerly known as the Third International Mathematics and Science Study), at the fourth grade, more females than males reported that it was important to do well in mathematics and science. These attitudes shifted dramatically, however, as students became older. By the eighth grade, there were few differences between the genders regarding the importance of doing well in mathematics and science and by the final year of secondary school – significantly more males than females in most countries, agreed that it was important to do well in mathematics and science (Mullis et al., 2000; Neisser et al., 1996). Until about the ninth grade, the mathematics and science achievement for girls and boys is almost identical (Seymour & Hewitt, 1997). It has been found in some studies that students demonstrated many discrepancies in men's and women's perceptions of their own performance. The women became discouraged due to their own perceptions. It was also found that women began their education with better predictors of success when compared to men. Nevertheless, the drop out rate in women was still higher than men.

The expectations that students have concerning their introductory physics course plays a critical role in what they learn during the course. It affects what information they pay attention to and what information they tend to ignore during a typical course. It also affects the activities that students select in order to build their own knowledge base and in building their own understanding of the course material (Neisser et al., 1996; Redish, Saul, & Steinberg, 1998). Preliminary evidence suggests that student attitudes are significantly related to science achievement. J. Daniel House (1996) found that

achievement expectancies and specific aspects of academic self-concept are significant predictors of subsequent science achievement.

Student achievement in introductory college physics courses is important because satisfactory grades are required to enroll in more advanced courses in the basic sciences, engineering, and health sciences. In order to create more successful scientists and engineers, a diligent effort to aid students in progressing smoothly through successive courses in mathematics, science, and technology must be given. Too few are succeeding despite their interest in those subjects (Bailey, 1990; Lee, 2002; Levine & Eubanks, 1990). Therefore understanding the connection between attitude and science achievement is crucial.

### Purpose

This research analyzed the attitudes towards physics of African-American students enrolled in introductory college physics courses at a Historical Black College or University (HBCU) located in the southeastern United States. The goal was to gain insight by using attitudes as effective predictors of achievement in introductory physics courses. This knowledge would be of benefit to faculty, staff, and administrators as they guide and encourage students in the pursuit of highly technical careers.

### Theoretical Framework

This dissertation explores student attitudes and beliefs about introductory physics and how their attitudes and beliefs affect their achievement in introductory physics. Student attitudes towards science have been researched for decades, particularly in science education. Science educators often work to improve the instructional methods of science through inquiry based learning and to involve students in the learning experience

through class participation. In addition, science educators work to increase the number of science majors who actually go on to graduate. A student's attitude is a definite factor in learning science. Positive attitudes towards science can inspire students to pursue degrees in science and science related careers (Carey & Shevelson, 1988; Norwich & Duncan, 1990). Moreover, students bring a system of beliefs, intuitions, ideas, and perceptions about the physical world around them as a result of their personal experience (Halloun & Hestenes, 1985). Student attitude toward science may be fashioned by such factors as teaching, school environment, parental influence, and level of ambition (Morrell & Lederman, 1998; Papanastasiou & Papanastasiou, 2004). Research in this area currently and overwhelmingly employs quantitative methods (Gardner 1975; Osborne et al. 2003; Schibecchi, 1984; Simon, 2000). White et al. (1995) reported that students in first year university physics courses found general enjoyment of physics concepts.

It has been difficult for minorities to enter science and science related fields (Hines, 1996). In previous work in the USA and Australia, attitudes towards science classes has been found to be the best predictors of students' desires to enroll in science classes (Crawley & Black, 1992; Crawley & Coe, 1990; Gardner, 1975; Koballa, 1988; Stead, 1985). It can be seen that attitudes towards science lessons and intentions towards studying science are strongly related (the higher the attitudes towards science lessons the more pupils want to study science) (Reid & Skryabina, 2003).

### Hypotheses

The following hypotheses were investigated in this research:

1. There would be significant differences in the domain scores of African-American college students in the Fennema-Sherman Math Attitudes Scales adapted for physics.
2. There would be a statistically significant difference in domain scores between African-American males and females in the Fennema-Sherman Attitude Scales.
3. There would be a statistically significant relationship between attitude towards physics and achievement for African-American students. The students with good attitudes toward physics will have a higher level of achievement.

#### Assumptions

1. The Fennema-Sherman Attitudes Scale would be appropriate for use in surveying introductory college physics students.
2. The Fennema-Sherman Attitudes Scale would be appropriate for African-American college students.
3. Students would answer the survey questions honestly.

#### Delimitations

1. This study was limited to students enrolled in Introductory Physics, both algebra-based and calculus-based, at an HBCU located in the southeastern United States in the fall 2008 semester.
2. The number of participants depended on the number of students attending class on the day that the survey was conducted.
3. The majority of the students was non-physics majors.
4. The validity of the findings was dependent upon the accuracy of the data provided by the volunteer participants of the survey.



## Definition of Terms

*Achievement* – The final grade earned by the student enrolled in an introductory physics class.

*Attitudinal Survey* – The survey that was used in this study is the Fennema-Sherman Mathematics Attitude Scales that has been modified to measure physics attitudes and additional questions were developed for the purpose of this study.

*Attitude* – A psychological tendency that is expressed by evaluating some particular entity with some degree of favor or disfavor (Albarracin, Johnson, Zanna & Kumkale, 2005, p. 4) In this case, the subject of physics. A modified version of the Fennema-Sherman Mathematics Attitude Scales will be used to measure student's attitudes. Table 1 describes the domains as established by Fennema and Sherman (1976).

Table 1

### *Fennema and Sherman Domain Descriptions*

Domain	Description
Attitude toward success in physics scale (S)	Measures the degree to which students anticipate positive or negative consequences as a result of success in physics.
The physics as a male domain scale (MD)	Measures the degree to which students see physics as a male, neutral, or female domain.
The mother scale (M)	Measures the students' perception of their mother's interest, encouragement, and confidence in the student's ability.
The father scale (F)	Measures the students' perception of their father's interest, encouragement, and confidence in the student's ability.

Table 1 (continued)

Domain	Description
The teacher scale (T)	Measures the students' perception of their teacher's attitudes towards them as learners of physics. It includes the teacher's interest, encouragement, and confidence in the student's ability.
The confidence in learning physics scale (C)	Measures the confidence in one's ability to learn and perform well on physics tasks.
The Physics Anxiety Scale (A)	Measures feelings of anxiety, dread, nervousness, and associated body symptoms to doing physics.

*Introductory Physics* – This is often the first course in physics for students. This course introduces students to the basic laws of physics. This course may be algebra based or calculus based.

*Gender equity* – Koch & Irby (2002) defines gender equity as when viewed in terms of treatment of students, gender differences in roles for which schools prepare students and gender disparities in educational outcomes.

*Physics course anxiety* – A set of beliefs and behaviors that prevent a student from performing properly in physics and thus not allowing the student to achieve at the proper ability level.

*Student Expectations* – The set of attitudes, beliefs, and assumptions about what sorts of things that they will learn, skills required, and what they will be expected to do

brought to the physics class by each student. These expectations are based on each student's experiences (Redish, Saul, & Steinberg, 1998).

*Trends in International Mathematics and Science Study (TIMSS)* – A study that provides reliable and timely data on the mathematics and science achievement of U.S. 4th- and 8th-grade students compared to that of students in other countries. TIMSS data have been collected in 1995, 1999, 2003, and 2007. TIMSS 2007 results were released on December 9, 2008 (Gonzales et al., 2008). This study was formerly known as the Third International Mathematics and Science Study.

### Justification of Study

Knowing how students learn involves several parts:

1. exploring theories of cognition and motivation,
2. knowing the backgrounds of the students that you are teaching,
3. and being aware of differences in learning styles and stages of development among one's students.

When instructors teach, they teach to the whole individual not just specific parts of the individual. Moreover, instructors must be cognizant of student differences and the role of prior knowledge. Therefore, understanding the various attitudes empowers the educator in developing and implementing instruction that is meaningful to students. In addition, students who make up the physics classrooms have unique ways of learning. Teachers for a long time have recognized this and have devised ways to accommodate students with different learning styles. A benefit of focusing on knowledge about how people learn is that it helps us think in more principled ways about critical issues such as the selection of instructional strategies.

Many published reports confirm that minorities are not entering fields that require advanced science and mathematics degrees (American Association of University Women, 1998; Lewis, 2003; National Science Foundation, 2004; Task Force on Women, Minorities and the Handicapped in Science and Technology, 1989). In addition to the underrepresentation of African-Americans in science and mathematics there is the underachievement of African-Americans in the science and mathematics classes (Brand, Glasson, & Green, 2006). Stanic & Hart (1995) found it crucial that the attitudes and beliefs of minorities are studied in order to gain a better understanding of how attitudes and behaviors affect academic achievement.

It is well established that women are underrepresented in science careers and in receiving science degrees. Results from TIMSS show a significant gender gap in physics achievement for high school seniors who have taken advanced science (Mullis et al., 2000). Males tend to outperform females on Science Advance Placement Exams (AAUW, 1998) and on standardized tests in physics and mathematics (Sadker & Sadker, 1994).

There is still a great deal of progress that needs to be made to increase the number of females and other minorities in physics. African-Americans make up 4 % of bachelor degrees in physics while Asian-Americans make up 4%, Hispanic-Americans make up 4%, Whites make up 86% and 2% is made up of other races. African-Americans make up 3% of master degrees in physics, Whites make up 89%, Asian-Americans make up 3%, Hispanic-American make up 3% and 2% is made up of other. African-Americans make up 2% of doctorate degrees in physics, Whites make up 86%, Asian-Americans make up 6%, Hispanic-Americans make up 3% and 3% is made up of other races (Oliver, 2005).

## CHAPTER II

### REVIEW OF RELATED LITERATURE

#### Introduction

An achievement gap exists between African-American students and their white counterparts. The achievement gap refers to the disparity in academic performance between many African-American and Hispanic students, at the lower end of the performance scale, and their non-Hispanic white peers at the higher end. The statistics in the area of physics illustrates the achievement gap. African-Americans make up 4 % of bachelor degrees in physics, Hispanic-Americans make up 4%, Whites make up 86% . African-Americans make up 3% of master degrees in physics, Whites make up 89%, and Hispanic-American make up 3%. African-Americans make up 2% of doctorate degrees in physics, Whites make up 86%, and Hispanic-Americans make up 3% (Oliver, 2005). There is a similar academic disparity between students from low-income and well-off families. The achievement gap manifests in grades, standardized-test scores, course selection, dropout rates, and college-completion rates and has become the heart of education reform efforts (Editorial Projects in Education, 2004). Despite many efforts, programs and research initiatives, the achievement gap between African-American students and white students still exists and is a vital concern to our society (Jencks & Phillips, 1998; Lee, 2002, 2006; Walker & McCoy, 1997). A majority of the studies conducted on the achievement gap point to how school and family variables affect the achievement level of African-American students (Ford, Grantham, & Whiting, 2008).

The inspection of the attitudes that students exhibit toward science is very important since attitudes can influence student's educational achievement. This influence can

reinforce higher or lower academic performance (Papanastasiou & Papanastasiou, 2004; Papanastasiou & Zembylas, 2002). Positive attitudes tend to encourage a student to perform better. The converse is true in that students that perform well in science tend to have more positive attitudes toward science (Beaton et al., 1996; Ma & Kishor, 1997). Researchers in science education have found that student classroom experience is shaped by a variety of student attitudes and beliefs (Bransford, Brown & Cocking, 2002; Hammer, 2000; Redish, 2003; Seymour & Hewitt, 1997). Research also indicates that students' expectations are good predictors of college science performance. When compared to other predictors such as the amount of high school science or math completed, it was found that students' expectations were better predictors of achievement (House, 1996; Tai & Sadler, 2001).

#### Attitudes toward Success in Physics

In earlier research, the students' attitude towards science class has been shown to be the best predictor of students' intentions to register for science classes (Crawley & Black, 1992; Crawley & Coe, 1990; Gardner, 1975; Koballa, 1988; Stead, 1985). A significant factor in learning science is the attitude of the students. When students develop positive attitudes toward science, they often develop increased interest in science and science related fields as careers (Carey & Shevelson, 1988; Norwich & Duncan, 1990). Positive attitudes inspire students to continue to learn outside of class. Attitudes developed by students are often communicated to friends and peers (Mager, 1968). Hoffman & Haussler (1998) have shown that interest in science is very important for learning science.

### Physics as a Male Domain

Ormerod (1975) showed that students perceive the physical sciences as male domains. Girls generally don't choose to take physical science classes or to pursue science related professions. Science is a male dominated profession (National Science Foundation, 2008). A longitudinal study of students' attitudes toward and achievement in science demonstrated that boys have more positive attitudes toward science (Simpson & Oliver, 1990). Other studies have shown that the link between boosting the performance of girls in physics is related to three main areas. These areas include designing lessons on the experiences and interests of girls, teachers from other subject areas monitoring their own behavior toward girls and toward teachers who teach physics, and methods of coeducational teaching (Hoffman, 2002).

### Mother, Father, and Teacher's Physics Attitude

Parents contribute to their daughters' negative attitudes toward science since they view science as not suited to girls. Warner and Curry (1997) stated that "If a parent shows no interest in the child's school or in what the child is learning, the message given to that child is that education is not important". Parents also help their children develop positive attitudes toward school. As observed, "When parents are involved, students exhibit more positive attitudes and behaviors" (National PTA Standards, 1997, p. 7). Fantuzzo, Davis, and Ginsburg (1995) demonstrated in their study that students who experienced parental involvement developed higher self-concept ratings than other students in the control groups. Eight graders that participated in the TIMSS, reported that their mother's views of the importance of doing well in science were closely related to their own views (Beaton et al., 1996). The quality of instruction is directly proportional to

the quality of science education. The attitude of the teacher strongly affects student attitudes toward science (Freedman, 1997). Darling-Hammond and Hudson (1998) demonstrated that teacher quality influences the quality of instruction which in-turn affects the outcomes of students in various classes.

### Physics Anxiety and Motivation

Other variables that affect attitudes toward science are achievement motivation, science self-concept, science anxiety and science activities (Haladyna et al., 1982; Talton & Simpson, 1986). Recent studies indicate that when students develop a joy of learning, achievement levels increase. Other factors such as self concept, prior knowledge, interest, anxiety and boredom were also investigated and showed to have an impact on achievement (Laukenmann, 2003). Studies have also shown that males after completing a college level physics course have less anxiety when compared to females. College level students in this study attended the same physics course and received the same instruction (Udo, Ramsey, Reynolds-Alpert, & Mallow, 2001).

