TRAINING STUDENTS' SELF-REGULATION OF MOTORIC FLEXIBILITY;

THE EFFECTS OF MODELING AND SELF-EVALUATION

by

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Abstract

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Advisor: Distinguished Professor Barry Zimmerman

The purpose of this research was to determine if technique modeling and self-evaluation had an impact on college students' self-regulation of motoric flexibility, measured through physiological assessments and surveys of stretching practices, flexibility outcome expectations, self-efficacy, and knowledge. In order to measure the impact of the treatments, students were randomly assigned to three conditions: 1) control lecture condition, in which flexibility fitness was taught using a scripted lecture format; 2) technique modeling condition, in which flexibility fitness was taught using the same script in addition to the researcher modeling proper stretching technique; and 3) technique modeling and self-evaluation condition, in which flexibility fitness was taught using the same script and technique modeling in addition to students being taught to measure their own motoric flexibility and to record their progress. It was hypothesized that the three treatment conditions would produce the following linear trend: condition 3 > condition 2 > condition 1 on the outcome measures. The results of this research study did demonstrate that flexibility training had a significant positive linear effect on college students' right upper body motoric flexibility, stretching practices, outcome expectations, self-efficacy and flexibility procedural knowledge.

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CHAPTER 1

Introduction

Physical activity is an important behavioral component in health promotion and disease prevention. One formal type of physical activity is exercise that is initiated in order to maintain or improve health, fitness and athletic performance. Despite these potential benefits, the Department of Health and Human Services reports currently that less than one-quarter of American adults engage in moderate-intensity physical activity and only one-quarter of the nations' adolescents regularly engages in moderate intensity physical acts (DHHS, 2002). In view of this, it is not surprising to learn the health and fitness status of Americans is declining. Wildman and Miller (2004), following a review of youth physical activity and fitness surveys, found 50% of students were not able to run a mile in under 10 minutes, 40% had poor upper body muscular fitness, and flexibility was inadequate among males. The concern is that school physical and health education programs do not adequately focus on current fitness nor promote the long-term goal of fitness for life. An instruction model that shifts the learning of exercise behaviors from external social sources to the individual in the form of self-regulation may greatly increase the possibility of long-term behavior adoption. The effect of exercise behaviors that are maintained over time extends well beyond the parameters of gym class. Long-term adoption of exercise behaviors have the potential to significantly impact the health status of Americans and reduce disease morbidity. This study seeks to investigate the impact of technique modeling and self-evaluation on college students' development of motoric flexibility – a subset of fitness. In addition, this study examines whether exposing students to the self-regulation skills needed by individuals to make appropriate adjustments in exercise behaviors will help to sustain the high level of motivation needed to achieve long-term fitness.

This chapter begins with the identification of health problems that afflict a majority of Americans mainly because of their lack of physical activity. In order to alleviate these health problems, fitness was declared a national objective in 2000 by the Department of Health and Human Services (DHHS, 2000). Also presented in this chapter is an overview of fitness, which includes its definition, a description of its development, and the rationale for its inclusion in physical and health education programs. The campaign for fitness has intensified recently in response to the public's failure to adopt exercise behaviors and commit to an active lifestyle. Understanding the obstacles individuals face, when intending to exercise, is essential for effective program planning. Identified in this chapter are barriers to fitness that health educators have faced in the past and still need to consider. A review of the research studies, involving interventions targeting activity and exercise levels, is also presented in this chapter. This study, based on Bandura's Social Learning Theory, is designed to use modeling to instruct college students on the proper technique for stretching, a sub-set of exercise. In addition, students in the study will be trained to self-evaluate, which is linked to monitoring, judging, and reacting to their technique with adjustments. These adjustments will presumably lead to greater flexibility, which will enhance joint and muscular function and reduce the chance of injury. If injuries are not avoided, they can interfere with one's long term efforts to exercise. This study seeks to contribute information about exercise behaviors and fitness to the field of health education in which the research is generally limited and even more so for the exercise sub-set of stretching.

Health Problems Associated with Inactivity

Millions of Americans suffer from chronic illness that often results from a sedentary lifestyle. As mentioned earlier, the Department of Health and Human Services reports that less than one-quarter of American adults engage in moderate-intensity physical activity and only one-quarter of the nations' adolescents regularly engages in moderate intensity physical acts (DHHS, 2002). This inactivity has led Wildman and Miller (2004) to characterize America as a nation of unfit and overweight individuals. Further substantiating this assessment, the DHHS released to the public in 2002 the incidence rates for several chronic diseases associated with inactivity. The report, entitled *Physical Activity Fundamental To Preventing Disease* cites: coronary heart disease afflicts 12.6 million; diabetes mellitus affects 17 million (90 – 95% have type 2 diabetes, which is associated with obesity and lack of exercise); pre-diabetes imposes on 16 million; colon cancer afflicts 107,000 newly diagnosed persons; hip fractures occur in 300,000 people a year; hypertension affects 50 million; and 50 million adults (age 20 to 74) are obese (27%), while 108 million are overweight (61%). DHHS concludes the report by stating "these diseases can be prevented or improved through regular physical activity (DHHS, 2002).

The Department, in addition to tracking health behaviors and disease rates, is charged with the responsibility of guiding its citizens towards optimal health. To that end, national health objectives were set in 2000 with a target date of 2010; the publication, entitled *Healthy People 2010*, identifies increased physical activity and exercise as a means to achieve the national goal of a physically fit population. The following is an excerpt from the publication.

Healthy People 2010 (DHHS, 2000)

- Increase to 35% the proportion of adolescents who engage in moderate physical activity for at least 30 minutes on 5 or more of the previous 7 days.
- Increase to 30% the proportion of adults who engage regularly, preferably daily, in moderate physical activity for at least 30 minutes per day.
- Increase to 43% the proportion of adults who perform physical activities that enhance and maintain flexibility.
- Increase to 30% the proportion of adults who perform physical activities that enhance and maintain muscular strength and endurance.

Thus fitness must be achieved in order to alleviate many of the health problems currently plaguing Americans.

Definition of Fitness

Fitness, an outcome of exercise, is defined lexically as a condition that enables a person to function physically - at work, in leisure, or in response to an emergency - with vigor (Wildman & Miller, 2004). Physical fitness is also described operationally as the ability to carry out daily tasks - without undue fatigue and with ample energy to enjoy leisure time pursuits and to meet unforeseen emergencies (President's Council on Fitness, 1985). Furthermore, the term fitness may be described structurally by its components - those that relate to specific sports and those that relate to general health.

The ability to perform a particular sport may depend on skill-related fitness components such as speed, power, agility, balance, coordination, and reaction time. Skill-related fitness tends to be sport-specific and is best developed through practice. Some fitness experts contend, however, that certain sports do not contribute fully to the requisite health-related components of physical fitness. Health-related fitness, on the other hand, includes cardiorespiratory endurance, muscular strength, flexibility, and body composition (Insel & Roth, 2010).

Components of Health-Related Fitness

Cardiorespiratory endurance is defined lexically as the ability of the body to perform prolonged, large-muscle, dynamic exercise at moderate to high levels of intensity. It can be achieved through aerobic activities, such as jogging, running, cycling, swimming, rope skipping and aerobic dance, if maintained for a period of 20 to 60 minutes. Muscular strength is defined operationally by the amount of force a muscle can produce with a single maximum effort. It depends on factors such as the size of the muscle cells and the ability of nerves to activate muscle cells. Muscular strength can be developed through calisthenics, such as push-ups and sit-ups, or more so by training with resistance weights. Muscular endurance, however, is the ability of a muscle or group of muscles to remain contracted or to contract repeatedly for a long period of time. Endurance is built through increasing the number of repetitions in an exercise set, such as a set of 10 sit-ups, as well as performing additional sets. For muscle movements that involve the joints, a degree of flexibility is needed to avoid injury. Flexibility, described as the ability to move joints through their full range of motion, is developed through stretching exercises. Proper technique involves stretching different parts of the body to the point of tension and holding the stretch for 15 to 30 seconds. It is also worth noting that muscle and connective tissue is an important constituent of overall body composition; greater muscle mass increases one's rate of metabolism, thereby facilitating quicker calorie use and helping to maintain a healthy body weight. Plainly, these components of fitness have a positive impact on overall health and, thus, are referred to as aspects of health-related fitness (Insel & Roth, 2010).

Explanation for Inactivity and Lack of Fitness

At present, the majority of Americans are not physically active. Kulinna, Zhu, Kuntzleman, and De Jong (2004) and Sniehotta, Scholz, and Schwarzer (2004), through surveys used in descriptive research, have identified a lack of knowledge among participants of cardiorespiratory and muscular fitness. In addition, Sollerhed, Apitzch, Rastam, and Ejlertsson (2008) examined the relationship between self-perceived physical competence and physical activity. Low rates of self-perceived competence were directly associated with low rates of self-reported physical activity as well as poor performance on actual fitness tests. As explained by Bandura (1986) in social cognitive theory, the lack of knowledge or skill can negatively impact self-efficacy. The findings from Sollerhed's et al. (2008) research suggest individuals, who see themselves as incapable, lack the motivation necessary to exercise. Furthermore, Americans are not convinced of the desirability and feasibility of exercise. Outcome expectancy involves the perceived probability of a result. Outcome expectations can be positive or negative; many individuals view the physical discomfort and the time commitment of starting an exercise regime as disincentives (Winters, Petosa, & Charlton, 2003). Without positive outcome and self-efficacy beliefs, the motivation of Americans to form goal intentions to initiate exercise is simply lacking.

Rationale for Inclusion of Fitness Goals in Physical and Health Education Programs

In line with the recommendations of the Centers for Disease Control (CDC), physical and health education programs have recently been requiring an increase in physical activity and exercise among participants in an attempt to collectively reach national fitness goals (CDC, 2001). The rationale for targeting activity and exercise levels are based on CDC's collected evidence, which demonstrates the mediating effects of them on both health and fitness (CDC, 2002). Adhering to a primary prevention model, CDC advises school-based physical and health education programs to emphasize exercise and moderate-to-vigorous intensity physical activity as part of their curriculum. Furthermore, after consideration of the epidemiological evidence on inactivity and obesity, Surgeon General Richard Carmona in his 2003 address called for “strong societal action” and invoked school administrators to emphasize through education the role physical activity has in lifelong maintenance of a healthy weight. Finally, physical activity and exercise have both been demonstrated in the scientific community to have a direct impact on organ functions and bodily systems as outlined below.

Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy expenditure (Insel & Roth, 2010). An increase in physical activity results in increased energy expenditure, which plays a critical role in weight loss and maintenance. Exercise, a subset of physical activity, however, is a planned physical act; it is distinguished by being structured, repetitive, and purposeful. One purpose of exercise is to promote fitness; this fitness enables one to respond appropriately to the physical challenges imposed by an active lifestyle and offers protection from injury or disease (Insel & Roth, 2010). Insel and Roth (2010) state that while physical activity is essential to health and confers wide-ranging health benefits, exercise is necessary to significantly improve physical fitness. Exercise regimes designed to improve general fitness are comprehensive and must address aerobic capacity, muscular strength, and flexibility.

Cardiorespiratory endurance training makes the heart muscle stronger and able to pump more blood per beat; thus fewer heart beats are required to circulate the amount of blood necessary for life-sustaining functions. Hence, regular physical activity can lead to cardiovascular fitness, which decreases the risk of hypertension and cardiovascular disease mortality. Aerobic exercise increases the amount of air breathed into the body per minute, elevating oxygen consumption (Insel & Roth, 2010). The result is increased oxygen transport via blood flow to working skeletal muscles, the heart and the brain, which significantly lower one's risk of heart attack and cerebral stroke.

Strength training exercises facilitate muscle cell changes that allow for greater energy production and power output (Insel & Roth, 2010). Weight bearing exercises in particular increase density and strength of bones, ligaments, and tendons, thereby protecting individuals against falls, fractures, and the condition of osteoporosis (Insel & Roth, 2010). In addition, muscular strength in the abdomen, hips, lower back, and legs supports the back in proper alignment enabling appropriate body mechanics when carrying out everyday activities, such as walking and lifting. Muscular strength in this area helps to protect against lower-back pain. Furthermore, multi-joint exercises, such as squats, bench presses, and pull-ups, assist in the development of coordinated functional movement patterns and balance. According to Wildman and Miller (2004), improving flexibility enhances joint and muscular function, reduces the chance of injury, and optimizes athletic performance and fitness levels.

In summary, regular physical activity has been shown to have beneficial effects on most organ systems and consequently leads to better control of blood pressure, blood cholesterol, blood glucose, and plasma insulin levels (Insel & Roth, 2010, *The Physical Educator*, 2003). The Department of Health and Human Services (2002) states: "regular physical activity has been shown to reduce morbidity and mortality from many chronic diseases." Experts believe interventions aimed at improving health and fitness must address, as mentioned earlier, aerobic capacity, muscular strength, and flexibility. In

2007, Wijndaele et al. found evidence that the inclusion of strength training as well as aerobic exercise in physical activity programs was related to a reduction in participants' risk levels for metabolic syndrome. Ideally, exercise regimens promoted by physical and health education programs should be structured with specifications for the intensity level, duration and frequency of the particular exercises, as suggested in the Healthy People 2010 objectives. Because physical inactivity is a risk factor for many diseases and conditions, making physical activity and exercise an integral part of one's daily life is crucial.