### Usefulness of Physics

The National Assessment of Educational Progress (1978) reported that 9 year olds, 13 year olds, and 17 year old students had positive attitudes about the usefulness of science. Yager, Simmons, and Penick (1989) found that the 9 year old students in the study reported positive attitudes about the usefulness of science for daily living, further science study, and for future living. Students don't develop a deep understanding of how physics has transformed the world around them and most develop a more negative attitude toward physics after a course in introductory physics (Demirci, 2004). Discussing real world applications and challenging students to think about physics and how it is used



outside of class helps students develop and maintain a positive attitude toward physics. Moreover, the discussions make the subjects studied in the classroom come alive and seem more relevant to the students in the introductory physics course (Duda & Garrett, 2008). In a study by Watson & McEwen, (1994) students rated five subjects above average for their social benefit with biology being the most socially beneficial: mathematics < English < physics < chemistry < biology. This study also suggested that students do not choose careers in science as a vehicle for the acquisition of social power. Moreover, students do not understand how learning physics will be of benefit to them in their personal goals in life.

## CHAPTER III

### RESEARCH METHODOLOGY

#### Introduction

This chapter includes a description of the setting, the methodology, the instrumentation used to collect student data and the methods of analysis. The purpose for the study explored the physics attitude of African-American college students enrolled in an introductory physics course at a HBCU. This research investigated the following hypotheses:

1. There would be significant differences in the domain scores of African-American college students in the Fennema-Sherman Math Attitudes Scales adapted for physics.
2. There would be a statistically significant difference in domain scores between African-American males and females in the Fennema-Sherman Attitude Scales.
3. There would be a statistically significant relationship between attitude towards physics and achievement for African-American students. The students with good attitudes toward physics will have a higher level of achievement.

#### Setting

The study was conducted at a public historical black college or university (HBCU) located in the southeastern United States. The focus was on African-American college students enrolled in introductory physics courses. There are two levels of introductory physics courses at the research institution, the algebra-based Basic Physics (201 and 202) and the calculus-based General Physics (211 and 212). Basic physics requires algebra as a prerequisite and is required for pre-health majors and some liberal arts majors. General

physics requires calculus as a prerequisite and is required for “hard” science majors such as engineering, chemistry, mathematics, and of course, physics. Both levels of introductory physics require a laboratory to accompany the lecture sequence. All sections are administered common examinations and share a common syllabus. A research proposal was submitted for approval to the Institutional Review Board at both the research HBCU and The University of Southern Mississippi before the start of the research. Upon receipt of approval letters from the research HBCU (Appendix C) and The University of Southern Mississippi (Appendix D) during the Fall of 2008, the study was initiated.

### Population

The participants were African-American college students enrolled in an introductory college physics class. The classes were taught by 4 different instructors. The maximum number of students in the algebra based classes is 30. The maximum number of students in the calculus based classes is 24 per class. The approximate number of students enrolled in any given semester is 270. Students from seven sections of introductory physics classes were given the opportunity to participate in this research. A total of 135 participants were used in this study.

### Design

The goal was to determine the attitudes of African-American males and females towards physics. This study was also used to determine if there was a correlation between student attitudes and achievement. The survey, Fennema-Sherman Mathematics Attitude Scales, was administered by the researcher during a single class meeting. The students had a maximum of 50 minutes in order to complete the survey. Instructions on

how to complete the survey were given by the investigator before the survey was administered. Students were told to mark their answer sheets by telling how they felt about the sentences on the survey. Also, they were informed that they should not spend too much time with any statement, but to be sure every statement is answered. Moreover, work fast but carefully. Students were also instructed that there was no "right" or "wrong" answers. The only correct responses were those that were true for them. Students were further instructed that whenever possible, to base their answers on their own personal experiences. Next, students were informed that all information would be confidential and that midterm and final grades would be included in the analysis. Each survey would also ask for classification, race, and gender. There would not be any direct benefits for the participants. There was no physical, psychological, or social damage to students. All surveys would be kept in a locked cabinet in my office. I and my advisor would be the only ones to have direct access to the data. All forms would be destroyed at the end of the study.

### The Instrument

The Fennema-Sherman Mathematics Attitude Scales were originally developed in 1976 as part of a grant funded by the National Science Foundation. Dr. Fennema has graciously agreed that the Fennema-Sherman Mathematics Attitude Scales may be used for this research (see Appendix E). There are currently nine domain scales that consists of twelve questions in which all questions use a 5 point Likert Scale to measure the students' attitudes. Six questions are stated positively and six questions are stated negatively (Fennema & Sherman, 1976). This instrument has been used over the last 30 years to test attitudes of students ranging from elementary school to college. The

Fennema-Sherman Mathematics Attitude Scales are broadly used to research attitudes towards mathematics in students of different ethnic backgrounds, gender, and grade levels ranging from middle school to college (Forgasz, Leder, & Kloosterman, 2004; Tapia & Marsh, 2004). Fennema-Sherman Mathematics Attitude Scales are used extensively and modified by many researchers to suit the purpose or context of their studies. The modifications are typically slight variations in the wording of items or the number of items that are used (Brandell & Staberg, 2008; Forgasz, Leder, & Kloosterman, 2004). The attitude scales were adapted and modified for use with Physics. For the sake of this study, the Fennema-Sherman was modified to exclude the term “mathematics” and was replaced with the term “physics”. The questions and format otherwise remained the same. This study was the first to use the Fennema-Sherman Mathematical Attitudes Scale to measure the attitudes of African-American college physics students. The scales are described as follows:

1. The Attitude toward Success in Physics Scale (AS) measures the degree to which students anticipate positive or negative consequences as a result of success in physics.
2. The Physics as a Male Domain Scale (MD) measures the degree to which students see physics as a male, neutral, or female domain. This is measured in the following ways: (a) the comparative ability of the sexes to perform in physics; (b) the masculinity/femininity of those who achieve well in physics; and (c) the suitability of this line of study for the two sexes.
3. The mother scale (M) measures the students’ perception of their mother’s interest, encouragement, and confidence in the student’s ability. It also includes

the student's perception of their mother's example as a person interested in, secure in, and sensitive of the importance of physics.

4. The father scale (F) measures the students' perception of their father's interest, encouragement, and confidence in the student's ability. It also includes the student's perception of their father's example as a person interested in, secure in and sensitive of the importance of physics.
5. The Teacher Scale (T) measures student's perceptions of their teacher's attitudes toward them as learners of physics. This scale includes the teacher's interest, encouragement, and confidence in the student's ability to learn.
6. The Confidence in Learning Physics Scale (C) measures the confidence in a person's ability to learn and to perform well on mathematical tasks. This scale does not measure anxiety or mental confusion, interest, enjoyment, or zest in problem solving.
7. The Physics Anxiety Scale (A) measures feelings of anxiety, dread, nervousness, and associated bodily symptoms related to doing physics. This scale does not measure confidence in, or enjoyment of physics.
8. The Effectance Motivation Scale in Physics (E) measures effectance as applied to physics. The questions investigate topics from the lack of involvement in physics to the seeking of a challenge.
9. The Physics Usefulness Scale (U) measures the student's belief about the current and future use of physics (Fennema & Sherman, 1976).

Fennema-Sherman (1976) calculated split-half reliabilities values, thus demonstrating the reliability of the nine scales (Table 1).

Table 2

<i>Fennema-Sherman Split-Half Reliabilities and Cronbach's Alpha</i>			
Fennema-Sherman Scale	FSMAS Split-Half Reliabilities	FSMAS Cronbach's Alpha	Current Cronbach's Alpha
The Confidence in Learning Mathematics Scale	.93	.91	.92
Attitude Toward Success in Mathematics Scale	.87	.84	.68
The Mother Scale	.86	.84	.84
The Father Scale	.91	.91	.90
The Teacher Scale	.88	.83	.75
The Mathematics as a Male Domain Scale	.89	.90	.62
The Mathematics Usefulness Scale	.88	.88	.93
The Mathematics Anxiety Scale	.89	.90	.93
The Effectance Motivation Scale in Mathematics	.87	.88	.93
TOTAL		.96	

### Method of Analysis

Means were calculated from the demographic information and the Fennema-Sherman Mathematics Attitude Scales, modified for Physics, using SPSS. The hypotheses was tested at a 0.05 alpha level of significance. For the first hypotheses, there would be significant differences in the domain scores of African-American college students in the Fennema-Sherman Math Attitudes Scales adapted for physics, a repeated measure ANOVA was used for this analysis. For the second hypotheses, there would be a statistically significant difference in domain scores between African-American males and

females in the Fennema-Sherman Attitude Scales, a MANOVA was used to analyze this hypothesis. For the third hypotheses, there would be a statistically significant relationship between attitude towards physics and achievement for African-American students. The students with good attitudes toward physics will have a higher level of achievement. A multiple linear regression analysis was used to test this hypothesis.



## CHAPTER IV

### RESULTS OF DATA ANALYSIS

#### Introduction

The purpose of this research was to provide data that would determine the attitudes that African-American students have towards introductory college physics classes at a Historical Black College and University located in the southeastern United States. The research also investigated whether a correlation exists between attitude and achievement. All statistical procedures were performed with SPSS. The statistical significance in this study was set at the .05 level. The insight gained in this research would enable researchers and science educators to design programs that would aid students in successfully understanding the major concepts in a college physics course. Also, the students would display a higher level of achievement.

Students were asked to complete a personal data information sheet (see Appendix F). The personal information sheet asked students to indicate their gender, class, age group, high school type, high school location, high school size, the relatives that were active in their education, math classes taken in high school, science classes taken in high school, expected grade in introductory physics class, how many hours were spent studying physics, whether the student worked and their high school GPA. The Fennema-Sherman Mathematics Attitude Surveys, modified for Physics, was used to analyze the student attitudes in nine domains. Each domain consisted of twelve questions: six questions stated positively and six questions stated negatively. The survey used a 5 point Likert scale with the following possible responses: strongly agree, sort of agree, not sure, sort of disagree, and strongly disagree. Positively worded items received a score based

on the following point scale: A = 5 B = 4 C = 3 D = 2 E = 1. Negatively worded items received a score based on the following point scale: A = 1 B = 2 C = 3 D = 4 E = 5. The score was then added for each group to get a total for that attitude. A total of 141 surveys were administered to students enrolled in 8 separate college introductory physics classes at the HBCU. One hundred and thirty-five (N = 135) were able to be used in the analysis.

### Descriptive Data

Listed in Table 3 are the residency characteristics of the participants by state. Most of the participants came from Mississippi, 68.9%, 5.2 % from Illinois, 3.7% from Texas, 3.7% from Georgia and 3% from Louisiana, while the remaining 15.5% came from various other states. All of the participants in the study were African-American science majors enrolled in an introductory physics course at the same Historical Black College or University located in the southeastern United States at the same time.

Table 3

<i>States</i>		
	Count	Percent
State		
Mississippi	93	68.9
Illinois	7	5.2
Texas	5	3.7
Georgia	5	3.7
Louisiana	4	3.0
Other States	21	15.5

Table 4 displays the gender and age characteristics of the participants. Of the 135 participants, 33.3% were male and 66.7% were female. Females typically outnumbered the males particularly in the algebra-based introductory physics course. Most students that take this course are pre-health field majors. Typically, the students intend to seek admission to medical school, pharmacy school, physical therapy school and other various professional health institutions. By age, 11.1% of the participants were 18 to 19, 51.1% were 20 to 21, 23% were 22 to 23, while the remaining students' ages ranged from 24 and older. Since 51.1 % of the students that participated in the study were in the age range of 20 to 21 years of age, this suggested that a majority of the students were juniors or seniors.

Table 4

*Gender and Age Characteristics of Students*

	Count	Percent
Total Students	135	
Gender		
Male	45	33.3
Female	90	66.7
Age		
18-19	15	11.1
20-21	69	51.1
22-23	31	23.0
24-25	9	6.7
26-	9	6.7

Table 5 displays the educational characteristics of the participants. The majority of the participants, 43.7%, were classified as college juniors. The percentage of participants classified as freshmen was 1.5%, sophomores made up 12.6%, and seniors comprised 38.5%. The percentage of participants that indicated that their mother was involved in their education was 84.4%. In contrast, 59.3% of the students indicated that their father was involved in their education while 27.4% indicated that their grandmother was involved in their education and 14.8% indicated involvement by their grandfather.

Table 5

*Educational Characteristics of Students*

	Count	Percent
<b>Classification</b>		
Freshman	2	1.5
Sophomore	17	12.6
Junior	59	43.7
Senior	52	38.5
<b>Involvement in Education</b>		
Mother	114	84.4
Father	80	59.3
Grandmother	37	27.4
Grandfather	20	14.8

Table 6 indicates study habits and employment. The majority of the participants, 50.4%, indicated they studied between 1 and 2 hours per week for their physics class,

while 17% indicated studying less than 1 hour per week. The second largest percentage, 31.1% studied physics more than 2 hours per week. The percentage of the students that indicated that they were currently unemployed was 17% with only 16.3% of the students indicating that they were employed full-time. The majority, 37%, indicated they were employed part-time and 17% were employed as student workers.

Table 6

*Study and Work*

	Count	Percent
<b>Hours per Week Studying Physics</b>		
Under 1 hour per week	23	17.0
1 to 2 hours per week	68	50.4
More than 2 hours per week	42	31.1
No Response	2	1.5
<b>Employment</b>		
Full-Time	22	16.3
Part-Time	50	37.0
Student Worker	37	27.0
None	23	17.0
No Response	3	2.2

Table 7 describes the high school characteristics of the participants. The majority of the participants, 91.1%, indicated that they attended a public high school. They also indicated that 46.7% of the high schools were in an urban area, while 24.4% were in the suburbs, and 25.2% were in rural schools. The percentage of participants that indicated

that the number of students in their high school was over 1000 was 33.3%, while 28.9% of the participants indicated that their school ranged from 501 to 1000 students, and 35.5% indicated that the size of their school was fewer than 500 students.