Research Studies on the Specific Exercise Subset: Stretching and Flexibility

Stretching is often the pre-exercise activity suggested to improve muscle flexibility. Yuktasir and Kaya (2007) investigated the long-term effects of static stretching and proprioceptive neuromuscular facilitation (PNF) stretching on range of motion, measured by a goniometer. After six weeks of training four times a week, subjects in both stretching conditions significantly improved their range of motion beyond the control no-stretching group (N=28). Also comparing stretching techniques, Bacurau et al. (2009) studied the effect of static stretching (SS) and ballistic stretching (BS) on lower limb flexibility and strength. All fourteen subjects were exposed to the three conditions: (1) 20 minutes of static stretching followed by leg press one-repetition maximum (1 RM), (2) 20 minutes of ballistic stretching followed by leg press 1RM, and (3) control condition of leg press 1RM. Bacurau and colleagues (2009) found that static stretching produced greater acute improvement in flexibility compared to ballistic stretching. The following researchers examined factors pertaining to scheduling and duration of stretching. In a randomized, single-blind, test-retest design study (N = 32), conducted by Rancour, Holmes, and Cipriani (2009), it was shown that intermittent stretching of hamstrings (3 days/week) was sufficient to maintain hip range of motion gains acquired from a prior (daily) static stretching program. Furthermore, Allison, Bailey, and Folland (2008) studied the acute effects of prolonged (40 seconds) static stretching (8 different stretching exercises) on male runners. A significant effect of prolonged static stretching was demonstrated, compared to the no-stretching control group, for sit and reach range of motion, isometric strength, and countermovement jump height.

Often stretching is recommended as a means to strengthen muscles and enhance physical performance. Kokkonen, Nelson, Tarawhiti, Buckingham, and Winchester (2010) examined lower-body strength among weight lifters. Two approaches to weight lifting training were investigated among 32 college students. A standard weight lifting program, that included 3 sets of 6 repetitions of knee extension, knee flexion, and leg press - 3 days per week for 8 weeks with weekly increases in weight lifted, was used with the weight training (WT) group. The second group (WT + S) performed the same lifting program as the WT group, combined with static stretching exercises designed to stretch the hip, thigh, and calf muscles twice a week for 30 minutes. Kokkonen and colleagues (2010) reported that the WT+S group had significantly greater knee extension and leg press gains than the WT group. The researchers recommend novice lifters include static stretching exercises in their weight lifting regimen in order to maximize the strength gains made in the early phase of training.

Studies have shown stretching exercises increase flexibility and, in certain circumstances, enhance strength; yet some experts also include injury prevention among the benefits of stretching. Hamstring strains, as cited by O’Sullivan, Murray, and Dainsbury (2009), are one of the most common injuries experienced by athletes; these injuries often result in significant loss of playing time. Research conducted by O'Sullivan et al. (2009) demonstrated, in a randomized, crossover design study with 36 subjects, that static stretching significantly increased hamstring flexibility, whereas dynamic stretching did not. In addition, Eston, Rowlands, Gleeson, Coulton, and McKinney (2005) demonstrated through their research that an increase in the flexibility of the hamstring muscle group leads to some protection from strength loss at long muscle lengths following exercise-induced muscle damage. Eston et al. (2005) believe that proprioceptive neuromuscular facilitative (PNF) stretching stimulates an increase in the number of sarcomeres-in-series, which leads to a favorable length-tension relationship within the muscle, thereby reducing possible damage from excessive strain to the sarcomeres.

Stretching has also been purported to enhance balance. Costa, Graves, Whitehurst, and Jacobs (2009) examined the effect, on the balance of 28 women, of different durations of static stretching. It was found that subjects maintaining a static stretch for 15 seconds, as compared to 45 seconds, produced significant improvement in balance scores, assessed by using the Biodex Balance System. Costa et al. (2009) suggest stretching interventions with 15-second hold durations may improve balance by decreasing postural instability. Additionally, Hrysomallis (2010) states that abnormal postural alignment can be detrimental to muscle function and contribute to joint pain. It is postulated that faulty posture may result from short and tight scapular abductor muscles or weak and lengthened scapular retractor muscles or a combination. In a review of strengthening and stretching exercises for postural correction of the scapulae, Hrysomallis (2010) cites correlational studies that demonstrate a significant relationship between muscle length and scapular position. Also cited in the review were prospective intervention studies that demonstrate stretching, of the anterior chest muscles on its own or in combination with strengthening the scapular retractors, can beneficially alter the position of the scapula at rest in individuals with abducted scapulae (Hrysomallis, 2010).

The Challenge of Acquiring Fitness

Adoption of physical activity and exercise behaviors is a complex process, involving multiple personal and environmental factors. It is clear, based on declining fitness rates, that exercise behaviors have not been adequately integrated into the contemporary American lifestyle. The baseline data collected in 1995, during the formation of *Healthy People 2010* objectives, reveal that at this time only one-quarter (24.5%) of the population regularly performed flexibility exercises, less than one-fifth of the population regularly performed muscle strength exercises, and less than one-third of American adolescents participate in daily physical education (DATA 2010, DHHS 2000). Furthermore, the DHHS's report, entitled *Physical Activity Fundamental To Preventing Disease,* states physical activity participation, during the ages of 14 and 19 years, declines steadily (DHHS, 2002).

Affecting exercise behaviors requires understanding of the cognitive forces that operate within individuals as well as recognizing the physical and social environments of family, peers, school, and community. Personal factors are cognitions, thoughts, and beliefs that may impact the performance of exercise; these include personal characteristics such as knowledge, attitudes, expectations, self-efficacy, and locus of control. Prevalent in the research is the finding that physical education which exclusively uses a sports-based curriculum can negatively impact personal factors, such as self-efficacy, thus decreasing one's likelihood of performing exercise (Brooks & Magnusson, 2006; Gronmo & Augestad, 2000; Masurier & Corbin, 2002; Mohr, Townsend, & Pritchard, 2006; Solomon, 2007; The Physical Educator, 2003).

Environmental factors are those elements of an environment that may influence the enactment of exercise behaviors. Regarding physical activity, they may include teacher instruction, peer influences, role models, cultural and social norms, social support, facility availability, equipment options, and exercise opportunities. Research has cited a general non-compliance, by physical educators, to the CDC-recommended health-based curriculum as a hindrance in students' achievement of overall fitness (Brooks & Magnusson, 2006; Masurier & Corbin, 2002; Mohr, Townsend, & Pritchard, 2006; Sibley & LeMasurier, 2008; *The Physical Educator*, 2003). In addition, within the school culture, physical education has an inferior position when compared to other academic disciplines; this has yielded to lower budgets, fewer physical education teachers, and inadequate facilities (Couturier, Chepko, & Coughlin, 2007; Masurier & Corbin, 2002; Sibley & LeMasurier, 2008). These factors in conjunction with a lack of policy enforcement have resulted in a reduction of exercise opportunities for students (Masurier & Corbin, 2002).

Behavioral factors that may impact exercise include individual's physical skills, activities, behavioral intentions, adaptations, and coping responses. More recently studies have examined the gap between intentions and actual exercise; thus far, correlational data has shown intentions and other factors to have a mediating effect on activity levels (Kulinna, Zhu, Kuntzeman & DeJong, 2006; Lutz, Karoly, & Okun, 2007; Motl et al., 2005; Petosa, Suminiski & Hortz, 2003; Rovniak, Anderson, Winett, & Stehens, 2002; Scholz, Sniehotta, Schuz, & Oeberst, 2007; Sinehotta, Scholz, Schwarzer, 2005; Winters, Petosa, & Charlton, 2003; Ziegelmann & Lippke, 2007). More research is needed, however, on health and physical education interventions that directly impact exercise behaviors.

Research on Curriculum Interventions

Educators have responded to CDC's call for action by examining the various components of both health education and physical education. The focus of research in this field for the last decade has mainly been on curriculum content and the format of its delivery. Aggeloussis, Derri, and Petraki (2004) examined the use of a health-related fitness curriculum, delivered through lecture format, to elementary school children. Whereas a format using physical activity exercises was the experimental means, by which health-related fitness principles were conveyed to elementary school children by Faigenbaum et al. (2009) and to high schools students by Faigenbaum and Mediate (2006) and Wright and Karp (2006). The physical activities employed in the aforementioned studies included pylometrics, medicine ball training, and aerobic exercise, respectively. In each of these studies, the use of a health-related fitness curriculum, which conveys the principles of cardioerespiratory endurance, muscle strength and flexibility, was shown to have a positive effect on student fitness levels over the control condition of traditional physical education, comprised of running games and sports.

Educational researchers have also examined, with regard to exercise, self-regulatory constructs, such as goal setting, planning, self-efficacy, outcome expectations, social and environmental structuring, monitoring, and self-evaluation, among high school students (Motl et al., 2005; Winters, Petosa, Charlton, 2003) and college students (Lutz, Karoly, Okun, 2008; Petosa, Suminiski & Hortz, 2003; Rovniak, Anderson, Winett & Stephens, 2002). These same self-regulatory constructs were investigated, by health researchers, among cardiac patients (Scholz, Sniehotta, Schuz, & Oeberst, 2007; Sinehotta, Scholz, Schwarzer, 2005) and orthopedic patients (Ziegelmann & Lippke, 2007). In each of the aforementioned studies, the psychosocial variables were measured through self-report questionnaires. Analysis of the data, utilizing structural equation modeling (Lutz, Karoly, Okun, 2008; Motl et al., 2005; Sinehotta, Scholz, Schwarzer, 2005; Ziegelmann & Lippke, 2007) and hierarchical multiple regression (Petosa, Suminiski & Hortz, 2003; Rovniak, Anderson, Winett & Stephens, 2002; Scholz, Sniehotta, Schuz, & Oeberst, 2007; Winters, Petosa, Charlton, 2003) reveals most of the self-regulatory constructs to be predictive of exercise among these individuals.

As mediational studies have identified potential determinants of physical activity and exercise, researchers have designed interventions targeting these mediating self-regulatory factors. Sinehotta, Scholz, Schwarzer, Fuhrmann, Kiwus, and Voller (2005) investigated the impact of self-regulation training on the exercise levels of cardiac patients. Likewise, educational researchers incorporated self-regulation training into the curriculum used by health and physical educators. Sallis, McKenszie, Alcaraz, Kolody, Faucette, and Hovell (1997) utilized a combined self-regulation and health-related fitness curriculum to study fitness outcomes among elementary school children. Similarly, a combined curriculum, merging self-regulation with fitness instruction, was the intervention examined in studies among high school students (Hortz & Petosa , 2008; Ward, Saunders, Felton, Williams, Eping &Pate, 2006) and among college students (T. Adams, Graves, & H. Adams, 2006; Cardinal & Spaziani, 2007; Chen, Wang, & Yeh, 2005; Petosa and Suminski, 2006).

Increased exercise and physical activity, recorded through recall checklists, was demonstrated in several studies using the combined health-related fitness and self-regulation curriculum (Sinehotta, Scholz, Schwarzer, Fuhrmann, Kiwus, & Voller, 2005; Sallis, McKenszie, Alcaraz, Kolody, Faucette, & Hovell, 1997; Hortz & Petosa , 2008; Ward, Saunders, Felton, Williams, Eping &Pate, 2006). One exception is the study by Cardinale and Spaziani (2007) in which exercise differences, post-intervention, were not found to be significant. However, improved fitness, measured through various physical tests, including timed distance runs, sit and reach assessments, and repetition of sit-ups and push-ups, was demonstrated in a few studies using the combined intervention curriculum (Sallis et al., 1997; Chen et al., 2005). Lastly, increased self-regulation, assessed through self-reported questionnaires, was an outcome of the following studies: Sinehotta et al. (2005), Hortz and Petosa (2008), Cardinal and Spaziani (2007), and Petosa and Suminski (2006).

Although the results look promising, there are some problems limiting the utility of specific research designs presented here. First of all, the mediational studies are mostly correlational and do not permit definitive statements regarding causal relationships between self-regulation variables and exercise or physical activity. Although the other studies do attempt to form treatment groups and manipulate curriculums, in order to examine the resultant effect on exercise, the majority relied on convenience sampling, which threatens the validity of the research. Chen et al. (2005) further limits the study's validity by utilizing a one-group, pre-test, post-test design. Only in the studies conducted by Faigenbaum et al. (2009), Faigenbaum and Mediate (2006), and Hortz and Petosa (2008) were subjects randomly assigned to treatment or comparison groups. However, Sallis et al. (1997) and Wright and Karp(2006) did utilize random cluster sampling. Regarding comparison groups, T. Adams, Graves, and H. Adams (2006), as well as Cardinale and Sapziani (2007), weakened the results of their study by using less than ideal comparison conditions. And lastly, Petosa and Suminski (2006) had a viable research design but did not measure students' fitness, exercise or physical activity levels, limiting the usefulness of the evidence.