Table 7

*High School Characteristics*

	Count	Percent
<b>School Type</b>		
Public	123	91.1
Private	9	6.8
<b>Religious Based Education</b>		
Yes	6	4.4
No	126	93.3
<b>School Area</b>		
Urban	63	46.7
Suburban	33	24.4
Rural	34	25.2
<b>School Size</b>		
Under 100 Students	6	4.4
101-500 Students	42	31.1
501-1000 Students	39	28.9
Over 1000 Students	45	33.3

Table 8 describes the high school educational background of the participants. The majority of the participants indicated that they took Algebra I (92.6%), Algebra II (80.0%), and Geometry (93.3%) in high school. It was also indicated that 69.6% had trigonometry and 32.6% had calculus in high school. The majority of the participants indicated that they took Biology (97%) and Chemistry (88.1%) in high school. In addition, the results of the demographics showed that 48.1% took Physical Science and 39.3% took Physics in high school.

Table 8

*High School Science and Math Courses*

	Count	Percent
<b>High School Math Courses</b>		
Algebra I	125	92.6
Algebra II	108	80.0
Geometry	126	93.3
Trigonometry	94	69.6
Calculus	44	32.6
<b>High School Science Courses</b>		
Biology	131	97.0
Chemistry	119	88.1
Physical Science	65	48.1
Physics	53	39.3

Table 9 is a comparison of participant high school Grade Point Average (GPA). Participants reported their high school GPA as one of seven categories (3.67 to 4.00, 3.34

to 3.66, 3.00 to 3.33, 2.67 to 2.99, 2.33 to 2.66, 2.00 to 2.33, and below 2.00) on a 4.0 scale. The high school GPA of the participants was distributed as 54 participants (40%) with 3.67 to 4.00, 31 participants (23%) with 3.34 to 3.66, 30 participants (22.2%) with 3.00 to 3.33, 15 participants (11.1%) with 2.67 to 2.99, and 3 participants (2.2%) with 2.00 to 2.33. Overall 84.07% of participants (89.86% female and 75% male) reported their high school GPA as being above 3.0.

Table 9

*Comparison of Participant High School GPA*

	Gender					
	Female		Male		Total	
	Count	Percent	Count	Percent	Count	Percent
2.00 to 2.33	1	1.1	2	4.5	3	2.2
2.67 to 2.99	6	6.7	9	20.5	15	11.1
3.00 to 3.33	20	22.5	10	22.7	30	22.2
3.34 to 3.66	21	23.6	10	22.7	31	23.0
3.67 to 4.00	41	46.1	13	29.5	54	40.0
Total						
Above 3.0	62	89.86	33	75.0	95	84.07
Below 3.0	7	10.14	11	25.0	18	15.93

Table 10 lists the number of times a participant enrolled in a college introductory physics class and their expected grade from the course. The majority, 78.5%, indicated that this was their first time enrolled in a college introductory physics course with 15.6% indicating that this was their second time enrolled in introductory physics. The



participants that expected an A in the course was 59.3% and 23% expected a grade of B. Only 10.4% of the participants expected a grade of C while 2.2% of students expected a grade lower than a C.

Table 10

*Introductory Physics Enrollment, Expected Grades*

	Count	Percent
<b>Number of Times Enrolled in Introductory Physics</b>		
1	106	78.5
2	21	15.6
3	1	0.7
4 or more	1	0.7
No Response	6	4.4
<b>Expected Introductory Physics Grade</b>		
A	80	59.3
B	31	23.0
C	14	10.4
D	2	1.5
F	1	0.7
No Response	7	5.2

Table 11 shows the midterm and final grades of the participants. Overall, the midterm grades were evenly distributed with 16.3% of the participants earning an A for midterm while 31.1% earned a B. Only 16.3% of the participants earned a C while 36.3% earning a grade less than C. Final grades indicated that 67.4% of the participants received

an A in the class with another 20% earning a grade of B. Only 9.6% of the student earned a grade of C while 2.9% earned either a D or F in the class. When nonparticipants were included, 54.7% earned a grade of A, 17.2% earned a grade of B, 14.1% earned a grade of C while 14.1% earned either a D or F in the class.

Table 11

*Midterm and Final Grades*

	Count	Percent
Midterm Grade in Introductory Physics		
A	22	16.3
B	42	31.1
C	22	16.3
D	25	18.5
F	24	17.8
Final Grade in Introductory Physics		
A	91	67.4
B	27	20.0
C	13	9.6
D	1	0.7
F	3	2.2

Table 12 displays the mean scores for each of the nine measured attitude scales (Attitude Toward Success in Physics Scale (AS), The Physics as a Male Domain Scale (MD), The Physics Usefulness Scale (U), The Teacher Scale (T), The Confidence in

Learning Physics Scale (C), The Mother Scale (M), The Father Scale (F), The Physics Anxiety Scale (A), and The Effectance Motivation Scale in Physics (E)). The minimum possible score was 12 and the maximum possible score was 60. A lower score indicated a more negative attitude while a higher score indicated a more positive attitude. Attitude Toward Success in Physics Scale (M=54.14) received the highest score, followed by the Physics as a Male Domain Scale (M = 53.09), The Teacher Scale (M = 48.15), The Confidence in Learning Physics Scale (M = 47.94), The Mother Scale (M = 46.56), The Physics Anxiety Scale (M = 46.18), The Physics Usefulness Scale (M = 45.54), The Father Scale (M = 43.95), and The Effectance Motivation Scale in Physics (M = 40.54) which received the lowest score.

Table 12

*Descriptive Statistics*

	Mean	SD	Standard Error
Attitude Toward Success in Physics Scale (AS)	54.14	4.95	0.442
The Physics as a Male Domain Scale (MD)	53.09	4.37	0.391
The Teacher Scale (T)	48.15	6.45	0.577
The Confidence in Learning Physics Scale (C)	47.94	9.92	0.887
The Mother Scale (M)	46.56	8.19	0.733
The Physics Anxiety Scale (A)	46.18	10.95	0.979
The Physics Usefulness Scale (U)	45.54	11.67	1.044
The Father Scale (F)	43.95	10.06	0.900
The Effectance Motivation Scale in Physics (E)	40.54	10.12	0.905

*Note.* Minimum = 12 and Maximum = 60.

Hypothesis I: There would be significant differences in the domain scores of African-American college students in the Fennema-Sherman Math Attitudes Scales adapted for physics. It was found using a repeated measures ANOVA that there was a significant difference between the domain scores,  $F(8,992) = 43.09$ ,  $p < .001$ . Pairwise comparison revealed: Attitude Toward Success in Physics Scale ( $M=54.14$ ) > Physics as a Male Domain Scale ( $M = 53.09$ ) > The Teacher Scale ( $M = 48.15$ ) > The Confidence in Learning Physics Scale ( $M = 47.94$ ) > The Mother Scale ( $M = 46.56$ ) > The Physics Anxiety Scale ( $M = 46.18$ ) > The Physics Usefulness Scale ( $M = 45.54$ ) > The Father Scale ( $M = 43.95$ ) > The Effectance Motivation Scale in Physics ( $M=40.54$ ).

Hypothesis II: There would be a statistically significant difference in domain scores between African-American males and females in the Fennema-Sherman Attitude Scales. It was found using a MANOVA that there was not a significant difference between the domain scores of African-American males and females,  $F(8, 116) = .38$ ,  $p > .05$ . Table 13 shows the nine scales and their relationship with gender.

Table 13

*Between Subjects Effects*

	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Gender						
	(AS)	3.418	1	3.418	0.136	0.713
	(MD)	30.460	1	30.460	1.768	0.186
	(M)	2.675	1	2.675	0.039	0.843
	(F)	70.458	1	70.458	0.690	0.408

Table 13 (continued)

	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Gender						
	(T)	1.878	1	1.878	0.047	0.828
	(C)	8.484	1	8.484	0.085	0.771
	(A)	2.881	1	2.881	0.023	0.880
	(E)	2.295	1	2.295	0.021	0.884
	(U)	23.035	1	23.035	0.160	0.690

Hypothesis III: There would be a statistically significant relationship between attitude towards physics and achievement for African-American students. The students with good attitudes toward physics would have a higher level of achievement. A multiple linear regression analysis (MLR) was done using the domains, Attitude Toward Success in Physics Scale (AS), The Physics as a Male Domain Scale (MD), The Physics Usefulness Scale (U), The Teacher Scale (T), The Confidence in Learning Physics Scale (C), The Mother Scale (M), The Father Scale (F), The Physics Anxiety Scale (A), and The Effectance Motivation Scale in Physics (E). The MLR revealed that the relationship was significant,  $F(9, 115) = 2.97$ ,  $p = .003$ ,  $R^2 = .189$ . This implies that 18.9% of the grade could be explained by the domain scales. The confidence scale had a significant beta weight with  $Beta = .438$ ,  $t = 2.755$ ,  $p = .007$ . The motivation scale also had a significant beta weight with  $Beta = -.273$ ,  $t = -2.041$ ,  $p < .05$ . All of the other predictors had negative betas that were not significant.

## CHAPTER V

### DISCUSSIONS AND CONCLUSIONS

#### Introduction

This research began as a result of conversations with colleagues concerning possible methods to improve the performance of African-American students in introductory college physics courses at an HBCU. The students that enroll in introductory physics are pre-health majors and “hard” sciences majors such as chemistry majors, mathematics majors and physics majors. It is imperative that these students understand the concepts presented in the introductory physics course. The primary purpose of this study was to gain insight by using attitudes as effective predictors of achievement in introductory college physics courses. This knowledge would be of benefit to faculty, staff, and administrators as they guide and encourage students in the pursuit of highly technical careers.

This research explores student attitudes and beliefs about introductory physics and how individual attitudes and beliefs affect their achievement in introductory college physics. Research suggests that student attitudes are significantly related to science achievement. J. Daniel House (1996) found that achievement expectancies and specific aspects of academic self-concept are significant predictors of subsequent science achievement. Understanding the connection between attitude and science achievement is crucial. A student’s attitude is a definite factor in learning science. Positive attitudes towards science can inspire students to pursue degrees in science and science related careers (Carey & Shevelson, 1988; Norwich & Duncan, 1990). Moreover, students bring a system of beliefs, intuitions, ideas, and perceptions about the physical world around

them as a result of their personal experience (Halloun & Hestenes, 1985). Student attitude toward science may be fashioned by such factors as teaching, school environment, parental influence, and level of ambition (Morrell & Lederman, 1998; Papanastasiou & Papanastasiou, 2004).

### Summary and Discussion of Findings

All of the participants in the study were male and female African-American students from a single HBCU located in the southeastern United States. The participants were all enrolled in an introductory college physics course. There are two levels of introductory physics courses at the research institution, the algebra-based Basic Physics (201 and 202) and the calculus-based General Physics (211 and 212). Basic physics requires algebra as a prerequisite and is required for pre-health majors and some liberal arts majors. General physics requires calculus as a prerequisite and is required for “hard” science majors such as engineering, chemistry, mathematics, and of course, physics. Both levels of introductory physics require a laboratory to accompany the lecture sequence.

The majority of the participants indicated that they had taken Biology (97%) and Chemistry (88.1%) in high school. Students also indicated that they had taken Physical Science (48.1%) and Physics (39.3%) in high school. The majority of the participants indicated that they took Algebra I (92.6%), Algebra II (80.0%), and Geometry (93.3%) in high school. In addition, 69.6% had trigonometry and 32.6% had calculus in high school. This suggests that our students are well prepared for mathematics and science courses in college. In a study by D. Bramlett (2007) at the same institution as this study, the final grades earned in college algebra by the participants indicated that 44.6% of the

participants received either a D or F in the class. The high grades earned in their high school math courses should have resulted in a high rate of achievement in college algebra. This could be an indication of possible grade inflation in their high school mathematics courses. The midterm grades in the introductory physics courses earned by the participants in this study indicated that 16.3% of the participants earned an A for midterm while 31.1% earned a B. Only 16.3% of the participants earned a C while 36.3% earning a grade less than C. Final grades indicated that 67.4% of the participants received an A in the class with another 20% earning a grade of B. Only 9.6% of students earned a grade of C while 2.9% earned either a D or F in the class. This data suggests that after midterm, the students are performing better on tests and assignments and have therefore managed to raise their individual final grade in the physics course. This trend should be investigated in greater detail since it appears that students with D or F for midterm grades are raising several grade levels to receive an A or B. The data indicates that approximately 33.4% of the participants significantly change their final grade for the better.

The first hypothesis examined whether there would be significant differences in the domain scores of African-American college students in the Fennema-Sherman Math Attitudes Scales adapted for physics. This hypothesis was found to be correct. The Attitude Toward Success in Physics Scale had a mean of  $M = 54.14$ . This is positive attitude since a mean of  $M = 36$  would indicate a neutral attitude. This indicated that students realized that it is important to be successful in physics. The lowest mean was The Effectance Motivation Scale in Physics ( $M = 40.54$ ). This indicated a neutral attitude when it comes to enjoying working physics problems and a lack of interest in working on



a physics problem that they do not know how to immediately solve. The students indicated by their attitudes that they would like to be successful in physics but they do not want to put too much effort into working the physics problems. When one considers that according to the demographics, 84.07% of the students had a GPA above 3.0 on a 4.0 scale and that 39.3% of the students was enrolled in physics in high school, it is not surprising that they would have a positive attitude toward success in physics. Reid and Skryabina (2003) found similar results when their research explored attitudes towards physics in Scotland, looking at students aged from about 10 to 20 years old.

The second hypothesis examined whether there would be a statistically significant difference in domain scores between African-American males and females in the Fennema-Sherman Attitude Scales. A MANOVA was used to analyze this hypothesis. A significant difference between the African-American females and African-American males domain scores was not found in this study. The Attitude toward Success in Physics Scale (AS) measures the degree to which students anticipate positive or negative consequences as a result of success in physics. The Physics as a Male Domain Scale (MD) measures the degree to which students see physics as a male, neutral, or female domain. This is measured in the following ways: (a) the comparative ability of the sexes to perform in physics; (b) the masculinity/femininity of those who achieve well in physics; and (c) the suitability of this line of study for the two sexes. The mother scale (M) measures the students' perception of their mother's interest, encouragement, and confidence in the student's ability. It also includes the student's perception of their mother's example as a person interested in, secure in, and sensitive of the importance of physics. The father scale (F) measures the students' perception of their father's interest,

encouragement, and confidence in the student's ability. It also includes the student's perception of their father's example as a person interested in, secure in, and sensitive of the importance of physics. The Teacher Scale (T) measures student's perceptions of their teacher's attitudes toward them as learners of physics. This scale includes the teacher's interest, encouragement, and confidence in the student's ability to learn. The Confidence in Learning Physics Scale (C) measures the confidence in a person's ability to learn and to perform well on mathematical tasks. This scale does not measure anxiety or mental confusion, interest, enjoyment, or zest in problem solving. The Physics Anxiety Scale (A) measures feelings of anxiety, dread, nervousness, and associated bodily symptoms related to doing physics. This scale does not measure confidence in, or enjoyment of physics. The Effectance Motivation Scale in Physics (E) measures effectance as applied to physics. The questions investigate topics from the lack of involvement in physics to the seeking of a challenge. The Physics Usefulness Scale (U) measures the student's belief about the current and future use of physics (Fennema & Sherman, 1976).

Since there was not a significant difference in domain scores between African-American males and African-American females, this suggests that both genders have the same attitudes. When the demographics are considered, this result is reasonable. Of the participants, 69% listed their home state as Mississippi, 91.1% attended public high school, 93.3% attended a non-religious based high school and 46.7% indicated that their high school was located in an urban area. In terms of gender, 93.3% of females and 93% of males attended public high school. While 73.3% of females and 64.4% of males indicated that Mississippi was their home state. The population in this study was more alike than they were different. The students all had very similar experiences concerning

home state, high school type and high school location so it is not surprising that they had similar attitudes concerning physics as measured by the Fennema-Sherman attitude scales.

The third hypothesis examined if there would be a statistically significant relationship between attitude towards physics and achievement for African-American students. The students with good attitudes toward physics would have a higher level of achievement. A multiple linear regression analysis (MLR) was done using the domains, Attitude Toward Success in Physics Scale (AS), The Physics as a Male Domain Scale (MD), The Physics Usefulness Scale (U), The Teacher Scale (T), The Confidence in Learning Physics Scale (C), The Mother Scale (M), The Father Scale (F), The Physics Anxiety Scale (A), and The Effectance Motivation Scale in Physics (E). The results of the research indicated that the hypothesis was supported. The results implied that 18.9% of the grade could be explained by the domain scales.

#### Limitations

1. This study was conducted during the last day of class and there were a number of students that did not attend class. These students may have had different overall attitudes than those that chose to participate in the survey.
2. Some participants may have also gone through each question and statement too rapidly, not giving themselves enough time to reflect on each question in order to finish the survey more quickly. Some may have chosen to deliberately give misleading opinions and not their actual opinion when they answered the survey.
3. This study was limited to the introductory college physics courses at the research institution.

## Recommendations

Researchers concerned with investigating the attitudes of African-American college students toward physics should make the following considerations for current practices and further research:

- 1 . This study found that the student's confidence and motivation to do physics was the most significant of the nine domain scores when it came to student achievement in physics. Considering this result, instructors should adapt practices that encourage students to have more confidence in their own abilities to do physics and to work harder.
- 2 . The participants had a strong attitude toward success in physics. This means that they expected positive consequences as a result of success in physics. This should be reinforced by the instructors of physics by providing attainable short-term goals for the students.
- 3 . The results of this study could be submitted for publication in journals such as Science Education, The International Journal of Science and Mathematics Education, The Journal of Higher Education and the Journal for Research Education.
- 4 . The study could be expanded to compare African-American college students' attitudes towards introductory college physics and demographic information with other ethnic groups.
- 5 . The study could be expanded to investigate the hypotheses using African-American college students at several HBCUs.

- 6 . The study could be expanded to examine if there is a significant difference in the attitudes of African-American honor students towards introductory college physics with attitudes of African-American non-honor students toward introductory college physics.
- 7 . The study could be expanded to investigate the effects that different instructional strategies have on African-American college students' attitudes towards physics.

### Conclusion

The idea for this research developed as this researcher talked to colleagues about the students that enroll in introductory college physics and their attitudes toward physics. Through this research information on the attitudes that African-American college students have in introductory college physics class was collected along with demographic information to provide a better understanding of the typical African-American college student that is enrolled at the research HBCU. Most of the students surveyed had above a B average in high school. The research indicated that they had an overall positive attitude towards physics. This was not surprising considering the science and mathematics courses taken in high school and their performance in these courses.

The Fennema-Sherman Mathematics Attitude Scale was appropriate once modified for physics for this study as can be seen by the Cronbach alphas in Table 2. A study such as this one may help other researchers, faculty, and administrators gain a better understanding of African-American college students enrolled in an introductory college physics course and allow them to incorporate instructional methods that would encourage the development of a positive attitude toward physics. This positive attitude would then have a positive effect on achievement in the introductory college physics class. It is this

researcher's opinion that success in physics class will translate to an overall positive attitude toward college in general and therefore higher overall achievement. Physics is considered to be a difficult subject. Success in physics would build student confidence in themselves and their ability to learn. This would allow them to have a better opportunity to succeed globally.

## APPENDIX A

## COMMON PHY 201 (BASIC PHYSICS I) SYLLABUS

**Instructor:**                      **Office:**  
**Office Hours:**  
**Phone numbers:**  
**Email:**

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**Required Textbook:** *College Physics*, by Wilson, Buffa, & Lou, Sixth edition

**Course Description and Learning Objectives:**

In this course, you will learn the basic principles of mechanics and heat, and their applications. The physics and mathematical tools taught in this course are essential to Basic Physics II, Chemistry, Biology, Engineering, Medical School, the MCAT, etc. You must pay attention to problem solving since problem solving is the most important method to learn and understand physical concepts. You will be graded mainly on your ability to solve problems and your ability to understand the concepts. You are encouraged to regularly attend classes, listen carefully, take notes, and **most importantly**, ask questions in the class.

There are three basic requirements for your study of physics:

- (a) **Derivation:** Make sure that you understand the derivation of all the relationships (equations).
- (b) **Physical Meaning:** Make sure that you understand the physical meaning of each quantity, each term, and the whole equation or principle.
- (c) **Application:** Make sure that you are able to solve the homework problems using formulas and principles you have learned in the class. When you read the examples in the book, try to solve them before you read the solutions.

***Bring your binder, textbook, graphing calculator, and a pencil to every class!***

**Instructional Strategy:**

These will include (but are not limited to)

1. Lectures
2. Discussions/Questioning
3. Problem Solving
4. Evaluations and Testing

Evaluation of students will be done on the performance of the students in quizzes, tests, homework assignments, and attendance in class. The distribution of points as percentage and a description of these evaluation methods are given below.

**Hour Tests:**

There will be four 50-minute tests in this course. Tests will consist of:

- (a) Concept type of multiple choice questions (1/3 of total points)
- (b) Analytical problem solving exercises (2/3 of total points)

Tests will be given during the regular class hour. No one will be allowed to take the test at a later time. These tests are closed - book and closed - notes. You may only use the provided formula sheet. You may not make your own formula sheet. Your lowest test score will be dropped. Test dates are: **February 11, March 4, April 1, and April 22.**

**Makeup Tests:**

No makeup tests will be allowed in this course.

**Calculator:**

A scientific calculator is required. You are not allowed to share calculators during tests or quizzes. The model TI-83 Plus will be used in class and is highly recommended.

**Attendance:**

Attendance in class is required. If you miss the materials presented in class, you will find it difficult to do your best in this course. It is your responsibility to find out the material and the announcements should you miss class (es).

**Study Hours per Week:**

Usually, a person would not do more than 6 hours of work outside of class per week. Basic Physics is usually considered a difficult course, so it might be best to study the proposed 12 hours a week. If more hours are needed, take away some hours from easier courses, i.e., basket weaving.

**Homework:**

Working through problems is **CRUCIAL** for understanding the concepts and for performing well on the tests. Homework assignments and due dates are attached to this outline. You are encouraged to submit these assignments after each chapter is taught. You will be given opportunity to ask questions about problems during class. You are also encouraged to work together with other students on the problems, but you must complete your homework independently and never copy others. There will be homework problems for each chapter. Our main method of studying physics is to solve problems and do experiments as mentioned above. So completing all homework is crucial for understanding the material taught and for performing well on the tests. You are encouraged to ask me questions during class and during my office hours or by appointment. You are also encouraged to discuss the problems with other students, but you must do them by yourself so as to create your ability of solving problems independently.



**Quizzes:**

Quizzes will be administered either at the beginning or at the end of class. There will be approximately 11 quizzes. Your lowest score will be dropped. Please note the following:

- (a) Quizzes are open-book and open-class note exams.
- (b) You are not allowed to communicate with others during the quiz.
- (c) You will be given 5 to 10 minutes for each quiz.
- (d) If you miss the quiz, you will **not** be allowed to make it up.

**Midterm:**

**There will be no midterm exam. Midterm grades will be reported on the basis of the average of the quizzes and the first two tests given before the due date for midterm grades.**

**Final:**

The final examination will be on **Tuesday, May 5, 2009 at 3:00 p.m. – 4:50 p.m.** The final exam will be comprehensive. *(Note that this test date is different from the date published in the Class Schedule Booklet.)*

**Grading Scale:**

A.....	85 – 100
B.....	75 – 84
C.....	65 – 74
D.....	55 – 64
F.....	0 – 54

**Note:** *Incomplete grades will not be given in this course without completing the official form for this purpose, duly signed by both the student and the professor.*

**Grading:**

This class will **not** be graded on a curve. It is possible, theoretically, for the whole class to earn an A or an F for their final grade.

Quizzes	14 %
Hour Tests (3)	36 % (12% each)
Homework	20 %
Attendance	10 %
Final	<u>20 %</u>
	100%

**Disabled Students Statement:**

Students or employees with disabilities are offered a variety of services and resources through the ADA Coordinator for students, and employees, and campus visitors with disabilities. The Office of the ADA Coordinator is located in XXXXXXXX XXXXXXXXXXXXXXXX. Students or employees with documented disabilities such as hearing impairments, visual impairments, learning disabilities, and mobility impairments are eligible for services. Support Services, a component of the Office of the President, coordinates such services as registration assistance, tape recorded texts, testing accommodation, attendants referrals, and academic advice. The ADA Coordinator also works closely with XXXXXXXXXXXXXXXX XXXXXXXXXXXXXXXX and other organizations to assist students with disabilities.

**Cell Phones/Beeper/Pagers/etc.:**

If a cell phone/beeper/pager or any other annoying device that is in your possession goes off while you are in class during the class period, **you will lose one letter grade**, regardless of the circumstance. You will lose an additional letter grade each additional time the device goes off. If this is going to be a problem, please turn off or set your device to silent/vibrate mode before you enter the classroom. If your phone vibrates during the class meeting just leave the classroom to attend to the call. If I can not detect whose phone rang, and no one admits to it, everyone in the “area” of the call will lose one letter grade (until someone admits to the discretion.)

**E-mail Addresses:**

Please make sure that I can E-mail you at your E-mail address. Email addresses are assigned to students and are activated 24-48 hours after registration. Use the following link to get instructions: The format for Official University email addresses is as follows:

firstname.mi.lastname@ or firstname.lastname@

If I have to contact you, I will go to the web page and look up your E-mail address and send you the message through this address. If you do not use this E-mail address, I suggest you forward the E-mail sent to your address to wherever you currently get your E-mail – which you should have done anyway.

**Get access to your email**

Follow these three steps to get access to your email:

- ✚ Find out what your email address, Alias and NetID are.
- ✚ Activate your NetID.
- ✚ Login to Webmail.

**FIND OUT YOUR EMAIL ADDRESS**

1. Login to your.
2. Click the “Personal Information” bar.
3. Look for the “View E-mail Address” Link.
4. You will see “University Students Alias Email Address” and a “University Student Email Address”.

-The **Alias** is what you can give other people so that they can email you; this is in the format of `firstname.mi.lastname@students`

-The **University Student Email Address** (in the format of `j00012345@students`) is what will use to email you official information.

5. Either the alias or the email address will work to receive email; however, you always have to login to the webmail using your **NetID/Jnumber** and **NetID Password**.

### **Two options to Activate your NetID**

#### **OPTION 1:**

1. Open Internet Explorer.
2. Visit <http://>
3. Add the above link to your trusted sites.
4. Click on tools > Internet Options > Security TAB > Trusted Sites > Sites > it will show > click on add > refresh the page.
5. At this point you will see a logon screen.
6. Login using your NetID (J Number) and your six digit P.I.N. followed by @ <e.g., 123456@ > (same username and password that you use to login to P.A.W.S.).
7. You will be prompted to change your password; proceed to change it (the new password must contain at least 8 characters, one digit and a symbol).
8. You are done activating your NetID.

#### **OPTION 2:**

1. Click on Start button on the desktop > all programs > Accessories > Remote Desktop > Connection.
2. Enter IP address and click on connect.
3. At this point you will see a logon screen.
4. Login using your NetID) and six digit P.I.N. followed by @ <e.g., 123456@ > (same username and password that you use to login to.).
5. You will be prompted to change password; proceed to change it (the new password must contain at least 8 characters, one digit and a symbol).
7. You are done activating your NetID. – NOTE: Visit <http://tigerlab. /site/faq/logon.pdf> for more info.

#### **Login to your webmail:**

- ✚ Go to <http://www>
- ✚ Under the “Select Webmail Server” option, choose students..
- ✚ Click the “Go To Login” button.
- ✚ Type your NetID and the Password that you just created.
- ✚ You are done.

For questions or help about NetID, please call.

### **Academic Dishonesty:**

#### **Cheating includes:**

- Submitting material that is not yours as part of your course performance, such as copying from another student’s exam, allowing a student to copy from your exam;
- Using information or devices that are not allowed by the faculty; such as using formulas or data from a home computer program, or using unauthorized materials for a take-home exam;

- Obtaining and using unauthorized material, such as a copy of an examination before it is given;
- Fabricating information, such as the data for a lab report;
- Violating procedures prescribed to protect the integrity of an assignment, test, or other evaluation;
- Collaborating with others on assignments without the faculty's consent;
- Cooperating with or helping another student to cheat;
- Participating in or performing other forms of dishonest behavior, such as having another person take an examination in your place; or altering exam answers and requesting the exam be regarded; or communicating with any person during an exam, other than the exam proctor of faculty.

**Plagiarism includes:**

- Directly quoting the words of others without using quotation marks or indented format to identify them.
- Using sources of information (published or unpublished) without identifying them
- Paraphrasing materials or ideas of others without identifying the sources.
- Themes, essays, term papers, tests and other similar requirements that are not the work of the student submitting them.
- When direct quotations are used, they must be indicated and when the ideas of another are incorporated in papers they must be appropriately acknowledged.
- When a student is unsure about something that he/she wants to do or the proper use of materials, a faculty member should be consulted for clarification.