In summary, the research findings reported thus far suggest health-related fitness curriculums, delivered through lecture or physical activity formats, as well as self-regulation curriculums, delivered through lecture, and finally a combination curriculum, which incorporates self-regulation training into fitness instruction, may increase exercise and activity levels and subsequent fitness. It is clear, however, that more rigorous research is needed to better identify educational interventions that include manipulating students' regulatory styles in a way that results in increased exercise levels and fitness. Health and physical education research, that is experimental in design and theory driven and that acknowledges the importance of self-regulation in exercise behaviors, is needed to specifically improve flexibility among students. Currently, there is a paucity of research that explicitly addresses flexibility, and, when fitness status is measured in existing studies, flexibility is the area least likely to change post-intervention. The next section provides a description of the study, grounded in Social Cognitive Theory, which has the potential to impact the flexibility of students.

Self-Regulation Model

A conceptual model or theory can be useful in identifying the forces that influence exercise behaviors and affect change. In the past, health behavior change programs, utilizing Bandura's Social Cognitive Theory as a conceptual model, have achieved successful health outcomes (Baranowski, Perry & Parcel, 1996). Using this model, researchers can identify environmental, personal, and behavioral factors that may be predictive of physical activity and by modifying these same factors produce a change in exercise behaviors. To successfully change exercise patterns and improve fitness, interventions must be aimed at these factors.

The intervention employed in this research study is self-regulation training for college students, who are enrolled in an introductory health education class, which generally conveys the health-related principles of fitness and specifically addresses flexibility. The design of the intervention is based on the three key sub-processes of self-regulation outlined by Bandura (1986), which include self-observation, self-judgment, and self-reaction.

Bandura (1986) states that behavior can be affected by vicarious learning and vicarious reinforcement through observation of behavioral models; based on this premise modeling of stretching technique will be employed in this study. Observational learning, as described by Zimmerman and Schunk (2001), refers to an individual who learns the major features of a skill, such as stretching, by experiencing the lesson vicariously through written words and illustrations or by watching a model perform the task. The learners' memory of the modeled behavior then becomes an internalized point of reference. Subsequent learning is accomplished when individuals, demonstrating independent use of the skill, are able to self-judge their performance against the reference point or standard; this stage of learning is described as the self-judgment sub-process of self-regulation (Zimmerman & Schunk, 2001). Students in this study will be assigned stretching exercises to be conducted independent of class time. Evaluating one's progress, based on the feedback provided by self-monitoring and judging, inevitably leads one to react; this stage is referred to as the self-reaction sub-process. Students in the study will be given tape measures with instructions to measure their flexibility over time; this act will facilitate self-monitoring and judging. Reactions of satisfaction typically occurs when progress is made towards modeled standards; this in turn enhances self-efficacy and motivation to continue the target behavior, demonstrating the cyclical nature of self-regulation described by Zimmerman (Zimmerman & Schunk, 2001). When self-evaluation leads to a dissatisfied reaction, one can use the information provided by the monitoring feedback to adjust their skill performance; students will be encouraged to regulate their exercise behaviors based on this feedback. Furthermore if one believes improvement is possible, then more effort will be expended and the individual will persist. Through these self-regulatory mechanisms students can learn the fundamentals of flexibility exercises and the means to make appropriate adjustments so that individuals can maintain self-efficacy and stay motivated to attain fitness.

Adoption of physical activity that specifically enhances flexibility is a complex process, involving multiple personal and environmental factors. Efforts to train college students to incorporate flexibility exercises into their routines have produced mixed results. As shown in the literature review, health education classes generally promote exercise awareness through information dissemination in a lecture format, while physical education courses generally include a performance component in the curriculum. However, in this performance context, stretching is more often modeled as a warm up for a sport skill lesson. The benefits of stretching specifically for increased flexibility are not necessarily addressed. An instruction model that shifts the learning of flexibility exercises from external social sources to the individual in the form of self-regulation greatly increases the possibility for long-term behavior adoption.

Research Study

This research will compare the impact of traditional forms of health education with instruction designed to enhance self-regulation of a key outcome of exercise:

motoric flexibility. This study seeks to investigate the impact that two self-regulatory processes, technique modeling and self-evaluation, have on college students' self-regulation of motoric flexibility as measured through physiological assessments and surveys of stretching practices, outcome expectations, self-efficacy and procedural knowledge of flexibility exercises.

*Research Questions***:**

1) Does technique modeling produce greater motoric flexibility, stretching practices of greater duration, and higher levels of flexibility outcome expectations, self-efficacy, and procedural knowledge than lecturing?
2) Does technique modeling combined with self-evaluation produce greater motoric flexibility, stretching practices of greater duration, and higher levels of flexibility outcome expectations, self-efficacy, and procedural knowledge than technique modeling alone or lecturing?

Hypotheses:

1) There will be a significant linear trend between students' exposure to three levels of self-regulation training (no self-regulation lecturing, technique modeling alone and with self-evaluation) and students' *right upper body flexibility*.
2) There will be a significant linear trend between students' exposure to self-regulation training and students' *left upper body flexibility*.
3) There will be a significant linear trend between students' exposure to self-regulation training and students' *lower body flexibility*.
4) There will be a significant linear trend between students' exposure to self-regulation training and the duration of students' *stretching practices*.

5) There will be a significant linear trend between students' exposure to self-regulation training and students' flexibility *outcome expectations*.
6) There will be a significant linear trend between students' exposure to self-regulation training and students' flexibility *self-efficacy*.
7) There will be a significant linear trend between students' exposure to self-regulation training and students' procedural *knowledge* of flexibility exercises.

CHAPTER 2

Literature Review

This chapter provides a historical perspective of physical and health education, which encompasses sports-based and health-based curriculums. This section is followed by findings of survey research that identifies limitations of these curriculums. Additionally, epidemiological evidence is presented to explain the institution of the public health approach used in physical education that subsequently followed. However, non-compliance by schools to the physical education policies espoused by the public health model has resulted in an unfit and overweight student population. Researchers, therefore, have joined with educators in order to study the effect modified instruction may have on students' health and fitness. School researchers have focused their attention on interventions in which curriculum content and instructional format are examined. Furthermore, studies focusing on self-regulation of activity and exercise behaviors, within and outside the school context, are being investigated. Included in this section are the results of these various research studies, which were hypothesized to affect change in health and fitness knowledge, exercise and physical activity levels, and fitness status. The last subdivision of this chapter synthesizes the research presented here on instructional methods that employ self-regulation training to impact exercise behaviors and subsequent fitness, thus providing a rationale for this study.

Physical Education – Prior to 1960

Sports-based Curriculum

Physical education has long been considered a fundamental part of the school curriculum. Early on, the mission of physical educators was to prepare students to participate in sports that would undoubtedly continue to serve as a source of activity and enjoyment throughout their lifetime (*The Physical Educator,* 2003). Students received skill instruction and governing rules for specific sports as well as the provision of authentic opportunities for strategy development (Mohr, Townsend & Pritchard, 2006). The primary goal of physical education was to immerse the student in the culture of the activity so that students would become competent, literate, and enthusiastic sportsmen (Mohr et al., 2006). Physical education programs first became compulsory in California in response to state legislature enacted in 1866 mandating it as part of the public school curriculum (Masurier & Corbin, 2002). Physical education programs then spread to schools in the other states and the sports-based curriculum prevailed until the late twentieth century.

Limitations of Sports-based Curriculum

The focus of sports-based instruction is geared towards developing skill-related fitness, such as speed and agility for the sake of sport performance, instead of focusing on essential health-related fitness (*The Physical Educator,* 2003). Furthermore, the nature of the sport education model is competitive (Brooks, 2006) and in direct contrast to the socio-moral curriculum used by some physical educators to promote distributive justice reasoning (Solomon, 2007). Qualitative research, conducted with students participating in sports-based physical education, reveals problems with masculine hegemony. In a sports-based context, physical education reinforces “the construction of masculine identities based on physical prowess and competitiveness” (Solomon, 2007). The sports-based education model is noted to be problematic for non-athletic boys (Solomon, 2007). Researchers have found a relationship between adult males who view sports negatively and those who had a negative physical education experience during their school years (Solomon, 2007). Also cited in survey research is the finding that children’s perceptions of their physical education experiences contribute to their decisions regarding physical activity engagement, thus the importance of a positive experience (J. Jenkins, P. Jenkins, Collums, & Weronig, 2006). Furthermore, there are fewer opportunities for females and lower skilled students to meaningfully participate in sports-based activities (Mohr, Townsend, & Pritchard, 2006). In contrast, Gronmo and Augestad's (2000) research demonstrates students need gender-appropriate, age-modified, and ability-tailored physical education opportunities in order to positively affect self-worth and confidence.

Typically, the format of sports-based instruction involves rule disclosure during the orientation phase and governance for specific activities during the game phase (Brooks & Magnusson, 2006; Mohr, Townsend, & Pritchard, 2006). These activities are classified by sport, and teams of students are created to implement the game plan. The curriculum is a compilation of numerous brief sport activity units offered over the course of a year; each unit consists of abbreviated, consecutive sessions of skill instruction, decontextualized drill practice, and adult versions of the game being played. This approach persists with little variation or progression in activities from grade to grade, ignoring the need for sequential and developmentally appropriate physical education (Masurier & Corbin, 2002, *The Physical Educator*, 2003). The premise of sports-based instruction is that, through exposure to a wide range of activities, students discover through experimentation activities they can perform naturally or with limited practice and instruction (Mohr, Townsend, & Pritchard, 2006). Criticisms of this approach include: superficial exposure to skill and strategy development, the lack of time devoted to developing skill proficiency, and limited student involvement. Mohr et al. (2006) states "students typically discover they are neither naturally gifted nor proficient at most activities and the lesson is viewed as supervised recreation." Evidence suggests that exposure to team sports has not been effective in promoting health-related fitness or physically active lifestyles for the majority of students (Masurier & Corbin, 2002; Mohr et al., 2006). Furthermore, utilization of sports or group activities as the method of instruction distracts the educator from teaching individuals how to develop plans for personal fitness (Evans, Roy, Geiger, Werner, & Burnett, 2008).

The activities promoted through the sports education model are considerably different from the leisure activities performed by most adults (Masurier & Corbin, 2002). Relatively few people participate during adulthood in the sports that once dominated the physical education curriculum of their youth. After completing secondary school and college, adults must contend with the responsibilities of job, family, and reduced leisure time (The Physical Educator, 2003). The lack of adult participation in sports activities can also be attributed to limited access to facilities, equipment, transportation, and ready-made teams that are usually comprised of a large number of skilled and knowledgeable members (Masurier & Corbin, 2002; Mohr, Townsend, & Pritchard, 2006; The Physical Educator, 2003). For these reasons, physical education should be designed to afford adolescents the opportunity to learn and adopt fitness activities that are individualized, health-related, and can endure across the lifespan.

Health-related Fitness Curriculum in Physical Education

During the social unrest of the 1960s, universities were forced to address society's dissatisfaction with higher education. These social forces brought about a reform movement in which college courses underwent review (Masurier & Corbin, 2002). In some cases, decisions were made to eliminate courses; in other cases substantial revision was required in order to retain the program. During this time, many college physical education requirements were dropped, and those programs that did survive did so by changing to a health-based approach that focused on fitness (Masurier & Corbin, 2002). These health-based courses were tolerated by "stakeholders" of the educational community largely because of the emerging popularity of fitness with Americans. The availability of newly released fitness information sparked an interest in new approaches to the conventional sports-based physical education. Acceptance of the health foundations approach to college physical education occurred at about the same time that aerobic exercise material was first published and marketed to the general public. In fact, according to Masurier and Corbin (2002), the first health-based physical education textbook was published in 1978.

The health-related fitness movement, however, did not emerge in middle and secondary schools until the late 1980s. At this time, Florida's legislature mandated middle and secondary schools to provide health-based physical education; subsequently several states followed suit and adopted physical education requirements that focused on health-related fitness (Masurier & Corbin, 2002). During the 1990s, colleges began to apply another label, conceptual physical education (CPE), to courses that focused on health-related fitness and broader wellness concepts. CPE courses, still utilizing a health-based approach, are structured with a lecture component, addressing health and wellness issues, combined with a physical activity module (*The Physical Educator*, 2003).

Public Health Approach to Physical Education

As epidemiological evidence, showing the health benefits of regular physical activity, mounted health experts began to call for a "public health approach" to physical education (Masurier & Corbin, 2002). Researchers had accumulated sufficient data to demonstrate that moderate-to-vigorous intensity physical activity could substantially reduce the risk of developing heart disease, diabetes, colon cancer, and high blood pressure (*The Physical Educator*, 2003). Thus, the promotion of physical activity and health-related fitness initiated in middle and secondary physical education classes during the 1980s was legitimized. Additionally, public health experts, in an effort to prevent chronic disease, suggested comprehensive school health and wellness programs be implemented to further support health-based physical education. Utilizing school environments and curriculums to implement programs that could affect long-term health was seen as an efficient mechanism to deliver information to and impact health behaviors of a large segment of the population. Furthermore, students enrolled in physical education classes are at a developmental stage in which knowledge, attitudes and motoric skills are forming and, if properly directed, can lead individuals to lifelong fitness. Acknowledging that physical education's role is more important than ever in meeting the public health goals for Americans, the health-based approach has been called in recent times the public health model of physical education (Masurier & Corbin, 2002).

The realization that quality physical education is necessary for the public to attain health-related fitness led public officials to establish new guidelines, policies, and legislation governing physical education. In 2000, the Department of Health and Human Services (DHHS) issued a report to the President, entitled *Promoting Better Health for Young People Through Physical Activity and Sports*; it states: "all children from pre-kindergarten to grade 12 should participate in physical education classes every school day" (DHHS, 2000). In that same year, the DHHS also established specific measurable physical activity goals for the nation's student population to be reached by the year 2010. These objectives were based on epidemiological data collected in the 1990s. Outlined below are the 2010 objectives that pertain to physical education (DHHS, 2000)

Healthy People 2010 Objectives:

- Increase to 35% the proportion of adolescents who engage in moderate physical activity for at least 30 minutes on 5 or more of the previous 7 days.
- Increase to 85% the proportion of adolescents who engage in vigorous physical activity that promotes cardiorespiratory fitness 3 or more days per week for 20 or more minutes per occasion.
- Increase the proportion of the nation's public and private schools that require daily physical education for all students (i.e. 25% for middle schools and 5% for high schools).
- Increase to 50% the proportion of adolescents who participate in daily school physical education.
- Increase the proportion of adolescents who spend at least 50 percent of school physical education class time being physically active.

(DHHS, 2000)

The following year, in 2001, Congress authorized the United States Department of Education to administer the Physical Education for Progress (PEP) bill as part of Title X of the Elementary and Secondary School Act of 1965. The bill authorized 5 million dollars be used to improve school physical education programs. In 2002, the bill was extended and authorized 50 million dollars for additional improvements in physical education among school districts. Additionally, the Child Nutrition and WIC Reauthorization Act of 2004 included a requirement that school districts with federally funded meal programs create and implement wellness policies that address nutrition and physical activity by the start of the 2006-2007 school year. Policy guidelines included: increasing time allotted for physical education, providing daily recess, providing opportunities for physical activity before and after school hours, and not using physical activity as punishment (Sibley & LeMausier, 2008). These national initiatives clearly show that health-based physical education and compulsory physical activity play a central role in our nations' public health model.

Problems with the Public Health-based Approach to Physical Education

While the call for a health-based curriculum has been strong from a wide variety of sources including national health objectives, federal acts, and a report to the President, the adoption of a public health approach towards physical education has been less than universal (Masurier & Corbin, 2002).

Part of the problem lies in the bureaucratic process that governs public education. For example, although physical education recommendations are made at the national level, laws requiring physical education are enacted at the state level. Furthermore, the implementation of the laws, governing physical education, actually rests with the local school districts (Masurier & Corbin, 2002). For instance, the national Child Nutrition and WIC Reauthorization Act includes a requirement that school districts, with federally funded meal programs, create policies that address physical activity. When policy guidelines, aimed at increasing time allocated for physical education, were issued, school districts viewed them as voluntary acts - not procedures to become adopted (Sibley & LeMausier, 2008). So, while the law requires districts to create wellness policies, there is no accountability for adherence to the policies included in the law (Sibley & LeMausier, 2008).

Additionally, the multilevel governance of physical education inadvertently results in the inconsistent provision of physical activity opportunities. The National Association for Sports and Physical Education (NASPE) discloses these inconsistencies in a 2001 report on statewide physical education participation rates. State laws governing physical education vary according to the following breakdown. Eighteen states legally require high school students to participate in physical education for one year during their four-year tenure, while five states require a one-and one-half year participation, six states require a two-year participation, two states require a four-year participation, three states do not require any participation, and the remaining states defer to the local school districts to establish requirements (Masurier & Corbin, 2002; *The Physical Educator*, 2003). The School Health Policies and Programs' Study (SHPPS) reveals the percentage of elementary school districts requiring physical education for the year 2000 to be a mere 82.6% (Masurier & Corbin, 2002). Regarding post-secondary institutions, NASPE reveals 63% of all colleges require health-based physical education; the remaining colleges have physical education courses available as an elective (Masurier & Corbin, 2002). Clearly schools do not universally adopt polices that mandate physical education be provided to and required by students; this impedes the national quest for fitness and optimal health.

Besides the lenient policies regarding physical education requirements, the staffing policies for physical education teachers also appear relaxed, such that certification was not mandated in some cases. The National Association for Sports and Physical Education's 2001 Shape the Nation report discloses the following information regarding staffing (Masurier & Corbin, 2002). Only four states require elementary physical education be taught by a certified physical education teacher. The remaining 45 states recommend certified physical education teachers be assigned to teach gym, but non-specialized elementary school teachers were officially allowed to teach physical education. Regarding middle schools, 38 states mandate physical education be taught by certified physical educators; however teachers of other subject matter are permitted to teach physical education in the remaining states. Lastly, in high school, states mandated that physical education be taught by a physical education specialist (Masurier & Corbin, 2002).

Another consequence of the bureaucratic disposition of physical education policy is the lack of oversight the discipline experiences. The SHPPS 2001 report indicates daily physical education is required by as few as 8.0% elementary schools, 6.4% middle schools, and 5.8% high schools (Masurier & Corbin, 2002). Brooks and Magnusson (2006) cite that students did not have adequate access to physical education and, when able to participate, students were exposed to a limited range of activities. The School Health Policies and Programs Study also reveals non-compliance with the health-based curriculum endorsed by health and physical education professionals. For example, SHPPS researchers found 68.1% of the elementary schools surveyed regularly implemented bombardment games (dodgeball) and more than half utilized games called “king of the hill,” “steal the flag,” elimination tag, and “duck, duck, goose” - activities no longer considered appropriate in health-based physical education (Masurier & Corbin, 2002; Sibley & LeMausier, 2008). The evidence suggests that many educators continue to subscribe to the sports-based approach to physical education rather than focus on long-term health (Masurier & Corbin, 2002; The Physical Educator, 2003). Mohr, Townsend and Pritchard (2006) believe the resistance of physical educators to change curriculum direction rests with the popularity of team sports. According to Mohr et al. (2006), Americans tend to hold sports in high regard and find, even without active participation, enjoyment as a spectator. However non-compliance to the public health approach and lack of oversight enables a spectator mindset to develop among students rather than active involvement in lifetime fitness activities.

Further contributing to the barriers faced by advocates of the public health model for physical education is the shift in priorities. Politicians and school administrators changed their focus, which in 2000 was on implementing the public health model in physical education and later was redirected to improving national reading and math test scores in 2002 (The Physical Educator, 2003). The importance of student achievement on standardized tests is a legitimate concern for educators, since the No Child Left Behind Act was passed into law on January 8, 2002 (Sibley & LeMasurier, 2008). This federal law increases school accountability for student academic performance, and the law, in support of this new priority, enables spending flexibility with the federal funds at the local school level (Sibley & LeMasurier, 2008). The current emphasis on standardized test performance has subsequently jeopardized the initial advances made in health and fitness by physical education in the past decade (Sibley & LeMasurier, 2008). The Executive Director of the American Association of School Administrators has acknowledged that the time allocated to physical education has been reduced in recent days because principals are trying to avail as much academic instructional time as possible to prepare students for state achievement tests (Sibley & LeMasurier, 2008; *The Physical Educator*, 2003).

In response to the No Child Left Behind Act, several consequences have occurred that threaten the attainment of the public health objectives (Healthy People 2010) that were being sustained largely through the health-based curriculum of physical education. As the levels of physical activity declined, the prevalence of overweight female children increased from 13.8% in 1999-2000 to 16% in 2003-2004, as did the prevalence for overweight male children, which increased from 14% in 1999-2000 to 18.2% in 2003-2004 (Sibley & LeMasurier, 2008). With the emphasis now on academics, the budget for physical education departments are reduced, which negatively impacts the number of teacher positions, the equipment available and the facilities in which activity and exercise is conducted (Sibley & LeMasurier, 2008). Females, more often than males, express discomfort (64.8% of 5,308 survey responses) with the facilities used for physical education; these include deteriorating showers, lack of private changing areas, unsanitary locker rooms, and lack of storage for clothing, which preclude a willingness to participate (Couturier, Chepko and Coughlin, 2007).

Reacting to the pressure for greater achievement scores in math and reading, teachers are reluctant to decrease time in academic subjects for physical education. The time allocated for elementary physical education in most states, during 2001, ranged from 30 to 150 minutes per week, for middle school from 80 to 275 minutes per week, and for high school from none to 225 minutes per week (Masurier & Corbin, 2002). The time scheduled at the lower range for each school is, according to the National Association for Sports and Physical Education, grossly inadequate for fitness (Masurier & Corbin, 2002). The ease with which educators slash the time intended for physical education provides evidence of the inferior standing that physical education has within the school system. This is further substantiated by the School Health Policies and Programs' Study, which indicates that 41% of the schools offering physical education stipulated that physical education grades were to be weighted less or were not to factor at all in the grade-point-average (Masurier & Corbin, 2002; Sibley & LeMasurier, 2008). In addition, data collected from the SHPPS survey conducted in 2006 reveals that a significant percentage of students are routinely exempted from physical education, specifically 20.8% from elementary school, 22.7% from middle school, 30.9% from high school for a myriad of reasons that include: participation in community services, participation in school sports, and participation in other school activities, such as band or chorus (Masurier & Corbin, 2002; Sibley & LeMasurier, 2008). It was found that 46% of the states and 63.5% of the school districts had no policy for discouraging teachers from withholding physical education as punishment for bad behavior in another class. Use of physical education in this manner illustrates the prevailing viewpoint that physical education is essentially a form of recess (Sibley & LeMasurier, 2008).

Contemporary Research on Health and Physical Education

Public health officials and educators, witnessing the growing incidence of obesity among school children, have reemphasized the use of a health-based approach to physical education as a means to stop the obesity epidemic, reduce the associated chronic diseases, and promote exercise behaviors that will be sustained through adulthood. Policymakers have introduced more specific guidelines and additional resources to assist school administrators with the critical implementation. In an effort to make schools more accountable, non-profit organizations, such as the National Association for Sports and Physical Education, have taken on the responsibility to assess and report to the public the status of physical education at individual schools and the level of adherence to national recommendations. And lastly, researchers from both educational and health disciplines have allocated more resources to examine the factors that may impact activity and exercise behaviors.

Research on Today's Use of Health-related Fitness Curriculums (HRFC) in Schools

During the most recent decade, researchers in the field of health and physical education have concentrated their efforts on examining the components of curriculum content and the format of instruction. Much of the research has centered around health-related fitness curriculums, which address the principles of cardiorespiratory endurance, muscle strength, and flexibility, in comparison to traditional physical education curriculums, which are comprised of running games and sports activities. Within the school system, health and physical education curriculums tend to be delivered through a format of lecture, physical activity exercises, or a combination.

HRFC: Combined Format of Lecture and Physical Activity

Aggeloussis, Derri, and Petraki (2004) studied the effect that a health-related fitness curriculum, delivered through a format that combined lecture with physical activity, had on elementary school children's fitness ($N=38$). The principle tenets of the health-related fitness curriculum were conveyed to subjects in the treatment group, utilizing an after-school program. The program entailed lectures on fitness and nutrition as well as participation in exercise activities. The effect on subjects participating in the treatment condition for one hour three times a week was compared to the effect on the control subjects participating in traditional physical education class, which met two times a week for 45 minutes. MANOVA revealed the treatment group had significantly better cardiorespiratory endurance, measured by a timed one-mile walk/run test ($F[1,38]=7.08$, $p<.05$) and significantly better abdominal strength, measured by the number of curl ups ($F[1,38]=8.25$, $p<.01$). Although the interaction between the treatment and the group factors was statistically significant for the sit-and-reach test with the right ($F[1,38]=8.57$, $p<.01$) and left leg ($F[1,38]=7.07$, $p<.05$), means comparisons revealed that neither the experimental nor the control group had significant improvement in flexibility. The treatment group did however have a positive score change after treatment, while the control group showed a negative score change. A statistically significant interaction was found between the treatment and group factors for dietary habits ($F[1,38]=50.34$, $p<.01$).

Dietary habits were improved after treatment only for the experimental group. Note the treatment group met more often.