Generally, if a student writes while looking at a source or while looking at notes taken from a source, footnote should be given. Whenever any idea is taken from a specific work, even when the student writes the idea entirely in his/her own words, there must be a footnote giving credit to the author responsible for the idea. The student should never retain a sentence pattern and substitute synonyms for the original words. Paraphrasing means alteration of sentence pattern and changing of words. Any direct quotation should be footnoted or documented in an acceptable fashion. Methods of documentation vary, and it is possible to cite in the text itself, rather than in a footnote. The student should give credit in a manner specified by the instructor.

Academic honesty is a primary responsibility of the student. Students found guilty of academic dishonesty will incur sanctions as prescribed by the University's undergraduate or graduate student judicial system.

**Method of Course Evaluation:**

The course including the instructor will be evaluated by for the contents of the course and the quality of teaching.

**Diversity Statement:**

is committed to creating a community that affirms and welcomes persons from diverse backgrounds and experiences and supports the realization of their human potential. We recognize that there are differences among groups of people and individuals based on ethnicity, race, socioeconomic status, gender, exceptionalities, language, religion, sexual orientation, and geographical area. All persons are encouraged to respect the individual differences of others.

## STUDENT DECORUM POLICY

core values include tradition, accountability, learning, nurturing, service, and responsibility. believes that free expression is indispensable to the safeguarding of these values and that personal expression must be encouraged with only those limitations that are necessary to promote the University's mission for the benefit of all of its students.

The Student Handbook sets forth expectations and guidelines for appropriate student decorum, and this policy is put in place as a supplement to clarify and extend the dress code as well as the proscription against the use of inappropriate language. is committed to fostering an educational environment that, consistent with its academic freedom and mission, prepares its students for success in the classroom and later in their careers. may expect students to adhere to generally accepted standards of conduct. Actions that substantially interfere with the requirements of appropriate discipline or otherwise substantially interfere with the University's educational mission or the rights of other students may be regulated.

This Decorum Policy shall be applied without discrimination in regard to the viewpoint embodied in a student's dress or language, and it shall be applied to all students on an equal basis. Further, this policy is limited in time and place to University functions and educational facilities, specifically including classrooms. It is strongly encouraged, but not required, that these guidelines be followed elsewhere in an effort to provide a positive representation of ourselves and the University to the best of our abilities. Administrative, faculty, and staff members who observe student behavior proscribed by this Decorum Policy should report any such disregard or violations to the Offices of the Dean of Student Life.

### Prohibited Dress

Dress standards promote learning by establishing expectations that will reduce educational distractions as well as help prepare students for later success. These restrictions are minimum requirements that will result in a warning or disciplinary action if not followed. The University expects and strongly encourages its students to adhere to the higher standards of appropriate dress on campus and at University events as recommended in the Student Handbook. Prohibited dress shall include all **lewd or obscene clothing and attire** as well as any clothing or gear that, in the view of the Dean of Students or Vice President of Academic Affairs, **substantially interferes with the effectiveness of the educational environment and mission**. Lewd or obscene dress shall include attire or the lack thereof that leaves visible an area of the body that traditionally within the locality has been considered private and indecent to expose publicly, and that also lacks artistic or creative value within a particular University curriculum. Traditional private areas shall mean the breasts, buttocks, or areas proximate to the reproductive organs. Dress or gear that substantially interferes with the educational environment may

vary depending on the curriculum and context, but may include items that make distracting noises, such as music players, or attire that creates a visual obstruction to others. The only exemption to this dress code exists in the case of a student who, due to a medical condition or properly identified disability, requires such accommodation. Such accommodation, if reasonable, should be attempted with an effort to minimize any negative effect on the educational environment. This policy applies equally and without regard to the religious or secular nature of the attire.

Some examples of inappropriate dress and/or appearance include the following:

- Midriffs or halters, mesh, netted shirts, tube tops or cut-off t-shirts
- Short shorts
- Sagging or unbelted pants
- Do rags
- Clothing with words or images which are prohibited by this Decorum Policy
- Visible underclothing, including undershirts of any color, outside of the living quarters of the residence halls

### **Prohibited Language**

This policy does not prohibit language based on the expressive viewpoint of one's ideas, but rather proscribes certain language based on the disruptive or destructive manner and context in which such language is used.

**Lewdness, Obscenity.** Lewd and obscene language is prohibited.

**Fighting Words.** Language that by its very utterance tends to incite an immediate breach of the peace or imminent lawless action is prohibited. These words include those which when directed to the person of the hearer would naturally tend to provoke violent resentment. Such words also include those personally abusive epithets which, when addressed to the ordinary citizen, are, as a matter of common knowledge, inherently likely to provoke violent reaction.

**Profanity.** Profane, vulgar, and curse words are prohibited in limited contexts although their use is widely discouraged by the University. The proscription against profanity shall only regulate the manner of such speech rather than the content of any message conveyed. Profanity may subject a person to discipline when it lacks any artistic or literary value in connection with a University curriculum, it inherently tends to provoke a violent reaction, and it substantially interferes with the educational environment.

**Speech in violation of State or Federal Law.** Illegal speech is also prohibited.

Language usage can violate specific laws depending on the context. Some examples of such laws include disturbing the peace, intimidation, stalking, harassment, defamation, or libel.

### **Litter-Free Campus**

University takes great pride in the beauty of our campus. Littering is strictly prohibited and a violation of the University. Littering shall include, among other things, the throwing of debris such as cigarette butts, food wrappers, paper, cans, bottles, or other trash on the ground. No student shall intentionally dispose of refuse of any kind in or near any building owned or operated by the University except in receptacles provided for that purpose. Intentionally discarding such will be seen and adjudicated as a violation of the University Littering Policy. Fines may be imposed in an amount not to exceed two hundred dollars (\$200.00).

## **STUDENT DECORUM POLICY DISCIPLINARY PROCEDURES**

When the Dean of Student Life deems that a student has violated the Student Decorum Policy, the following procedures will be implemented.

**Verbal Warning.**

A verbal warning will be given to the student by the faculty or staff member who reported the misconduct, and a written record of the incident will be given to the student as well as placed in the student's file. The student may provide a written response (of reasonable length) which reflects his or her view of the incident and such response shall also be included in the file.

**Informal or Student Life Disciplinary Hearing.**

If the verbal and written warning has no impact on a student's behavior and further violations occur, the student will be contacted by the Dean of Student Life or designee thereof in regard to an informal or formal hearing. For allegations of misconduct of a less serious nature, the student will be summoned to appear before the Dean of Student Life for an informal hearing. The student will be allowed to know the allegations which he or she is accused of and be given an opportunity to respond. Based on the discretion of the Dean of Student Life, the student may be given a final warning or directed to attend counseling. If the Dean of Student Life believes that a fine, University service, probation, suspension, or expulsion is appropriate, the matter will be referred to the Student Life Disciplinary Committee ("SLDC") for adjudication. The SLDC shall hear all cases in which fines, University service, probation, suspension, or expulsion may be imposed. The SLDC may impose one of these actions only after the student has been informed of the allegations against him or her, and the student has been given a meaningful opportunity to explain why the allegations are incorrect or why a certain sanction is too harsh. An appeal from the SLDC for violations of this policy may be made in writing to the Dean of Students within two (2) days from the student's notification of the SLDC decision. The decision of the Dean of Students is final.

**NOTICE TO STUDENTS**

This Student Decorum Policy, including its Disciplinary Procedures, must be made available or disseminated in such a way to ensure that students receive notice of and access to this policy as well as information regarding the effective date from when it will be actively enforced.

**Tentative Order of Lectures (Revised):**

Day	Date	Activity
F	January 16	Handout and discussion of the policy. <i>Chapter 1:</i> SI units, metric units, dimensional analysis, unit analysis, and unit conversion.
M	January 19	<b>Martin Luther King Day Holiday (No Class)</b>
W	January 21	Significant figures and problem solving.
F	January 23	<i>Chapter 2:</i> Distance and speed, one dimensional displacement and velocity. <b>Quiz #1.</b>
M	January 26	Acceleration; Constant acceleration equations and Free Fall.
W	January 28	<i>Chapter 3:</i> Vector addition and subtraction, relative

		velocity.
F	January 30	Projectile motion. <b>Quiz #2.</b>
M	February 2	<b>Chapter 4:</b> Concepts of force and net force, Inertia and Newton's First Law of Motion, Newton's second and third law of motion.
W	February 4	Newton's second law and Free-body diagrams
F	February 6	Free-body diagrams <b>Quiz #3</b>
M	February 9	Free-body diagrams and translational equilibrium.
W	<b>February 11</b>	<b>Test I.</b>
F	February 13	Friction. <b>Quiz #4.</b>
M	February 16	Friction
W	February 18	<b>Chapter 5:</b> Work done by constant and variable forces.
F	February 20	Work-Energy theorem, Kinetic and Potential energy, <b>Quiz #5.</b>
M	February 23	Conservation of energy and power.
W	February 25	<b>Chapter 6:</b> Linear momentum, Impulse, Conservation of Linear Momentum.
F	February 27	Elastic and inelastic collisions. <b>Quiz #6.</b>
M	March 2	Center of mass, Jet propulsion and Rockets.
W	<b>March 4</b>	<b>Test II.</b>
F	March 6	<b>Chapter 7:</b> Angular Measure, angular speed and velocity, uniform circular motion and centripetal acceleration.
M	March 9	Angular acceleration, Newton's law of Gravitation.
W	March 11	Kepler's Laws and Earth satellites.
F	March 13	<b>Chapter 8:</b> Rigid bodies, translations, and rotations. <b>Quiz #7.</b>
	<b>March 16-20</b>	<b>Spring Break (No Class)</b>
M	March 23	Rotational dynamics, Rotational work and kinetic energy, angular momentum.
W	March 25	<b>Chapter 9:</b> Solids and elastic moduli, Fluids.
F	March 27	Torque, equilibrium, and stability. <b>Quiz #8.</b>
M	March 30	Fluids, Buoyancy and Archimedes' Principle.



W	April 1	<b>Test III.</b>
F	April 3	Fluid dynamics and Bernoulli's equation, Surface tension.
M	April 6	<b>Chapter 10:</b> Temperature and heat, the Celsius and Fahrenheit temperature scales, Gas laws and Absolute temperature.
W	April 8	Thermal Expansions, the Kinetic Theory of Gases, Diatomic Gases, and the Equipartition Theorem.
F	April 10	<b>Good Friday (No Class)</b>
M	April 13	<b>Easter (No Class)</b>
W	April 15	<b>Chapter 11:</b> Units of heat, Specific heat.
F	April 17	Phase changes, Latent heat, and Heat Transfer. <b>Quiz #9.</b>
M	April 20	<b>Chapter 12:</b> Thermodynamic systems, states, and processes. The first and second law of thermodynamics, and entropy.
W	April 22	<b>Test IV.</b>
F	April 24	Heat engines and thermal pumps, The Carnot cycle and ideal heat engines. <b>Quiz #10.</b>
M	April 27	<b>Chapter 13:</b> Simple Harmonic Motion, Equations of Motion. Wave Motion, Wave properties.
W	April 29	<b>Chapter 14:</b> Sound Waves, Speed of Sound, Sound Intensity and sound intensity level.
F	May 1	Sound phenomena, Doppler Effect, Musical instruments and sound characteristics. <b>Quiz #11.</b>
T	May 5	<b>Comprehensive Final Exam, 3:00 – 4:50 p.m.</b>

### Homework Assignments

The homework will be available online from the home work service at the University of Texas. You will get your homework from this site and you will submit your solutions for grading to the site. There will be homework problems for

each chapter. Our main method of studying physics is to solve problems and do experiments as mentioned above. So completing all homework is crucial for understanding the material taught and for performing well on the tests. You are encouraged to ask me questions during class and during my office hours or by appointment. You are also encouraged to discuss the problems with other students, but you must do them by yourself so as to create your ability of solving problems independently.

### Student Enrollment

- Obtain the unique number of your course from your instructor.
- If you have not already done so, obtain a UT EID from <http://www.utexas.edu/eid>.  
If you give the EID system bogus information, you may not be able to retrieve your EID nor the password in the future. If your email address changes, you need to return to this URL and correct it.  
**NEVER obtain a second EID.**
- Log into <http://quest.cns.utexas.edu/student>  
You will be sent to the EID system for your EID and password, then redirected back to us. If the redirection doesn't work, type in the URL again:  
<http://quest.cns.utexas.edu/student>
- Click the arrow beside "Get Started"
- Make sure that the "Hello" in the upper right-hand corner has your name.
- Under the MY COURSES tab, choose "ENROLL IN NEW COURSE"
- Supply the unique number in the box and choose "LOOKUP COURSE INFO"

Unique Number =     xxxxxxxx

- Select the appropriate course (if more than one option) and choose "REQUEST ENROLLMENT"
- Your instructor has to approve your request before you can proceed in the course.

### View assignments (PDF files)

To view assignments you will need to be able to view PDF files.

If needed, you can download the free Adobe Acrobat reader.

### Numbers

a) **Numeric input:** On "numeric" questions, you input ONE NUMBER -- integer, decimal or scientific notation.

**b) Significant digits and precision**

The computer carries out all calculations to at least six significant digits. Do not round off intermediate calculations or your final answer. Six digits are shown in solutions.

To be scored as correct, an answer must be within 1% of the computer's answer (except for an answer of zero, which must be exact). You will be informed of any exceptions to this tolerance.

**c) Scientific/Engineering notation ("times 10 to the power")**

Very large or very small numbers may be input with "scientific notation," *e.g.*, +3.56e-10, which is 3.56 times ten to the negative tenth power. However, 468 (or 468.0) is just as good as +4.68e+02 or +4.68E+02.

**Constants and Conversion Factors**

Be aware that using conversion factors and/or constants not identical with those used by the algorithm in the computer may cause discrepancies (*e.g.*,  $\pi = 3.14$  is not the same as  $\pi = 3.14159265358979324$ ). In general, constants other than those given in the links below should be given in the question by the instructor.

**Constants:** [HTML](#) [PDF](#)

**Conversion Factors:** [HTML](#) [PDF](#)

**Reporting Issues**

Contact your instructor with specific details about your issues. If necessary, he/she can contact the homework service for help.