HRFC: Format of Physical Activity

The format, in which physical activity was used exclusively to implement the health-related fitness curriculum, was studied in elementary schools by Faigenbaum et al. (2009) and in high schools by Faigenbaum and Mediate (2006) and Wright and Karp (2006). Faigenbaum et al. (2009) focused on comprehensive fitness when implementing the health-related curriculum for elementary school children. The format chosen for the intervention involved pylometric exercises, dynamic movements that entail rapid eccentric muscle action immediately followed by rapid concentric muscle action, such as hops, skips, jumps, and throws. Subjects in the treatment group (n=40) experienced 15 minutes of pylometric training followed by 40 minutes of traditional physical education, while subjects in the control group (n=34) experienced 55 minutes of traditional physical education. ANOVA results show the treatment group made significant ($p<.05$) gains in: lower body power, measured by the long jump (+ 7.9 cm vs. -0.3 cm control); abdominal strength, measured by right angle push-up (+ 4.1 reps vs. 1.1 control); and cardiorespiratory endurance, measured by half mile run (- 52.1 sec. vs. -10.5 sec. control). No significant differences were revealed in sit and reach test scores measuring flexibility.

Among high school students, Faigenbaum and Mediate (2006) implemented the health-related fitness curriculum through medicine ball training for those in the treatment group (n=69), whereas students in the control group (n=49) were exposed to traditional physical education. Medicine ball training consisted of using a 6 pound leather ball to perform exercises such as underhand squat, shoulder press, single leg toss, and straddle ball roll; each subject performed the same type of exercises for the same number of repetitions. This 6-week training was conducted two times a week during the first 15 minutes of physical education class, followed by 30 minutes of typical sports activities. The control group only participated in the same 30 minutes sports activities. The group that participated in the medicine ball training program made significantly greater gains in the shuttle run, long jump, sit and reach flexibility, medicine ball abdominal curl, medicine ball push-up, and medicine ball toss as compared to the control group ($p<.05$). Comparisons of absolute changes (post-results- pre-results [Delta] between groups for each dependent variable were analyzed with independent t tests. Also investigating high school students, Wright and Karp focused only on aerobic fitness and delivered the curriculum in four different conditions over 10 weeks, using a cluster sampling design. During physical education class, students in the varied approach condition ran in games, on trails, in relays, etc., while students in the teach-to-the test condition ran 2400 meters without a time limit. Students in the control condition ran for 15 minutes at any pace for any distance, while students in the choice condition, after being taught the principles of an aerobic program and designing their own aerobic routines, could choose which routine to perform. Regarding aerobic capacity, measured by a timed 2400 meter run, ANOVA revealed the varied approach group had a mean improvement of 135.71 seconds, followed by the control group with a mean improvement of 88.92 seconds, and the choice group with a mean improvement of 86.62 seconds, and lastly the teach to the test group with a mean improvement of 60.74 seconds, ($F[3,136] =5.65$, $p=.001$). Thus far, the aforementioned research shows positive results on some aspects of fitness, from the use of health-related fitness curriculums (Aggeloussis, Derri, & Petraki, 2004; Faigenbaum et al., 2009; Faigenbaum & Mediate, 2006; Wright & Karp, 2006). In reviewing these studies, the experimental designs appear adequately rigorous except for that of Aggeloussis et al. (2004). The positive effects that were attributed by Aggeloussis et al. to the health-related fitness curriculum might very well have been caused by the generous amount of time the treatment group was afforded to engage in physical education over the control group. The other formats of instruction, which included pylometric training, medicine ball training and a varied aerobic program appear to have a more direct effect on fitness, specifically cardiorespiratory capacity. The resistance training of pylometrics and medicine ball were shown to increase muscular strength as well; however pylometric training and the aerobic program were not adequate for flexibility fitness. The improvements in fitness that were achieved through the use of these health-related curriculums are considered by public health officials to be short-term. The reason for this assumption is because these curriculums failed to address self-management, which according to CDC is necessary for long-term adoption of exercise behaviors. Researchers have therefore been encouraged to examine self-regulatory mechanisms that may provide insight into long-term exercise practices; these studies are outlined in the following section.

Research on the Mediators of Exercise Behaviors

Mediators of Student Exercise

Kulinna, Zhu, Kuntzeman and DeJong (2006) intended to analyze multilevel data from schools for the purpose of studying curriculum effectiveness. This study used the hierarchical linear model to investigate the effects of a health-related physical activity curricular program, known as Exemplary Physical Education Curriculum (EPEC), on elementary school students' fitness. In this particular study 11 teachers used the EPEC with their classes, while 8 comparison-matched teachers used traditional physical education with their students. The hierarchical linear analysis conducted by Kulinna et al. demonstrated the effect of both EPEC use and teacher experience on aerobic capacity X[sup2] (13, N=1235)=295.317, p<.001, measured by 600 yard run/walk test, and overhand throw ability, graded by two trained raters, X [sup2] (13,N=1235)=138.62, p<.001. Students from the EPEC curricular group also had significantly higher self-reported social skill scores X[sup2] (13, N=1235) =62.837, p<.001.

In researching high school students (N=853), Motl et al. (2005) examined Perceived Behavioral Control (PBC), described as one's perception of the ease or difficulty associated with exercising, given consideration of the internal factors, such as beliefs, and the external influences, such as opportunity, time, facilities, and equipment. Physical activity was measured by a self-reported 3 Day Physical Activity Recall (3DPAR), which involved specification of intensity as well as duration. Motl et al. (2005) found PBC to be a significant mediator of vigorous physical activity longitudinally, across a one year period (B=.15, p<.05). Also investigating high school students (N=174), Winters, Petosa, and Charlton (2003) examined the influence of social cognitive constructs, specifically social situation, self-efficacy, outcome expectations values, and self-regulation, among this population. These psychosocial constructs, measured through questionnaires, were found to be significant predictor variables in the final hierarchical linear regression model and could explain 29% of the variance in vigorous leisure exercise frequency, measured using self-reported Godin Leisure-time Exercise Questionnaires (LTEQ), (p=.000). Regarding moderate intensity exercise, all of the same constructs were significant predictors, except social situation, in the final regression equation and could explain 11% of the variance in moderate leisure time exercise (p=.001).

Among university students (N=535), Lutz, Karoly, and Okun (2008) examined exercise goals and exercise behaviors, assessed through a series of questionnaires. By means of a multiple mediator model, Lutz et al. (2007) demonstrated the effects of the self determination index on goal process mediators and exercise (F[10,494]=13.13, $p<.0001$), which accounted for 21% of the variance in exercise frequency ($R^2=.21$). Goal process variables, specifically self-monitoring (.53), planning (.52), positive affect (.30), were found to have a significant direct effect on exercise, measured by self-reported LTEQ, ($p<.05$). Also researching university students (N=277), Rovniak, Anderson, Winett, and Stephens (2002) examined the relationship between social cognitive variables, measured at initiation through questionnaires, and physical activity, measured eight weeks later through self-recorded activity diaries. Rovniak et al.(2002) found social support exhibited a moderate total effect on physical activity, mediated entirely by self efficacy ($B_{total/indirect}=.28$, $p<.001$). Self-efficacy had the greatest total effect on physical activity ($B_{total} = .71$, $p<.001$). However the total effect of self-efficacy on physical activity was largely mediated by self-regulation ($B_{indirect} = .57$, $p< .05$). Self-regulation also exerted a strong total effect on physical activity ($B_{direct/total} = .48$, $p<.05$).

Petosa, Suminiski & Hortz (2003) also examined, among college students (N=350), the influence of social cognitive variables, assessed through questionnaires, on exercise behaviors, measured through a self-reported 7 Day Physical Activity Recall (7DPAR) instrument, with specification of mode, duration and day. The hierarchical model regression analysis of this study revealed that each social cognitive construct - self-regulation, exercise role identity, outcome expectancy value, social support, and self efficacy - made a unique contribution to the prediction of vigorous physical activity frequency. Together, these social cognitive constructs accounted for 27.2% of the variance in days of physical activity ($p<.05$).

Mediators of Patient Exercise

In studying cardiac patients (N=122), Scholz, Sinehotta, Schuz, and Oeberst (2007) assessed retrospective activity levels, prior to individuals' heart attacks, using the International Physical Activity Questionnaire (IPAQ). During the hospitalized rehabilitation stage, patients were required to create action plans for exercise regimes to be enacted post-discharge. Patients were also required to assess their perceived capability to execute the plan exactly, known as plan execution self-efficacy (PESE). Questionnaires, assessing the success or failure of plan implementation and the current status of PESE, were mailed weekly to patients' homes following discharge, with a prepaid return envelope for the responses. Scholz et al. (2007) demonstrated through hierarchical linear regression that mastery ($B=.08$, $SE=.02$, $p<.01$) and non-mastery of personal action plans ($B = .40$, $SE= .07$, $p<.01$) were significantly related to plan execution self-efficacy (PESE). Furthermore, regression analyses show plan execution self-efficacy (PESE) was predictive of changes in exercise behavior ($B=.26$, $p<.05$). Additionally, Sinehotta, Schultz, and Schwarzer (2005) examined a longitudinal sample of 307 cardiac patients who were advised to adopt and maintain regular exercise behaviors. At the first point in this study, the predictors of intention and intention itself were assessed through self-report questionnaires. Two months and four months later, the mediators and outcomes were measured. The results of structural equation modeling reveal task self-efficacy ($B=.63$, $p<.01$) and outcome expectations ($B=.25$, $p<.01$) were most influential predictors of intentions. Together with risk awareness, all three variables account for 65% of the variance in intentions ($p< .05$). Furthermore, intentions were found to be a significant predictor of action planning ($B=.21$, $p<.01$), while action planning predicted exercise ($B=.28$, $p<.01$). Also noteworthy was the finding that maintenance self-efficacy was a significant predictor of action planning ($B=.41$, $p<.01$) and of exercise behavior, self-recorded by frequency and intensity ($B=.25$, $p=.05$). Thus, the amount of explained exercise variance was 24%. Lastly, Sinehotta, et al. (2005) demonstrated that action control also had a strong effect on exercise ($B=.34$, $p<.01$).

Meanwhile, Ziegelmann and Lippke (2007) investigated exercise strategy use in 368 orthopedic patients assigned to engage in exercise. Results of structural equation modeling show the strategies of selection (goal commitment), optimization (engagement in goal-directed actions despite barriers), and compensation (alternatives found to obstacles), all assessed through questionnaires, lessen the impact of resource loss and enable adoption of exercise behaviors. Selection, optimization and compensation (SOC) strategies emerged as partial mediators between perceived resource loss and exercise ($B=.47$, $p<.01$).

To summarize, these studies have revealed important information to researchers enabling greater understanding of the self-regulatory constructs that influence exercise behaviors. Although mediational analysis can demonstrate correlational linkages between psychosocial variables and behaviors on multiple levels, they cannot permit definitive statements regarding causal relationships. Thus far, several self-regulatory constructs have been shown to partially mediate physical activity and explain the variance seen in exercise outcomes. At best, a mediational analysis is useful in identifying which psychosocial factors may be predictive of exercise. Researchers then utilize this information to design interventions that produce changes in mediators, which in turn may produce changes in exercise behaviors. The following studies have chosen curriculums that address self-regulation as the intervention to target psychosocial mediators and produce changes in physical activity.

Research on the Use of a Self-regulation Curriculum with Patients

Sinehotta, Scholz, Schwarzer Fuhrmann, Kiwus, and Voller (2005) studied the exercise habits of three groups of cardiac patients ($N=240$). While hospitalized, all patients attended classes that advised an increase in general and strenuous exercise upon discharge. Those patients assigned to the treatment groups received training on planning - that is, creating detailed action and coping plans. An additional intervention was imposed on half of the patients in the treatment group, which included keeping a weekly diary on whether exercise plans were adhered to. Baseline data was collected through questionnaires in which behavioral intentions, exercise self-efficacy, action planning, coping planning, and action control were measured and again at 2 months and 4 months post-discharge. ANCOVA results showed both the planning and planning plus diary groups to have significantly greater behavioral intentions ($F[2,212] = 5.17$ $p<.01$) over the control group and significantly greater coping planning scores over the control group, ($F[2,212] =4.27$, $p<.05$); and the planning plus diary group had significantly greater self-efficacy ($F[2,212]=4.07$, $p< .05$) and action control ($F[2,212]= 7.08$, $p<.01$) over the control. Lastly minutes of general physical exercise increased for the planning group ($F[2,212]=3.41$, $p<.05$), whereas minutes of strenuous exercise increased for the planning plus diary group.

Research on the Use of Combined Health-related Fitness and
Self-regulation Curriculum with Students

Elementary School Students

A curriculum that combined principles of health-related fitness and principles of self-regulation was specifically designed for elementary school physical education; it was referred to as SPARK, an acronym for Sports, Play and Active Recreation for Kids. The SPARK intervention, studied by Sallis, McKenzie, Alcaraz, Kolody, Faucette, and Hovell (1997), was comprised of 15 minutes of health-fitness activities (walking/jogging, aerobic dance, aerobic games, jump roping) and 15 minutes of skill-fitness activities (basketball, soccer), enacted three times a week. In addition, the SPARK program included weekly self-management classes, lasting 30 minutes, in which goal setting, self-monitoring, problem solving, and self-reinforcement methods were described. The treatment group was exposed to the SPARK intervention, led by a physical education specialist, while the comparison group was exposed to the SPARK intervention, led by a trained classroom teacher, and the control group was exposed to traditional physical education. ANOVA results show students spent more minutes per week, measured by accelerometer, being physically active in specialist-led (40 min.) and teacher-led (33min.) physical education classes than in control classes (18 min.; $p < .001$). After 2 years, girls in the specialist-led condition were superior to girls in the control condition on abdominal strength and endurance, measured by bent knee sit-ups, ($p < .001$) and cardioresiratory endurance, measured by one-mile run/walk, ($p < .001$). No significant changes were observed in flexibility, measured by the sit-and-reach test.

High School Students

In studying high school students, Hortz and Petosa (2008) incorporated self-regulation training into the physical education curriculum for the treatment group, known as Planning To Be Active (PTBA) (n=143); whereas the control group (n=97) was exposed to the same activity-based physical education but without the self-regulation training lessons. Pre-and post-scores on psychosocial constructs were obtained from questionnaires, while activity was self-reported through the Previous Day Physical Activity Recall (PDPAR) sheet and tracked for 7 days prior to and after the intervention. ANOVA results show that the PTBA group displayed greater post-intervention self-regulation scores ($F [1,238] = 212.96$, $p<.01$), social situation scores ($F[1,238]= 7.29$, $p<.01$), and moderate intensity leisure time activity ($F[1,238]=38.99$, $p<.01$). Furthermore, regression analyses support a mediation model that suggests the effect of the intervention was mediated by differences in self-regulation ($R^2=.15$, $p<.01$) and social situation ($R^2=.15$, $p<.01$) . Ward, Saunders, Felton, Williams, Eping, and Pate (2006) also focused on high school students by changing the social and physical environments in twelve intervention schools as well as implementing an exercise self-management program, called Lifestyle Education for Activity Program (LEAP), within these schools. Compared to students in the twelve control schools, LEAP participants reported increased physical activity and exercise levels. Only results regarding the ease of program implementation and teachers' acceptance of the program were published in this article – not the impact on student fitness.

College Students

T. Adams, Graves and H. Adams (2006) utilized an intervention curriculum, that delivered information conceptually to college students (N=276) on nutrition, fitness, goal setting, and planning. Adams et al. (2006) examined the effects of the intervention curriculum on those college students currently enrolled in the course (group 2) and those previously enrolled in the course (< 52 weeks ago, group 3; 53-104 weeks ago, group 4; 105- 156 weeks ago, group 5; 157+ weeks ago, group 6) and those never enrolled (control group 1). ANOVA analysis revealed a significant difference between groups, regarding health-related fitness knowledge, measured by an 80 item multiple choice test (F [5,276]=49.77, p=.000). Health-related knowledge scores were significantly increased for students currently enrolled in the course.

Cardinal and Spaziani (2007) also delivered the intervention curriculum conceptually to college students (N=103), utilizing the transtheoretical model to guide their lesson plans. Lessons 1 through 4 focused on promoting awareness of exercise benefits and exercise methods, while lesson 5 emphasized setting specific, realistic, action-oriented exercise goals. Lessons 6 through 9 focused on planning to exercise with reference to time management, barrier removal, personal support, and environmental structuring. At the conclusion of the study, Cardinal and Spaziani compared the results from the treatment group, which received the intervention curriculum through in-class lectures, with the comparison group, which received the intervention curriculum via lectures on-line, with the subjects in the control group, who were not enrolled in the course. Self-reported leisure time exercise questionnaires, for which scores were converted into metabolic equivalent units (METs), reveal that the in-class treatment group had a 133% increase in exercise over the control group and the on-line comparison group had a 52% increase in exercise over the control. However ANCOVA analysis of exercise MET values do not reveal a main effect for group treatment ($F[2,103] = 2.97$, $p<.06$). Follow-up F tests reveal group differences in behavioral processes (I make sure I always have a clean set of physical activity clothes) ($F[2,103]=4.28$, $p<.05$) and cognitive processes of change (I find out about new methods for physical activity) ($F[2,103]=3.66$, $p<.05$), both measured by questionnaire. The in-class average behavioral score was significantly higher than the control group’s average behavioral score (M=49.7 vs. M=46.3, $p <.01$, d=.52). However the on-line average cognitive score was significantly higher than the control group's average cognitive score ($M= 53.8$ vs. $M= 46.3$, $p<.05$, $d=.83$).

The lecture series used by Chen, Wang, and Yeh (2005) to convey health-related fitness outcomes to university students (N=42) was impressive; it included coverage of nutrition, fitness, personal responsibility, decision-making, social supports, goal setting, and planning. Students were then instructed to increase exercise and physical activity and make subsequent adjustments in their plans; however, comparisons to other conditions could not be made, as this was a one-group design. Wilcoxon signed rank test showed post-intervention increased trunk flexibility ($z= 2.79$, $p=.005$), measured by standard sit and reach test; increased muscle strength ($z= 4.03$, $p=.001$), measured by number of sit-ups in 60 seconds; and increased cardiorespiratory endurance ($z=-5.06$, $p=.001$), measured by 800 meter run. Health Promotion Lifestyle Program (HPLP) questionnaire showed statistically significant improvement post-intervention ($p<.001$). Conversely, Petosa and Suminski (2006) utilized 3 groups of college students in their research study; the intervention curriculum was delivered through weekly lectures on fitness and self-regulation, supplemented by 3 weekly laboratory classes in which students performed weight lifting and aerobic exercise. This condition was applied to both the treatment group (n=127), which additionally had to complete 9 web-based homework assignments that addressed social cognitive constructs, and the comparison group (n=118), which additionally had to conduct 9 reading and writing homework assignments on fitness. Participants in the control group (n=178) attended two one-hour lectures a week on general health topics, excluding exercise and fitness. Physical activity was not measured in this study nor was actual exercise. Instead the use of self-regulation skills (writing down a goal for how many times one will exercise in a given week) was measured by a

43 item questionnaire. ANCOVA results show increased post-intervention self-regulation scores for treatment group over the comparison group scores ($p<.005$) and over the control group scores ($p< .001$).

In reviewing the aforementioned studies (Sinehotta, Scholz, Schwarzer Fuhrmann, Kiwus, & Voller, 2005; Sallis, McKenzie, Alcaraz, Kolody, Faucette, & Hovell,1997; Hortz & Petosa, 2008; Ward, Saunders, Felton, Williams, Eping, & Pate, 2006; T. Adams, Graves and H. Adams, 2006; Cardinal & Spaziani, 2007; Chen, Wang, Yeh, 2005; Petosa & Suminski, 2006) that included self-regulation training in the intervention, one notices a lack of rigor in several of the research designs. Chen et al. utilized a pre-test, post-test one-group design, which limits the validity of the research findings. Both Adams et al. (2006) and Cardinal and Spaziani used comparison groups that had limited utility for testing curriculum effectiveness. Adams et al. compared the treatment group, those enrolled in the course and currently exposed to the intervention curriculum, with those never enrolled (control group) and with those previously enrolled, further categorized by number of weeks ago (comparison groups). This breakdown resulted in a small number of subjects in several comparison groups, unmatched to the size of the control or treatment group. Furthermore, the outcome measured by the study was knowledge, which in itself is somewhat removed from the current goal of physical education – to increase physical activity. However the evidence Adams et al. did provide shows significantly that knowledge scores are highest for those currently enrolled and much lower for a greater passage of time since enrollment, demonstrating the problem of acquiring long-term knowledge retention. Cardinal and Spaziani implemented the intervention curriculum to the experimental group in-class, however the comparison treatments did not really present alternative curriculums. One group received the same curriculum through an on-line format; the other (control) group was not enrolled in the course. This may explain the lack of a significant treatment effect on exercise.

Furthermore the utility of the LEAP study, by Ward et al. (2006), is limited by the lack of published results about the effect on students' fitness and physical activity levels. The SPARK program, which did result in increased physical activity levels for participants, did not fully disclose the parameters of traditional physical education. Sallis et al. (1997) describes the activity portion of the SPARK program as being enacted 3 times a week for 30 minutes in addition to 30 minutes of weekly lectures on self-regulation. The frequency or duration for the traditional physical education is not stated; one cannot assume the effects can be totally attributed to the curriculum without considering the impact of the amount of time engaged in any physical education. In addition, the results of the 2 year SPARK program are not that impressive; only the fitness levels, specifically aerobic capacity and muscular strength, of females improved. Perhaps the activities were not rigorous enough to demonstrate improvement among males. Furthermore, no significant effect was shown for flexibility status, regardless of gender. Petosa and Suminski (2006) designed an experiment that did test the intervention curriculum against viable comparison treatments; the only shortcoming in this study was that students' physical activity, exercise behaviors, and fitness status were never measured - the focus was self-regulation scores. Finally, the research conducted by both Sinehotta, Scholz, Schwarzer Fuhrmann, Kiwus, and Voller (2005) and Hortz and Petosa, (2008) effectively demonstrates the effect of planning and monitoring on self-regulatory constructs and the outcome of increased physical activity.

Synthesis

The research presented here indicates health-related fitness curriculums, delivered through a lecture format or by way of physical activity exercises, can impact students' fitness levels (usually cardiorespiratory endurance and muscle strength). However for long-term adoption of exercise behaviors to occur, self-regulation mechanisms must be addressed so that individuals can employ them long after the social and environmental supports of gym class are removed. The evidence from the mediational analyses included in this literature review reveals goal setting, planning, monitoring, and adjusting as self-regulatory constructs significant for mediating exercise behaviors. In general, the few experimental studies that have incorporated self-regulation training, targeting these mediators, into the content of health-related fitness curriculums have shown positive effects on exercise and fitness outcomes. Thus, it is possible to train students to regulate their exercise behaviors and impact fitness.

Rationale

Upon completion of the health and physical education literature review, one may conclude that physical activity and exercise are crucial for attainment of good health and fitness. Yet, even with this knowledge, epidemiological evidence reveals declining fitness and poor health for the majority of Americans. Until recently, social cognitive theory has been sparingly applied to the study of exercise, however current research on self-regulatory constructs has begun to identify mediators that bridge the gap between knowledge and behavior.

Thus this study seeks to investigate the effect of a health-related fitness curriculum, which incorporates self-regulation training, on the motoric flexibility of college students, in comparison to more traditional forms of health education. The flexibility status of individuals is of importance for optimal joint and muscular function, development of coordination and balance, and its role in reducing one's chance of injury, especially back pain. Regarding flexibility, only one-quarter (24.5%) of the population regularly performs stretching exercises (DATA 2010), and youth flexibility has been deemed inadequate (Wildman & Miller, 2004).

In the research evidence presented here on exercise and fitness, very little attention was focused on stretching exercises as a behavior nor on flexibility status as a fitness outcome. In the few studies in which flexibility was measured, only one showed significant improvement post-intervention. More often, stretching is done in physical education as a warm-up for a sport skill lesson rather than as a means to achieve health-related flexibility benefits.

In this study, college students will be instructed through lecture on proper stretching techniques and provided with written guidelines and recommendations for frequency and duration, enabling vicarious learning. In addition to this, a comparison group will be exposed to technique modeling to facilitate observational learning. Lastly, a treatment group will be exposed to all of the previous conditions, in addition to assignments requiring students to measure their flexibility regularly. Students will utilize this feedback to assess their flexibility fitness progress and regulate their stretching exercises accordingly. An instruction model that shifts the learning of flexibility exercises from external social sources to the individual in the form of self-regulation greatly increases the possibility for long-term behavior adoption.

Research Questions

This research intends to answer the following questions:

1) Does technique modeling produce greater motoric flexibility, stretching practices of greater duration, and higher levels of flexibility outcome expectations, self-efficacy, and procedural knowledge than lecturing?
2) Does technique modeling combined with self-evaluation produce greater motoric flexibility, stretching practices of greater duration, and higher levels of flexibility outcome expectations, self-efficacy, and procedural knowledge than technique modeling alone or lecturing?

CHAPTER 3

Methodology

This chapter describes the methodology of this study, which was to examine whether self-regulation instruction improved students' motoric flexibility. The self-regulation intervention included two levels: technique modeling alone and combined with self-evaluation, which were compared to a non-self-regulation intervention (lecturing). Motoric flexibility was measured, before and after intervention, through physiological assessments and surveys of stretching practices, flexibility outcome expectations, self-efficacy, and procedural knowledge. This chapter begins with the selection of participants, followed by a description of the measures and the procedures used for conducting the study. The chapter concludes with a segment on data analysis.