## APPENDIX B

## COMMON SYLLABUS GENERAL PHYSICS

## PHY 211-02 (General Physics I)

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<b>Instructor:</b>	<b>Office:</b>
<b>Office Hours:</b>	11:00 AM – 1:00 PM (MWR), or by appointment
<b>Phone numbers:</b>	Office –            General Office –,            Fax –

**A. Objectives**

The objectives of this course are to provide you with a clear and logical presentation of the basic concepts and principles of physics, and to strengthen the understanding of the concepts and principles through a broad range of applications to the real world. In this course, you will learn the basic principles of Mechanics, Mechanical Waves, Thermodynamics, and their applications. The physics and mathematical tools taught in this course are essential to General Physics II, Engineering, Chemistry, and in some fields of Medicine. You must pay attention to problem solving since problem solving is the most important method to learn and understand physical concepts. You will be graded mainly on your ability to solve problems and your ability to understand the concepts. You are encouraged to regularly attend classes, listen carefully, take notes, and **most importantly**, ask questions in the class.

There are three basic requirements for your study of physics. You must ensure that all of these three requirements are met. These are:

- (a) **Derivation:** The concepts and principles are eventually expressed in form of relationships or equations. Make sure that you understand the derivation of all the equations. You will need to apply your previous knowledge of basic calculus in these derivations. It is advised that you refresh your calculus knowledge so that you can effectively use it as a mathematical tool. The instructor will explain the basics of calculus as needed.
- (b) **Physical Meaning:** Make sure that you understand the physical meaning of each quantity, each term, and the whole equation or principle.
- (c) **Application:** Make sure that you are able to solve the homework problems using formulas and principles you have learned in the class. When you read the examples in the book, try to solve them before you read the solutions.

**B. Required Text Book**

Halliday, D., Resnick, R. & Walker, J. (2008). *Fundamentals of Physics* (8<sup>th</sup> Edition). John Wiley & Sons.

[An electronic version of the textbook is available at a lower cost from the publisher's website <http://www.wiley.com/college/desktop>].

### C. Optional Supplements

1. *Student's Solutions Manual* by Christman, R. to accompany *Fundamentals of Physics* by Halliday, Resnick & Walker.
2. *Student Study Guide* to accompany *Fundamentals of Physics* by Halliday, Resnick & Walker.
3. *Physics as a Second Language: Mastering Problem Solutions* by Thomas Barrett.

### D. Website

Students can visit the publisher's website, which contains solutions of selected end-of-chapter problems, self-tests in the form of multiple-choice questions and tips on how to make the best use of a programmable calculator. Problems of the texts for which solutions are provided in this website are marked with a web symbol in your textbook. Regular visit to this website will help you further understand the application of the concepts learnt in class. Also, the Interactive Learning Ware tutorials develop interactively a solution process with appropriate feedback and access to error-specific help for the most common mistakes. The address of the website is:

<http://www.wiley.com/college/halliday>.

### E. Attendance

Attendance in class is required.

### F. Instructional Strategy

These will include (but are not limited to)

1. Lectures
2. Discussions/Questioning
3. Problem Solving
4. Evaluations and Testing

Evaluation of students will be done on the performance of the students in quizzes, tests, and homework assignments. The distribution of points as percentage, and a description of these evaluation methods are given below.

### G. Grading Policy

Quiz (8)		20%
Class Tests (4)	45%	
Final Exam		35%
		<hr/> 100%

### H. Home-works

Working through problems is **CRUCIAL** for understanding the concepts and for performing well on the tests. Suggested Homework Problems from the end-of-chapter-problems are attached to this outline. You are encouraged to solve these assigned problems after each chapter is taught. You will be given opportunity to ask questions about problems during class. You are also encouraged to work together with other students, but you must complete your homework independently and never copy others.

## I. Quiz

Quizzes are intended to help you guide through various concepts taught in lectures. These quizzes will be about the concepts, principles, laws, formulas, physical quantities, units their physical meaning and simple calculations. You will be asked to solve challenging problems on the topics covered in class in the previous week(s). Please note that the quizzes are open-book and open-class notes quizzes; however, you are not allowed to communicate with others during the quiz. There will be 8 quizzes in this course. Your lowest quiz score will be dropped. Quiz dates are: **January 26, February 9, February 20, March 2, March 13, March 27, April 17 and April 23.**

## J. Class Tests

There will be four 50-minute class tests in this course. These tests will be about the concepts, principles, laws, formulas, physical quantities, units, their physical meaning and simple calculations. You will be asked to solve challenging problems on the topics covered in class in the previous week(s). Tests will consist of

1. Concept type of multiple choice questions (1/5 of total points), and
2. Analytical problem solving exercises (4/5 of total points)

Tests will be given in regular class hour. No one will be allowed to take the test at a later time. These tests are *closed book* and *closed notes*. (*You will be provided with formula sheet*). Your lowest test score will be dropped. Class Test dates are: **February 13, March 6, April 6 and April 27.**

## K. Makeup Tests

Under normal circumstances, no makeup test will be allowed in this course.

## L. Midterm

There will be no midterm exam. Midterm grades will be reported on the basis of the average of the quizzes and the first two tests given before the due date for midterm grades.

## M. Final

Final examination will be on **May 5** (Tuesday) at 3:00 - 4:50 PM. Final examination will include all the chapters covered in the course, i.e., chapters 1 through 20 of your text. *Note that this test date is different from the date published in the Class Schedule Booklet.*

## N. Final Grade

- A: 85% and above
- B: 75% - 84%
- C: 65% - 74%
- D: 55% - 64%
- F: Below 55%

### **O. Services for Students with Disabilities:**

Students with disabilities are offered a variety of services and resources through the ADA Coordinator for students, and employees, and campus visitors with disabilities. The Office of the ADA Coordinator is located in XXXXXXXXXX. Students or employees with documented disabilities such as hearing impairments, visual impairments, learning disabilities, and mobility impairments are eligible for services. Support Services, a component of the Office of the President, coordinates such services as registration assistance, tape recorded texts, testing accommodation, attendants referrals, and academic advice. The ADA Coordinator also works closely with XXXXXXXX and other organizations to assist students with disabilities.

### **P. Cell Phones/Beeper/Pagers/etc.:**

Please turn off or set your device to silent/vibrate mode before you enter the classroom. If your phone vibrates during the class meeting, just leave the classroom to attend to the call. You are not allowed to keep your cell phone on the table (keep it in your tote bag or pocket). This is required to avoid text messaging during the tests.

### **Q. Student Advisement and Intervention Strategies (SAIS)**

The School of Science and Technology, under its SAIS plan, requires instructors teaching this course to identify a *student needing intervention* on the basis of low scores on tests or poor attendance record (three or more unexcused absences). If you are identified as one such student, you will then be required to take the following actions:

1. You must meet with your academic advisor and sign an Advising Session Report form.
2. You must attend tutoring sessions for at least two hours per week for the remainder of the semester and keep a record of these sessions on the Student Intervention Actions Report Form.
3. You must complete and return these forms (Advising Session Report and Student Intervention Action Report) to the instructor.

Failure to complete any of the above three steps will result in a formal letter being sent from the Dean's office to your parents/guardians with copies to Academic Affairs and to your advisor. Please note that the intervention plan is intended to help you.

### Tentative Class Schedule

<u>Dates</u>	<u>Topics</u>
Jan 15 (R)	Course outline and policy, Introduction, Review of Algebra
Jan 16	(F) <i>Chapter 1: Measurement:</i> The International System of Units, Changing units
Jan 21	(W) <i>Chapter 2: Motion Along A Straight Line:</i> Position, Displacement, Speed, Velocity, Acceleration
Jan 22	(R) Motion with Constant Acceleration
Jan 23	(F) Free-Fall Acceleration
Jan 26	(M) <b>Quiz 1</b> <i>Chapter 3: Vector:</i> Vectors and Scalars; Properties of Vectors; Components of Vectors and Unit Vectors;
Jan 28	(W) Adding Vectors by components; Multiplication of Vectors; Scalar Product; Vector Product
Jan 29	(R) <i>Chapter 4: Motion in Two and Three Dimensions:</i> Velocity and Acceleration, Projectile Motion
Jan 30	(F) Uniform Circular Motion
Feb 2	(M) Relative motion in one and two dimensions
Feb 4	(W) <i>Chapter 5: Force and Motion I:</i> Newton's Laws of Motion, Force, Mass
Feb 5	(R) Application of Newton's Laws of Motion
Feb 6	(F) Chapter 6: Force and Motion II: Friction, Drag Force; Air resistance and Terminal speed; Problems
Feb 9	(M) <b>Quiz 2</b>
Feb 11	(W) <i>Chapter 7: Kinetic Energy and Work:</i> Kinetic Energy, Work, Work and Kinetic energy
Feb 12 (R)	Review
Feb 13 (F)	Class-Test 1



- Feb 16 (M) Work done by gravitational force and spring force, Work done by general variable forces
- Feb 18 (W) *Chapter 8: Potential Energy and Conservation of Energy*: Work and Potential Energy, Conservative and non-conservative forces, Determining potential energy values
- Feb 19 (R) Conservation of Mechanical Energy, Work done on a system by external forces
- Feb 20 (F) **Quiz 3**  
Conservation of energy
- Feb 23 (M) *Chapter 9: Center of Mass and Linear Momentum*: Center of mass, Linear momentum, Linear momentum of a system of particles
- Feb 25 (W) Conservation of momentum, Collision and Impulse, Elastic and Inelastic collision
- Feb 26 (R) Collision and two dimensions, System with varying mass
- Feb 27 (F) *Chapter 10: Rotation*: Rotational variables, Rotation with constant angular acceleration
- Mar 2 (M) **Quiz 4**  
Relating Linear and Angular variables, Kinetic Energy of Rotation, Rotational Inertia
- Mar 4 (W) Torque, Newton's Second Law of Rotation, Work and Rotational Kinetic Energy
- Mar 5 (R) *Chapter 11: Rolling, Torque and Angular Momentum*: Rolling, Kinetic Energy of Rolling, Forces of Rolling
- Mar 6 (F) **Class-Test 2**
- Mar 9 (M) Angular Momentum, Newton's Second Law in Angular Form, Conservation of Angular Momentum
- Mar 11 (W) Chapter 12: Equilibrium and Elasticity: Requirements of Equilibrium, Center of Gravity, Static Equilibrium, Elasticity
- Mar 12 (R) Chapter 13: Gravitation: *Newton's Law of Gravitation, Gravitation near Earth surface, Gravitation Potential Energy*

- Mar 13** (F) **Quiz 5**  
Kepler's Laws of Planetary Motion, Satellites' orbits and energy, Einstein and gravitation
- Mar 16 – Mar 20** **No Class (Spring Break)**
- Mar 23** (M) *Chapter 14: Fluids:* Density and Pressure, Fluids at rest, Pascal's Principle, Archimedes' Principle
- Mar 25 (W)** Ideal Fluids in Motion, Equation of Continuity, Bernoulli's Equation
- Mar 26** (R) *Chapter 15: Oscillations:* Simple Harmonic Motion, Force Law of Simple Harmonic Motion, Energy in Simple Harmonic Motion
- Mar 27** (F) **Quiz 6**  
Pendulums, Simple Harmonic Motion and Uniform Circular Motion
- Mar 30** (M) Damped simple harmonic motion, Forced oscillations and resonance
- Apr 1** (W) *Chapter 16: Waves I:* Transverse and Longitudinal waves, Wavelength, Frequency, Speed of a traveling wave, Wave speed on a stretched string
- Apr 2** (R) Energy and Power of a wave along a string, The Wave Equation, Principle of Superposition
- Apr 3 (F)** Interference, Standing Wave, Resonance
- Apr 6 (M)** **Class-Test 3**
- Apr 8 (W)** *Chapter 17: Waves II:* Sound waves, Speed of sound; Traveling sound wave, Interference, Intensity and sound level
- Apr 9 (R)** Beats, Doppler Effect, Supersonic speed, Shock waves
- Apr 10 – Apr 13** **No class (Holiday Break)**
- Apr 15 (W)** *Chapter 18: Temperature, Heat and the First Law of Thermodynamics:* Temperature, Scales of temperature, Thermal Expansion
- Apr 16** (R) Temperature and Heat, Heat and Work, First Law of Thermodynamics

**Apr 17 (F) Quiz 7**

Heat Transfer Mechanisms

Apr 20 (M) *Chapter 19: The Kinetic Theory of Gases:* Ideal gases, Pressure, Temperature and RMS speed, Translational Kinetic energy

Apr 22 (W) Distribution of molecular speeds, Molar specific heats of an ideal gas, Adiabatic expansion of an ideal gas

Apr 23 (R) **Quiz 8**  
*Chapter 18: Entropy and the Second Law of Thermodynamics:*  
 Irreversible processes and entropy

Apr 24 (F) Changes in entropy, The Second Law of Thermodynamics

Apr 27 (M) **Class-Test 4**

Apr 29 (W) Entropy in Real World: Engines and Refrigerators, Efficiencies of Real Engines

Apr 30 (R) A statistical view of entropy

May 1 (F) *Review*

May 5 (Tuesday)

**FINAL EXAM (3:00 PM - 4:50 PM)**

*(Note: This is not the scheduled time from the catalog)*

**Homework Assignments**  
**PHY 211- 02**

Chapter	Problems
1	7, 9, 18, 23, 46, 50
2	5, 16, 19, 26, 34, 45, 56, 58, 71, 79, 82, 89
3	9, 13, 17, 25, 34, 36, 39, 43, 66, 71
4	5, 6, 13, 15, 21, 24, 28, 38, 57, 62, 67, 91, 120
5	3, 6, 25, 36, 41, 47, 55, 65, 78, 99
6	7, 14, 20, 29, 41, 44, 50, 55, 65, 70, 98, 107
7	5, 10, 13, 20, 23, 27, 29, 40, 41, 45, 56, 60
8	4, 5, 15, 22, 25, 32, 43, 47, 52, 55, 116, 127
9	1, 10, 15, 19, 27, 38, 39, 47, 49, 56, 62, 114, 129
10	2, 10, 14, 21, 31, 37, 46, 57, 60, 78, 113
11	5, 23, 28, 41, 48, 53, 60, 62, 86
12	5, 11, 21, 28, 46, 60, 82,
13	1, 6, 17, 19, 31, 37, 38, 43, 57, 60, 61, 76, 88, 97
14	3, 9, 11, 22, 26, 28, 31, 35, 39, 53, 57
15	2, 7, 15, 22, 28, 31, 75, 80, 92
16	8, 15, 20, 22, 26, 38, 47, 73, 74, 86
17	5, 10, 16, 26, 30, 39, 42, 48, 55, 56, 69, 111
18	4, 5, 10, 16, 24, 30, 35, 44, 45, 81

## APPENDIX C

## PERMISSION TO USE HUMAN SUBJECTS



## JACKSON STATE UNIVERSITY

1400 J. R. LYNCH STREET • JSU BOX 17057  
JACKSON, MISSISSIPPI 39217-0157


THE OFFICE OF RESEARCH DEVELOPMENT  
AND FEDERAL RELATIONS

PHONE: (601) 979-2931  
FAX: (601) 979-3664

DATE: November 13, 2008

## MEMORANDUM

TO: Carl T. Drake  
706 Primos Avenue  
Jackson, MS 39209

FROM: Dr. Sophia Leggett   
IRB, Chair

Re: Protocol entitled: "African-American College Students Attitudes Towards Physics And Its Affect on Achievement."