Participants

Ninety urban community college students enrolled in health education classes were recruited to volunteer for this research study (Appendix A). Seventy-three students consented to participate in the research (Appendix B). Subjects were randomly assigned to one of three groups: (1) control lecture group (CLG) (i.e. no self-regulation) (2) technique modeling group (TMG), and (3) technique modeling and self-evaluation group (TMSEG). By the end of the study, data was collected for a total of seventy-one subjects (N = 71); two participants had dropped out.

Fifty-five percent of the subjects were female and 45% were male. The ethnic breakdown of the participants was as follows: Caucasian 19%, Asian 27%, Black 12%, Hispanic 32%, and other 10%. Demographic data revealed student status to be 88% full-time and 12% part-time, and employment status to be for: ≤ 10 hr/ week (48%), ≤ 21 hr/week (28%), ≤ 35hr/week (13%) and > 35 hr/week (11%). The age breakdown of the participants was: 18 to 25 years (81%), 26-32 years (16%), 33-46 years (3%) and 47+ years (0%).

Measures

Physical Flexibility of the upper body was measured utilizing a centimeter tape-measure to record the distance between opposing thumbs when one hand was put behind the lower back and the other hand was put overhead and down towards the lower back. See the illustration in Figure 1.

Figure 1. Shoulder-girdle flexibility measured via thumb reach test

Source: www.istockphoto.com (2010)

Measurement occurred after a 10 second “arms overhead” stretch. Measurement was conducted twice; right upper body flexibility was recorded when the right hand was put initially overhead then down, and left upper body flexibility was recorded when the left hand was put initially overhead then down. This scale is inversely related to physiological flexibility; for example, the lower the number, the more flexible the individual is at this body location. A rating of 8-9 cm represents average upper body flexibility, whereas a measurement of 0-1 cm indicates an excellent range of motion (Jones & Rikli, 2002; Reid & Thomson, 1985). The score, resulting from the *thumb reach* test, was transformed during data analysis to present a direct relationship, lending itself to interpretative ease. Thus, in the results section, an increasing upper body flexibility score is interpreted to mean greater flexibility.

Subjects' lower back flexibility was measured by the *sit and reach flexibility* test utilized by the National Athletic Health Institute. While sitting on the buttocks, with both legs outstretched forward, students bent and reached toes. Feet were in flexed position, pointing upward, and leaning against a block. See the illustration in Figure 2.

Figure 2. Sit and reach flexibility test

Source: Topend Sports Network (1997-2010)

The tape measure at this point read 14 inches. If a student could reach beyond this point, the measurement increased. The measurement was recorded on the fourth attempt. This scale is directly related to physiological flexibility; for example, the greater the number on the scale, the individual possesses greater lower body flexibility. For example, a measurement of 16 and 20 inches (40-50 cm) indicates above-average lower body flexibility, while a measurement of 18 and 22 inches (45-55 cm) represents excellent lower body range of motion for men and women respectively (Davis, Bull & Roscoe, 2000).

Stretching Practices questionnaire surveyed the type, duration, number of repetitions and frequency of subjects' stretching routines (Appendix C). Each response was assigned a point value for the item. The *stretching practices* score was calculated by adding the number of points obtained for each item response selected and arriving at a total score upon completion of the four-item survey (Cronbach's alpha test of reliability = .79). Regarding the *stretching practices* score, a greater number represents greater implementation of stretching exercises, in other words more practice; the highest score possible on the questionnaire is 20.

Outcome Expectations survey included an eight-item questionnaire that measured subjects' beliefs specific to the flexibility domain, utilizing a Likert scale (4 strongly agree to 1 strongly disagree) (Cronbach's alpha test of reliability = .78). Statements, such as "flexibility can develop over time by regularly stretching," were included in the survey. The highest score possible was 32. See Appendix D.

Self-Efficacy Beliefs survey included four items that assessed one's perception of one's capability for choosing exercises and performing exercises to enhance flexibility. A Likert scale was used to measure agreement with the statements (4 strongly agrees to 1 strongly disagrees) (Cronbach's alpha test of reliability = .64). The highest score possible was 16. See Appendix D.

Flexibility Knowledge test is a ten-item, multiple-choice exam that measured the subjects' knowledge level of flexibility procedures and standards (Cronbach's alpha test of reliability = .43). The highest score possible was 10. (Appendix E).

The *Demographic Information Sheet* included questions that assess one's reasons for exercise if applicable as well as pre-existing exercise routines. In addition, the survey obtained information regarding the participants age, gender, ethnicity, work and student status (Appendix F).

Design and Procedure

A 3 group experimental design was utilized, with pre- and post-test measures for stretching practices, outcome expectations, self-efficacy, and flexibility procedural knowledge as dependent variables. In addition, physiological measurements of upper and lower body flexibility were collected for all subjects. Subjects were randomly assigned to one of three groups: 1) control lecture condition, 2) technique modeling condition, and 3) technique modeling and self-evaluation condition.

During session one, all participating students, who signed the consent form, completed the *Demographic Information Sheet*, *Stretching Practices* questionnaire, *Flexibility Knowledge* test, and *Outcome Expectations and Self-Efficacy Beliefs* survey. Additionally, students were measured for upper body and lower body flexibility, utilizing the *thumb reach* and *sit and reach* tests recommended by the National Athletic Health Institute.

During session two, the students in the control lecture group (group1) attended a lecture on exercise in which the following script was used. Script: “The goal of flexibility exercises is to optimize range of motion in the joints. Flexibility exercises can include performing upper body and lower body stretches, preferably 5 to 7 times a week. Each stretch should be held (no bouncing) 15 to 30 seconds and be repeated two times. Other activities that can increase flexibility include yoga, martial arts, pilates, and ballet. Stretching prior to physical activity, as a warm-up, can increase one’s agility and thus help to prevent injury. Frequent stretching helps one avoid stiffness and the pain associated with inflexibility, for example back pain. Stretching after exercise is important too; as part of the cool down, muscles are returned to their normal resting state." During subsequent class sessions, Group 1 subjects attended lectures on the other health-related topics, such as nutrition, diet, tobacco, alcohol, illicit drugs, stress, sexuality, pregnancy, and contraception.

During session two, the students in the technique modeling group (group 2) attended a lecture utilizing the same script. In addition, they observed stretching techniques modeled, described, and illustrated by the experimenter. While modeling, the experimenter performed the following exercises: (1) abdominal stretch, (2) chest stretch, (3) mid-back stretch, (4) overhead arm pull, (5) hamstring stretch, (6) thigh (quadricep) stretch, (7) groin stretch, and (8) calf stretch. Simultaneously, the experimenter verbally described the procedures involved in implementing each exercise. While modeling, the experimenter held each of the exercise positions for 15 seconds and then repeated each of the stretches twice. Students were also given a handout that contained pictorial images of the exercises as well as narrative text describing the exercise procedures (Appendix G). Students were then told to attempt the stretches almost daily on their own – outside of class. During subsequent class sessions, Group 2 students attended lectures on nutrition, diet, tobacco, alcohol, illicit drugs, stress, sexuality, reproduction, and contraception.

During session two, the students in the technique modeling and self-evaluation condition (group 3) attended the exercise lecture in which the aforementioned script was utilized. In addition, they observed stretching techniques modeled, described, and illustrated by the experimenter in the same manner described above, and they received the same handout presented in Appendix G. Students were also told to attempt the stretches almost daily on their own – outside of class. Unique to group 3 (TMSEG), students were shown with tape measures how to measure their upper and lower body flexibility, similar to the method utilized on the pre-tests. Students in this group were paired with a classmate to measure the other's degree of flexibility before class, during sessions 3, 5, 7, 9, 11, and 13. Students were told to use the measurement results to assess their flexibility status, mindful of their individual standing and comparative norms. Students then recorded their flexibility results graphically, allowing for a quick visual assessment of their progress during the course of the study (Appendix H). Group 3 students also attended lectures on nutrition, diet, tobacco, alcohol, illicit drugs, stress, sexuality, reproduction, and contraception.

During session 15, post-intervention measurements of flexibility as well as stretching practices, outcome expectations, self-efficacy, and knowledge were collected from students of all conditions created for group 1, 2, and 3. This research design is depicted in Table 1.

Table 1

Schedule of Treatment for Group Conditions

					Sessions				
Group	1	2	3	5	7	9	11	13	15
1	**All Pre tests**	**Fitness Script**	Other Health Topic Lectures	Other Health Topic Lectures	Other Health Topic Lectures	Other Health Topic Lectures	Other Health Topic Lectures	Other Health Topic Lectures	**All Post tests**
2	**All Pre tests**	**Fitness Script Model**	Other Health Topic Lectures	Other Health Topic Lectures	Other Health Topic Lectures	Other Health Topic Lectures	Other Health Topic Lectures	Other Health Topic Lectures	**All Post tests**
3	**All Pre tests**	**Fitness Script Model**	Other Health Topic Lectures **Measure Self-evaluation**	Other Health Topic Lectures **Measure Self-evaluation**	Other Health Topic Lectures **Measure Self-evaluation**	Other Health Topic Lectures **Measure Self - evaluation**	Other Health Topic Lectures **Measure Self-evaluation**	Other Health Topic Lectures **Measure Self-evaluation**	**All Post tests**

Data Analysis

The researcher used descriptive statistics to calculate the frequencies and percentages of participants by (a) age, (b) gender, (c) ethnicity, (d) student status (i.e. full time/part time) and (e) employment status. A correlation analysis was also performed to determine whether there were relationships between these demographic variables and exercise variables, such as pre-existing exercise routines, frequency of such routines, and reasons given for performing the routines, and the dependent pre-test flexibility scores.

Descriptive statistics were then used to calculate the means and standard deviations for pre- and post-dependent measures for each group. Dependent measures included: (a) right upper body flexibility, (b) left upper body flexibility, (c) lower body flexibility, (d) stretching practices, (e) flexibility outcome expectations, (f) self-efficacy, and (g) procedural knowledge.

Univariate analyses of pre-test dependent measures were performed to determine whether any significant differences existed between the three groups prior to the intervention. For the dependent measures where a significant difference was found on the pretest measures, an analysis of covariance (ANCOVA) was conducted with the pretest serving as the covariate. Furthermore, partial η^2 was calculated to determine the effect size of the group differences. Next, trend analyses were performed to test for linear trends across the three groups (ranging from lecturing to technique modeling to technique modeling combined with self-evaluation); partial η^2 was also calculated. Subsequently, LSD (least significant difference) pairwise comparisons were made to determine which of the groups scored significantly different from the other (Fisher, 1958).

For dependent measures where no significant difference was found on the pretest measures, an analysis of variance (ANOVA) was performed. Partial η^2 was calculated to determine the effect size of the group differences. Following this, trend analyses were performed to test for linear trends across the three groups (ranging from lecturing to technique modeling and to technique modeling combined with self-evaluation). Partial η^2 was again calculated. Afterward, LSD pairwise comparisons were made to determine which of the groups scored significantly different from the other. Finally, Pearson zero order correlations were conducted on the dependent measures to determine the relationship between the variables.

CHAPTER 4

RESULTS

Preliminary Analyses

Descriptive Statistics

Ninety students, enrolled in health education classes, were recruited to volunteer for this study, and 73 students consented to participate in the research. Subjects were randomly assigned to one of three groups: (1) *control lecture group* (CLG), (2) *technique modeling group* (TMG), and (3) *technique modeling and self-evaluation group* (TMSEG). By the end of the study, pre- and post-intervention data were collected for a total of 71 subjects (N = 71); two participants had dropped out. At the conclusion, group 1 (CLG) had 20 subjects (n = 20), group 2 (TMG) had 25 subjects (n = 25), and group 3 (TMSEG) had 26 subjects (n = 26).

Fifty-five percent of the subjects were female and 45% were male. The ethnic breakdown of the participants was as follows: Caucasian 19%, Asian 27%, Black 12%, Hispanic 32%, and other 10%. Demographic data revealed student status to be 88% full-time and 12% part-time, and employment status to be for: ≤ 10 hr/week (48%), ≤ 21 hr/week (28%), ≤ 35hr/week (13%) and > 35 hrs/week (11%). The age breakdown of the participants was: 18 to 25 years (81%), 26-32 years (16%), 33-46 years (3%) and 47+ years (0%).

Descriptive statistics were generated for the demographic data, pertaining to the independent measures of pre-existing reasons for exercise and exercise routines prior to the intervention. Twenty-two percent of the subjects never regularly exercised, while 47% exercised 1 to 2 times per week, 26% exercised 3 to 4 times per week, and 5% exercised 5 to 7 times per week. The reasons cited, by percentage of students, for exercising included the following: general health (50%), weight loss (33%), strength (32%), physical appearance (31%), psychological health (24%), sports performance (14%), health concerns (14%), muscle bulking (12%), flexibility (10%), and heart health (10%). Of those subjects that did exercise regularly prior to this study, a regime was reported that included (1) aerobic exercises by 82%, (2) strength training by 40%, and (3) flexibility exercises by 53% of respondents.