The Jackson State University Institutional Review Board (IRB) has reviewed your application and has come to the conclusion your responses are satisfactory and meet the requirements for protection of human participants as stipulated by the Federal government. Your application received an **Expedited** approval. This approval is good for **one year** from the date of this letter.

Any adverse reactions or problems resulting from this investigation must be reported immediately to the university Institutional Review Board. If you decide to modify or change your procedures in any way, please notify the IRB office in writing. We will review your request in the context of your complete application. If the changes are approved, you will receive written notification for the approval.

Any research that continues beyond one year should be resubmitted for approval before the end of each year so there is no lapse. Contact the IRB office for the extension form and the submission requirements before the end of October 2009.

APPROVED

## Consent Short Form

INSTITUTIONAL  
REVIEW BOARD

Expires 11/12/2009

THE UNIVERSITY OF SOUTHERN MISSISSIPPI  
AUTHORIZATION TO PARTICIPATE IN RESEARCH PROJECT

(Short Form - to be used with oral presentation)

Participant's Name \_\_\_\_\_

Consent is hereby given to participate in the research project entitled African-American College Student Attitudes Towards Physics and Its Affect on Achievement. All procedures and/or investigations to be followed and their purpose, including any experimental procedures, were explained by **Mr. Carl T. Drake**. Information was given about all benefits, risks, inconveniences, or discomforts that might be expected. The opportunity to ask questions regarding the research and procedures was given. Participation in the project is completely voluntary, and participants may withdraw at any time without penalty, prejudice, or loss of benefits. All personal information is strictly confidential, and no names will be disclosed. Any new information that develops during the project will be provided if that information may affect the willingness to continue participation in the project. Questions concerning the research, at any time during or after the project, should be directed to Mr. Carl T. Drake at (601)979-3624 or [carl.drake@jsums.edu](mailto:carl.drake@jsums.edu). This project and this consent form have 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 participant should be directed to the Chair of the Institutional Review Board. The University of Southern Mississippi, 118 College Drive #5147, Hattiesburg, MS 39406-0001, (601) 266-6820. This research study and this consent form have been reviewed by the Human Subjects Protection Review Committee of the Office of Research and Federal Relations at Jackson State University, which ensures that research studies involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to contact Dr. Felix A Okojie, Vice President of Research and Federal Relations, 601-979-2931.

\_\_\_\_\_  
Signature of participant\_\_\_\_\_  
Date\_\_\_\_\_  
Signature of person explaining the study\_\_\_\_\_  
Date

APPROVED

NOV 11 2008

INSTITUTIONAL  
REVIEW BOARD

## Oral Presentation

Dear Participant,

Expires 11/12/2009

Prior to taking this class, what were your perceptions of this course? Were you excited? Were you frightened? What caused you to feel your preconceived feelings or attitudes toward this Physics class? Can a student's attitude towards Physics affect their individual level of achievement (success or failure) in a Physics course? According to Redish, E.F., Saul, J.M., & Steinberg, R.N., 1998, the expectations that students have concerning their introductory physics course plays a critical role in what they learn during the course. It affects what information they pay attention to and what information they tend to ignore during a typical course. It also affects the activities that students select in order to build their own knowledge base and in building their own understanding of the course material. Bailey in 1990, also conducted a study that found that student achievement in introductory college physics courses is important because satisfactory grades are required to enroll in more advanced courses in the basic sciences, engineering, and health sciences. We want more African American students to progress smoothly through successive courses in mathematics, science, and technology. Therefore identifying those underlying attitudes or factors that influence the achievement levels of African-Americans who plan to become science educators, doctors, engineers and health career professionals is critical. This is how you can help. First, I need your permission to use both your midterm and final grades. In addition, fill out the personal data sheet, written consent form and take the Fennema Sherman Survey. Completing the personal data sheet and written consent form should take about five minutes. The Fennema-Sherman should take about 50 minutes. Any questions that you do not want to answer, please leave it blank. The confidentiality of all participants will be protected. There are no direct benefits of participating in this study. The risks are very minimal. The personal data sheet and Fennema Sherman Survey Instrument will be kept in a locked cabinet that is only accessible to the researcher, Mr. Carl T. Drake. When the study is complete the Fennema Sherman Surveys and personal data sheet will be paper-shredded. I would like to give your consent to participate in this research. If you choose not to participate, that's fine. This research study and this consent form have been reviewed by the Human Subjects Protection Review Committee of the Office of Research and Federal Relations at Jackson State University, which ensures that research studies involving human subjects follow federal regulations. Any questions or concerns about rights as a research participant should be directed to contact Dr. Felix A Okojie, Vice President of Research and Federal Relations, 601-979-2931.

Thanks for all of your help.

Sincerely,

Carl T. Drake

\_\_\_\_\_  
Signature of person giving oral presentation\_\_\_\_\_  
Date

JSU-ORA-IRB-4-06

## APPENDIX D

## PERMISSION TO USE HUMAN SUBJECTS

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](http://www.usm.edu/irb)

TO: Carl T. Drake  
706 Primos Avenue  
Jackson, MS 39209

FROM: Lawrence A. Hosman, Ph.D.  
HSPRC Chair

PROTOCOL NUMBER: 28111001

PROJECT TITLE: African-American College Students' Attitudes Towards Physics  
and It's Affect on Achievement

Enclosed is The University of Southern Mississippi Human Subjects Protection  
Review Committee Notice of Committee Action taken on the above referenced  
project proposal. If I can be of further assistance, contact me at (601) 266-4279,  
FAX at (601) 266-4275, or you can e-mail me at [Lawrence.Hosman@usm.edu](mailto:Lawrence.Hosman@usm.edu).  
Good luck with your research.





# 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: 28111001

PROJECT TITLE: African-American College Students' Attitudes Towards  
Physics and It's Affect on Achievement

PROPOSED PROJECT DATES: 11/21/08 to 10/22/09

PROJECT TYPE: Dissertation or Thesis

PRINCIPAL INVESTIGATORS: Carl T. Drake

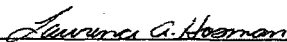
COLLEGE/DIVISION: College of Science & Technology

DEPARTMENT: Center for Science and Math Education

FUNDING AGENCY: N/A

HSPRC COMMITTEE ACTION: Expedited Review Approval

PERIOD OF APPROVAL: 11/24/08 to 11/23/09

  
Lawrence A. Hosman, Ph.D.  
HSPRC Chair

12-02-08

Date

## APPENDIX E

PERMISSION TO USE THE FENNEMA-SHERMAN MATHEMATICS ATTITUDE  
SCALES

From: Elizabeth Fennema [mailto:efennema@facstaff.wisc.edu]  
Sent: Thursday, March 09, 2006 11:55 AM  
To: Carl T. Drake  
Subject: Re: Fennema-Sherman MAS use for dissertation

Dear Carl, You have my permission to use the Fennema-Sherman scales in your doctoral research as long as you give proper reference to their source. My guess is that you will need to modify the wording of some of the items to be suitable for physics and college students. I would also anticipate that not all of the scales will be appropriate and you should omit them. Remember that those scales were developed about 30 years ago for high school students in mathematics.

Best wishes for finishing your dissertation. 10:39 PM 3/7/2006 -0600, you wrote:

>Hello.

>

> My name is Carl Drake and I am a Ph.D. candidate in the Center  
>for Science and Mathematics Education. I would like your permission  
>to use the Fennema-Sherman Mathematics Attitude Scale as the instrument  
>in my Dissertation research involving the attitudes of  
>African-American college students towards physics. Thank you in  
>advance.

>

>

>Carl Drake  
>Ph.D. Candidate  
>The University of Southern Mississippi

## APPENDIX F

## PERSONAL DATA INFORMATION

**Instructions: Circle the most appropriate response**

**Gender:** Male Female

**Class:** Freshman      Sophomore      Junior      Senior      Other

**Race:** African-American      White      Asian      Hispanic      Other

**Your Age as of today:** 18-19      20-21      22-23      24-25      Other: \_\_\_\_\_

**The following were actively involved in my education:**

Mother      Father      A Grandmother      A Grandfather      Other: \_\_\_\_\_

**In which state did you attend high school?** \_\_\_\_\_

**High School:** Public      Private      If private, was the school religious based? Yes      No

**High School:** Urban      Suburban      Rural

**High School Size:** Under 100      101-500      501-1000      Over 1000

**Number of times enrolled in Introductory Physics:** 1      2      3      4 or more

**Grade you expect to earn in Introductory Physics:** A      B      C      D      F

**Circle all math courses that you took in high school:**

Algebra I      Algebra II      Geometry      Trigonometry      Calculus      Other: \_\_\_\_\_

**Circle all science courses that you took in high school:**

Biology      Chemistry      Physics      Physical Science      Other: \_\_\_\_\_

**Employment:** Full-time      Part-time      Student Worker      None

**On average, how many hours per week do you study physics?**

Less than 1 hour      1 to 2 hours      More than 2 hours

**Do you prefer to study for this course with classmates or study by yourself?**

Study in group      Study alone      No preference

**The GPA (on the 4.0 scale) during your senior year in high school was approximately:  
(Mark One)**

3.67 to 4.00      3.34 to 3.66      3.00 to 3.33      2.67 to 2.99      2.34 to 2.66      2.00 to 2.33  
below 2.00

## REFERENCES

- Albarracin, D., Johnson, B. T., & Zanna, M. P., Kumkale, G. T. (2005). *The handbook of attitudes*. Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.
- American Association of University Women Educational Foundation (AAUW). (1998). *Gender gaps: Where schools still fail our children*. Washington, DC: American Association of University Women.
- American Institutes for Research, W. (1998, January 1). Gender Gaps: Where Schools Still Fail Our Children. (ERIC Document Reproduction Service No. ED427390) Retrieved September 23, 2008, from ERIC database.
- Bailey, R. (1990). Mathematics for the millions, science for the people: Comments on black students and the mathematics, science, and technology pipeline. *Journal of Negro Education*, 59(3), 239-245.
- Beaton, A. E., Martin, M.O., Mullis, I.V.S., Gonzalez, E.J., Smith, T.A., & Kelly, D.L. (1996). *Science achievement in the middle school years: IEA's Third International Mathematics and Science Study*. Boston, MA: Center for the Study of Testing, Evaluation, and Educational Policy.
- Bramlett, D. (2007). *A study of factors affecting african-american college students towards mathematics*. Unpublished doctoral dissertation, The University of Southern Mississippi, Hattiesburg.
- Brand, R. B, Glasson, G. E., & Green, A. M. (2006). Socio-cultural factors influencing students' learning in science and mathematics. *School Science and Mathematics*, 106(5), 228-236.

- Brandell, G., & Staberg, E. (2008). Mathematics: A female, male or gender-neutral domain? A study of attitudes among students at secondary level. *Gender & Education, 20*(5), 495-509.
- Bransford, J. D., Brown, A. L., & Cocking, R. R. (2002). *How people learn*. Washington, DC: National Academy Press.
- Business Roundtable. (2005). *Tapping America's potential: The education for innovation initiative*. Retrieved October 4, 2008, from <http://www.itic.org/archives/TAP%20Statement.pdf>
- Byun, T., Ha, S., & Lee, G. (2008). Identifying student difficulty in problem solving process via the framework of the house model (HM). *Physics Education Research Conference, 1064*, 87-90.
- Calder, A., & Ashbaugh, E. (2005, September 16). Transfer of Learning through Gender and Ethnicity. *AIP Conference Proceedings, 790*(1), 39-41. Retrieved September 16, 2008, from <http://adsabs.harvard.edu/abs/2005AIPC..790...39C>
- Carey, N., & Shavelson, R. (1988). Outcomes, achievement, participation, and attitudes. In R. J. Shavelson, L. M. McDonnell, and J. Oakes (Eds.), *Indicators for monitoring mathematics and science education* (pp. 147-191). Santa Monica, CA: Rand Corporation.
- Center for Public Education. (2007, June 17). *Key lessons: Math and science achievement in the united states*. Retrieved April 6, 2008, from <http://www.centerforpubliceducation.org>
- Children's Defense Fund. (2008, November 1). *Children's defense fund's priorities for america's children: What are president-elect Barack Obama's plans to make them*

a reality? Retrieved November 15, 2008 from

<http://cdf.childrensdefense.org/site/DocServer/president-elect-obama-plan-cdf-priorities-americas-child.pdf?docID=8961>

Cooper, J., & Schleser, R. (2006). Closing the Achievement Gap: Examining the Role of Cognitive Developmental Level in Academic Achievement. *Early Childhood Education Journal*, 33(5), 301-306. Retrieved October 2, 2008, from

<http://www.springerlink.com/content/x6h37390n7601q17/>

Crawley, F. E., & Black, C. (1992). Causal modeling of secondary students' intention to enroll in physics. *Journal of Research in Science Teaching*, 29, 585-599.

Crawley, F. E., & Coe, A. S. (1990). Determinants of middle school students' intention to enroll in a high school science course: An application of the theory of reasoned action. *Journal of Research in Science Teaching*, 27(461-476).

Darling-Hammond, L. (1998). Unequal opportunity: Race and education. *Brookings Review*, 16(2), 28-32.

Darling-Hammond, L., & Hudson, L. (1998). Teachers and teaching. In R.J. Shavelson, L. M. McDonnell, and J. Oakes (Eds.), *Indicators for monitoring mathematics and science education* (pp. 67-95). Los Angeles, CA: Rand Corporation.

Demirci, N. (2004, January 1). Students' Attitudes toward Introductory Physics Course. *Hacettepe University Journal of Education*, 26, 33-40. (ERIC Document Reproduction Service No. EJ807981) Retrieved April 1, 2009, from ERIC database.

- Duda, G., & Garrett, K. (2008). Blogging in the physics classroom: A research-based approach to shaping students' attitudes toward physics. *American Journal of Physics*, 76(11), 1054-1065.
- Editorial Projects in Education (2004). *Achievement Gap*. Retrieved September 11, 2008, from <http://www.edweek.org/rc/issues/achievement-gap/>
- Fantuzzo, J.W., Davis, G.Y., & Ginsburg, M.D. (1995). Effects of parent involvement in isolation or in combination with peer tutoring on student self-concept and mathematics achievement. *Journal of Educational Psychology*, 87(2), 272-281.
- Fennema, E., & Sherman, J.A. (1976). Fennema-Sherman Mathematics Attitudes Scales: Instruments Designed to Measure Attitudes toward the Learning of Mathematics by Females and Males. *Journal for Research in Mathematics Education*, 7(5), 324-326.
- Ford, D., Grantham, T., & Whiting, G. (2008). Another Look at the Achievement Gap. *Urban Education*, 43(2), 216-239. Retrieved October 2, 2008, from Academic Search Premier database.
- Forgasz, H.J., Leder, G.C., & Kloosterman, P. (2004). New perspective on the gender stereotyping of mathematics. *Mathematical Thinking & Learning*, 6(4), 389 – 420.
- Freedman, M.P. (1997). Relationship among laboratory instruction, attitude toward science, and achievement in science knowledge. *Journal of Research in Science Teaching*, 34(4), 343-357.
- Gardner, P.L. (1975). Attitudes to science: A review. *Studies in Science Education*, 2, 1-41.

- Gonzales, P., Williams, T., Jocelyn, L., Roey, S., Kastberg, D., & Brenwald, S. (2008, December 9). *Trends in international mathematics and science study*. Retrieved December 20, 2008, from <http://nces.ed.gov/TIMSS/>
- Guess, A. (2007). *Closing one gap for African Americans*. Retrieved September 16, 2008, from <http://insidehighered.com>.
- Gustafsson, J. E., & Balke, G. (1993, October 1). General and specific abilities as predictors of school achievement. *Multivariate Behavioral Research*, 28(4), 407-434.
- Haladyna, T., Olsen, R., & Shaughnessy, J. (1982). Relations of student, teacher, and learning environment variables to attitudes toward science. *Science Education*, 66, 671-687.
- Halloun, I. A., & Hestenes, D. (1985). The Initial Knowledge State of College Physics Students. *American Journal of Physics*, 53, 1043-1055.
- Hammer, D. (2000, July 1). Student resources for learning introductory physics. *American Journal of Physics*, 68(1), 52-59.
- Hines, S. (1996, December). Factors influencing persistence among African-American upperclassmen in natural science and science-related majors at a major research university. Retrieved September 16, 2008, from PsycINFO database
- Hoffman, L. (2002). Promoting girls' interest and achievement in physics classes for beginners. *Learning and Instruction*, 12(4), 447-465.
- Hoffmann, L. & Haussler, P. (1998). An intervention project promoting girls' and boys' interest in physics. In L. Hoffmann, A. Krapp, K. A. Renninger, and J. Baumert



- (Eds.), *Interest and learning: Proceedings of the Seeon conference on interest and gender* (pp. 301-316). Kiel, Germany: IPN.
- House, J.D. (1996). Student Expectancies and Academic Self-Concept as Predictors of Science Achievement. *The Journal of Psychology*, 130(6), 679-681.
- Jencks, C., & Phillips, M. (1998). America's next achievement test: Closing the black-white achievement gap. *The American Prospect*, 40, 44-53.
- Koballa, T. R. (1988). The determinants of eighth grade students' intentions to enroll in higher education. *Journal of Education*, 1.
- Koch, J., & Irby, B. (2002). *Defining and redefining gender equity in education*. Greenwich, CT: Information Age Publishing.
- Laukenmann, M. (2003). An investigation of the influence of emotional factors on learning in physics instruction. *International Journal of Science Education*, 25(4), 489-507.
- Lawson, A. E. (1983). Predicting science achievement: The role of developmental level, disembedding ability, mental capacity, prior knowledge, and beliefs. *Journal of Research in Science Teaching*, 20(2), 117-129.
- Lee, J. (2002). Racial and ethnic achievement gap trends: Reversing the progress toward equity. *Educational Researcher*, 31(1), 3-12.
- Lee, J. (2006). *Tracking achievement gaps and assessing the impact of NCLB on the gaps: An in-depth look into national and state reading and math outcome trends* (The Civil Rights Project at Harvard University). Cambridge, MA: Harvard Education Publishing Group.

- Levine, D. U., & Eubanks, E. E. (1990). Achievement disparities between minority and nonminority students in suburban schools. *Journal of Negro Education*, 59(2), 186-194.
- Lewis, B.F. (2003) A critique of literature on the underrepresentation of African Americans in science: Directions for future research. *Journal of Women and Minorities in Science and Engineering*, 9 (3&4), 361-373.
- Ma, X., & Kishor, N. (1997). Assessing the relationship between attitude toward mathematics and achievement in mathematics: A meta-analysis. *Journal for Research in Mathematics Education*, 28(1), 26-47.
- Mager, R. (1968). *Developing attitude toward learning*. Palo Alto, CA: Fearon.
- Mallory, J. L. (2004). *Factors which determine interest or fear in physics*. Unpublished doctoral dissertation, College of William and Mary, Hattiesburg, MS.
- Moore, W. R., & Foy, R. L. H. (1998). The scientific attitude inventory: A revision SAI II. *Journal of Research in Science Teaching*, 34(4), 327-336.
- Morrell, P. D., & Lederman, N. G. (1998). Students' attitudes toward school and classroom science: Are they independent phenomena: *School Science and mathematics*, 90(2), 76-83.
- Mulhern, F., & Rae, G. (1998, April). Development of a shortened form of the Fennema-Sherman... *Educational & Psychological Measurement*, 58(2), 295. Retrieved September 25, 2008, from Academic Search Premier database.
- Mullis, I. V.S., Martin, M. O., Fierros, E. G., Goldberg, A. L., & Stemler, S. E. (2000). *Gender differences in achievement*. Chestnut Hill, MA: Boston College.

- National Assessment of Educational Progress. (1978). *The third assessment of science, 1976-77*. Denver, CO: Author.
- National Congress of Mothers and Parent-Teacher Associations [National PTA]. (1997). *National standards for parent/family involvement programs*. Chicago: Author.
- National Science Foundation. (2004). Table C- 15. Bachelor's degrees, by race/ethnicity, citizenship, sex, and field: 2001. Retrieved March 31, 2006, from the NSF Women, Minorities, and Persons with Disabilities in Science and Engineering Web site: <http://www.nsf.gov/statistics/-wmpd/pdf/tabc-15.pdf>
- National Science Foundation. (2008, January 1). *Science and engineering indicators*. Retrieved March 4, 2008, from National Science Board Website: <http://www.nsf.gov/statistics/seind08/>
- Neisser, U., Boodoo, G., Bouchard, T. J., Boykin, W. A., Brody, N., & Ceci, S. J. (1996). Intelligence known and unknowns. *American Psychologist*, 51, 77-101.
- Norwich, B., & Duncan, J. (1990). Attitudes, subjective norm, perceived preventive factors, intentions and learning science: Testing a modified theory of reasoned action. *British Journal of Educational Psychology*, 60, 312-321.
- Oliver, J. (2005, August 1). *Graduate Enrollment in Science and Engineering Programs Up in 2003, but Declines for First-Time Foreign Students*. Retrieved August 21, 2008, from National Science Foundation Website: <http://www.nsf.gov/statistics/infbrief/nsf05317/>
- Ormerod, M.B. (1975). Subject preference and choice in co-educational and single-sex secondary schools. *British Journal of Educational Psychology*, 45, 257-267.

- Osborne, J., Simon, S. & Collins, S. (2003). Attitudes towards science: a review of the literature and its implications. *International Journal of Science Education*, 25, 1049-1079.
- Oskamp, S., & Schultz, P. W. (2004). *Attitudes and opinions*. Mahwah, New Jersey: Lawrence Erlbaum Associates, Inc.
- Papanastasiou, C., and Papanastasiou, E. C. (2002). The process of science achievement. *Science Education International*. 13(2), 12-24.
- Papanastasiou, C., & Papanastasiou, E. C. (2004). Major influences on attitudes toward science. *Educational Research and Evaluation*, 10(3), 239-257.
- Papanastasiou, E.C., & Zembylas, M. (2002). The Effect of Attitudes on Science Achievement: A Study Conducted Among High School Pupils in Cyprus. *International Review of Education*, 48(6), 469-484.
- Raw, A. J. (1999). Developing A-level physics students' mathematical skills - a way forward? [Electronic version]. *Physics Education*, 34(5).
- Redish, E. F., Saul, J. M., & Steinberg, R. N. (1998). Student Expectations in Introductory Physics. *American Journal of Physics*, 66, 212-224.
- Redish, E. F. (2003). *Teaching physics with physics suite*. New York: John Wiley & Sons.
- Redish, E. F., Saul, J. M., & Steinberg, R. N. (1998). Student expectations in introductory physics. *American Journal of Physics*, 66(3), 212-224.
- Reid, N., & Skryabina, E. (2003). Gender and physics. *International Journal of Science Education*, 25(4), 509-536.

- Roach, R. (2001). A FOCUS ON Physics. *Black Issues in Higher Education*, 18(15), 24.  
Retrieved September 16, 2008, from Academic Search Premier database.
- Sadker, M., & Sadker, D. (1994). *Failing at fairness: How American's schools cheat girls*. New York: Macmillan Publishing Company.
- Schibecchi, R.A. (1984). Attitudes to science: an update. *Studies in Science Education*, 11, 26-59.
- Seymour, E., & Hewitt, N. (1997). *Talking about leaving*. Boulder, CO: Westview Press.
- Simon, S. (2000). Students' attitudes towards science. In M. Monk and J. Osborne (Eds.) *Good practice in science teaching — What research has to say*. Buckingham: Open University Press.
- Simpson, R. D., & Oliver, J.S. (1990). A summary of major influences on attitude toward and achievement in science among adolescent students. *Science Education*, 74(1), 1-18.
- Stanic, G.M.A., & Hart, L.E. (1995). Attitudes, persistence, and mathematics achievement: Qualifying race and sex differences. In W.G. Sedada, E. Fennema, and D.L.B. Adajian (Eds.), *New directions for equity in mathematics education* (pp.258-278). New York: Cambridge University Press.
- Stead, K. (1985). An exploration, using Ajzen and Fishbein's theory of reasoned action, of students' intention to study or not study science. *Research in Science Education*, 15, 76-85.
- Stevenson, H.W., Chen, C., & Uttal, D.H. (1990). Beliefs and Achievement: A Study of Black, White, and Hispanic Children. *Child Development*, 61(2), 508-523.

- Tai, R. H., & Sadler, P. M. (2001). Gender differences in introductory undergraduate physics performance: University physics versus college physics in the USA. *International Journal of Science Education*, 23(10), 1017-1037.
- Talton, E. L., & Simpson, R. D. (1986). Relationships of attitude towards self, family, and school with attitude toward science among adolescents. *Science Education*, 70(4), 365-374.
- Tapia, M., & Marsh II, G. E., (2004). An instrument to measure mathematics attitudes. *Academic Exchange Quarterly*, 8(2), 16-21.
- Task Force on Women, Minorities, and the Handicapped in Science and Technology. (1989). *Changing America: The new face of science and engineering*. Washington, DC: National Science Foundation.
- Trends in international mathematics and science study*. (2007) Retrieved December 20, 2008, from IES national Center for Education Statistics:  
<http://nces.ed.gov/TIMSS/>
- Tuminaro, J., & Redish, E. F. (2004). Understanding students' poor performance on mathematical problem solving in physics. *Physics Education Research Conference*, 720, 113-116.
- Udo, M. K., Ramsey, G. P., Reynolds-Alpert, S., & Mallow, J. V. (2001, September 1). Does physics teaching affect gender-based science anxiety? *Journal of Science Education and Technology*, 10(3), 237-247.
- Verdugo, R., & Schneider, J. (2005). School Equity and Efficacy: Race and the Achievement Gap. *Conference Papers -- American Sociological Association*, Retrieved October 2, 2008, from SocINDEX.

- Vezeau, C., Chouinard, R., Bouffard, T., & Couture, N. (1998). Adaptation et validation des échelles de Fennema et Sherman sur les attitudes en mathématique des élèves du secondaire. *Canadian Journal of Behavioural Science/Revue canadienne des sciences du comportement*, 30(2), 137-140. Retrieved September 25, 2008
- Walker, E. N., & McCoy, L. P. (1997). Students' voices: African Americans and mathematics. In J. Trentacosta & M. J. Kenney (Eds.), *Multicultural and gender equity in the mathematics classroom: The gift of diversity* (pp. 34-45). Reston, VA: National Council of Teachers of Mathematics.
- Warner, C., & Curry, M. (1997). *Everybody's schoolhouse – The schoolhouse. Best techniques for connecting home, school, and community*. Thousand Oaks, CA: Corwin press.
- Watson, J., & McEwen, A. (1994). Sixth form A level students' perceptions of the difficulty, intellectual freedom, social benefit and interest of science and arts subjects. *Research in Science & Technological Education*, 12(1), 43-53.
- Welzel, M. (1999). A study of factors determining the difficulty and interestingness of physics problems. In R. Duit (Ed.), *Research in science education - past, present, and future* (Vol. 2, pp. 369-371). Kiel, Germany: 2nd International Conference of ESERA.
- White, R., Gunstone, R., Elterman, E., Macdonald, I., McKittrick, B., Mills, D., & Mulhall, P. (1995). Students' Perceptions of Teaching and Learning in First Year University Physics. *Research in Science Education*, 25(4), 465-478.
- Yager, R.E., Simmons, P.E., & Penick, J.E. (1989). Student perceptions of the usefulness of school science experiences. *School Science and Mathematics*, 89(4), 313-319.