The means and standard deviations for the pre- and post-intervention dependent measures of motoric flexibility, stretching practices, flexibility outcome expectations, self-efficacy, and knowledge for each group may be found in Table 2. Motoric flexibility was assessed through physiological measures of right upper body flexibility, left upper body flexibility, and lower body flexibility. A rating of 8 centimeters represents average upper body flexibility (Jones & Rikli, 2002; Reid & Thomson, 1985). This score was transformed during data entry in order to portray a direct relationship between the score and one's flexibility. Each upper body flexibility score was transformed by first multiplying the measurement by -1 and then adding 25 cm. Thus, an upper body flexibility measurement of 8 cm was transformed to 17 cm during data entry. Furthermore, a lower body flexibility measurement of 16 and 20 inches represents above-average trunk and hip agility for men and women respectively (Davis, Bull & Roscoe, 2000). The lower body flexibility score was converted from inches to centimeters by multiplying each inch by 2.5 cm. This step permitted all physiological measures to be reported in the same unit of measurement – centimeters. Thus 16 and 20 inches were coded as 40 and 50 cm during data entry for consistency purposes. Regarding the results of the physiological measures reported in this study, an increasing number represents increasing flexibility. The *stretching practices* measurement was calculated by adding the point value assigned to the responses students selected on the four-item *stretching practices* questionnaire. The highest scores possible on these instruments were: stretching practices (20), outcome expectations (32), self-efficacy (16), and knowledge (10).

Table 2

Means and standard deviations for pre- and post-dependent measures for each group

	Groups					
	CLG (1) (n = 20)		TMG (2) (n = 25)		TMSEG (3) (n = 26)	
Measures	M	SD	M	SD	M	SD
Pre-right upper body flexibility	23.29	3.32	18.44	8.81	21.17	3.74
Post-right upper body flexibility	21.75	5.35	18.54	8.73	22.62	3.55
Pre-left upper body flexibility	18.98	4.48	16.77	8.89	19.34	4.20
Post-left upper body flexibility	18.90	6.62	18.03	9.62	20.54	3.87
Pre-lower flexibility	44.31	9.45	40.81	11.43	46.75	6.40
Post-lower flexibility	46.80	8.90	41.78	7.16	49.43	5.47
Pre-stretching practices	8.24	3.49	8.35	3.61	10.12	2.96
Post-stretching practices	9.05	3.47	9.70	3.15	11.23	2.12
Pre-outcome expectations	26.85	4.42	28.70	2.75	28.84	2.70
Post-outcome expectations	26.89	3.54	29.04	2.67	29.92	2.29
Pre-self efficacy	12.10	2.25	12.04	3.18	13.52	2.08
Post-self efficacy	12.42	2.12	13.36	2.02	14.04	1.81
Pre-knowledge	3.76	2.02	4.27	1.61	5.19	1.67
Post-knowledge	4.79	1.87	6.20	2.02	7.12	1.82

Univariate Analyses of Pre-test Measures

To determine whether or not there were any significant differences in flexibility between the three groups prior to the intervention, analyses of variances (ANOVAs) were conducted for each dependent measure. There were no significant pre-test differences on the following dependent measures: left upper body flexibility, $F(2,72) = 1.22$, $p = .30$, lower flexibility, $F(2,69) = 2.66$, $p = .08$, stretching practices, $F(2,72) = 2.46$, $p = .09$, outcome expectations, $F(2,70) = 2.45$, $p = .09$, and self-efficacy, $F(2,70) = 2.58$, $p = .08$. These results demonstrate that the groups were comparable on these measures before training commenced. However, on two dependent measures, a significant pre-test difference was found: right upper body flexibility $F(2,71) = 3.86$, $p = .03$, and knowledge, $F(2,72) = 4.05$, $p = .02$. For these two measures, analyses of covariance (ANCOVAs) were conducted to adjust for initial differences in pretest scores of these dependent measures.

Statistical Analyses of Post-Intervention Phase Dependent Measures

Physiological Measures

Right-upper body flexibility. An analysis of covariance was conducted for post-test right upper body flexibility measures, utilizing pre-test right upper body flexibility scores as a covariate. The findings from this analysis demonstrated a significant effect of treatment, $F(2,65) = 4.74$, $p = .01$. The statistical effect size for right upper body flexibility between the groups was large (partial $\omega^2 = .14$) according to Cohen's (1988) definition of large effect size of partial ω^2 as > 0.13. Table 3 lists the ANCOVA test results. In addition, trend analysis using pre-test scores as covariates was conducted to assess whether the effects of flexibility training were linearly additive: technique modeling and self-evaluation group (TMSEG) > technique modeling group (TMG) >

control lecture group (CLG). Findings from this analysis demonstrated a significant linear effect on right upper body flexibility, $F(1,65) = 9.48$, $p = .00$. The results from the linear trend analysis may be found in Table 4. Figure 3 presents the positive linear trend of post-right upper body flexibility scores across groups visually. To compare the specific means of the groups in Figure 3, LSD pairwise comparisons were conducted, which demonstrated a significant difference between the students in the technique modeling and self-evaluation group (TMSEG) and the control lecture group (CLG). Pairwise comparisons between the three groups on RUBF appear in Table 5.

Figure 3. Trend analysis of post-right-upper-body-flexibility with pre-tests as covariates

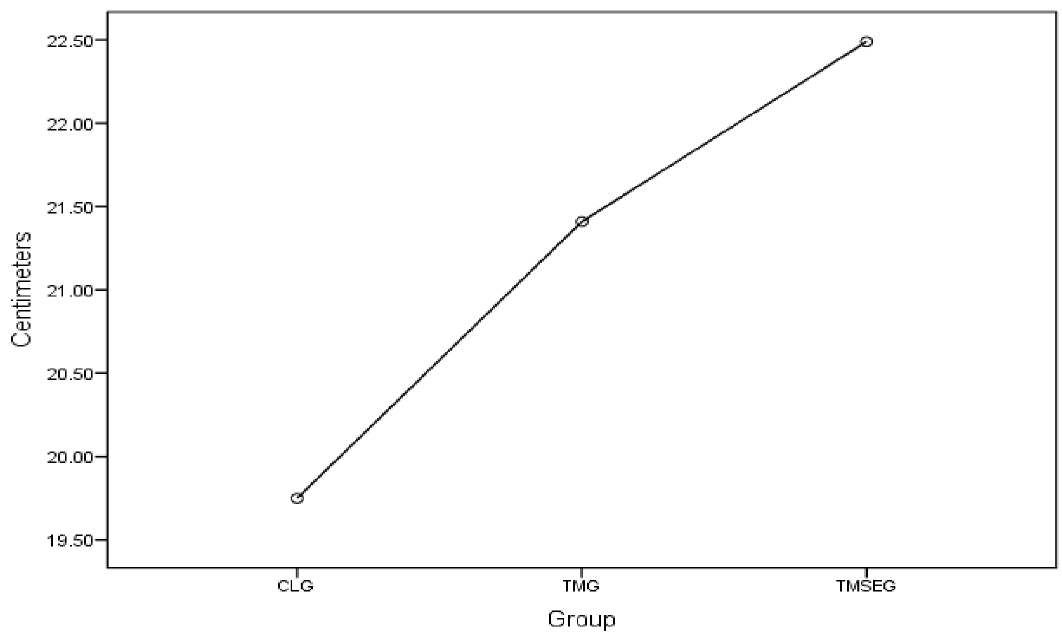


Table 3

Analysis of covariance for post-right-upper body flexibility and post-knowledge, with corresponding pre-tests as covariates

Post-Measures	*df*	*F*	*p*	Partial η^2
Right Upper Flexibility	2	4.74	0.01	.14
Knowledge	2	4.86	0.01	.13

Left-upper body flexibility. An analysis of variance (ANOVA) was conducted to determine whether there were any significant differences between groups. The group differences for left upper body flexibility did not attain significance, $F(2,64) = .77$, $p = .47$. These results may be found in Table 6. In addition, a trend analysis using pre-test scores as covariates was conducted; however, no linear effect was found, $F(1,64) = 2.12$, $p = .15$. The results from the linear trend analysis may be found in Table 4. Figure 4 presents visually the trend analysis of post-left upper body flexibility scores across groups, utilizing the pre-test value of 18.30 as the covariate.

Figure 4. Trend analysis of post-left upper body flexibility with pre-tests as covariate

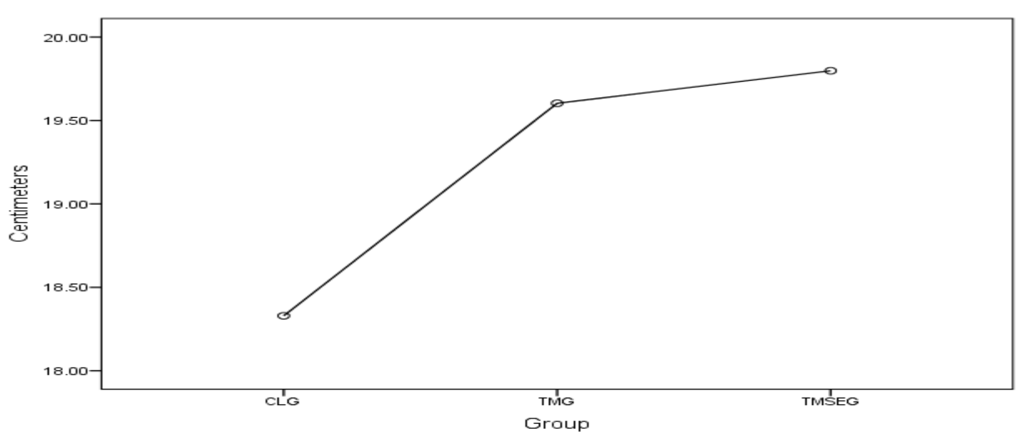


Table 4

Linear trend analyses summary for dependent measures

Dependent Measures	Mean Difference	*SE*	*df*	*F*	*p*	partial η^2
Right Upper Flexibility	1.94	.63	1	9.48	.00	.14
Left Upper Flexibility	1.04	.71	1	2.12	.15	.04
Lower Body Flexibility	1.31	1.08	1	1.47	.23	.13
Stretching Practices	1.54	.62	1	6.24	.02	.10
Outcome Expectations	2.14	.61	1	12.48	.00	.16
Self Efficacy	1.15	.43	1	7.26	.01	.10
Knowledge	1.65	.41	1	16.32	.00	.20

Lower body flexibility. An analysis of variance was conducted for lower body flexibility measures to determine whether there were significant differences between groups following the intervention. The findings from this analysis, listed in Table 6, demonstrated a significant group effect, $F(2,60) = 6.41$, $p = .00$. However, when a trend analysis for post-lower body flexibility measures was conducted using pretests as covariates, no linear effect was found, $F(1,60) = 1.47$, $p = .23$. The results from the linear trend analysis are presented in Table 4. Pairwise comparisons in lower body flexibility revealed a significant difference between the students in the technique modeling and self-evaluation group (TMSEG) (group 3) and the TMG (group 2). See Table 5. The flexibility of students in the TMSEG group surpassed that of students in the TMG group.

Table 5

Results from post hoc LSD pairwise comparisons for dependent measures

	Statistical Tests		
Measures	Mean Difference	Std. Error	Sig.
Right Upper Body Flexibility			
TMSEG (3) vs CLG (1)	2.74	0.89	.00
TMSEG (3) vs TMG (2)	1.08	0.91	.24
TMG (2) vs CLG (1)	1.66	0.99	.10
Left Upper Body Flexibility			
TMSEG (3) vs CLG (1)	1.47	1.01	.15
TMSEG (3) vs TMG (2)	0.20	1.04	.85
TMG (2) vs CLG (1)	1.27	1.09	.25
Lower Body Flexibility			
TMSEG (3) vs CLG (1)	1.86	1.53	.23
TMSEG (3) vs TMG (2)	4.33	1.51	.01
TMG (2) vs CLG (1)	-2.47	1.65	.14
Stretching Practices			
TMSEG (3) vs CLG (1)	2.18	.87	.02
TMSEG (3) vs TMG (2)	1.53	.86	.08
TMG (2) vs CLG (1)	.65	.93	.49
Outcome Expectations			
TMSEG (3) vs CLG (1)	3.03	0.86	.00
TMSEG (3) vs TMG (2)	0.88	0.80	.27
TMG (2) vs CLG (1)	2.15	0.86	.02
Self-Efficacy			
TMSEG (3) vs CLG (1)	1.62	0.60	.01
TMSEG (3) vs TMG (2)	0.68	0.56	.23
TMG (2) vs CLG (1)	0.94	0.60	.12
Knowledge			
TMSEG (3) vs CLG (1)	2.33	0.58	.00
TMSEG (3) vs TMG (2)	0.92	0.53	.09
TMG (2) vs CLG (1)	1.41	0.58	.02

Table 6

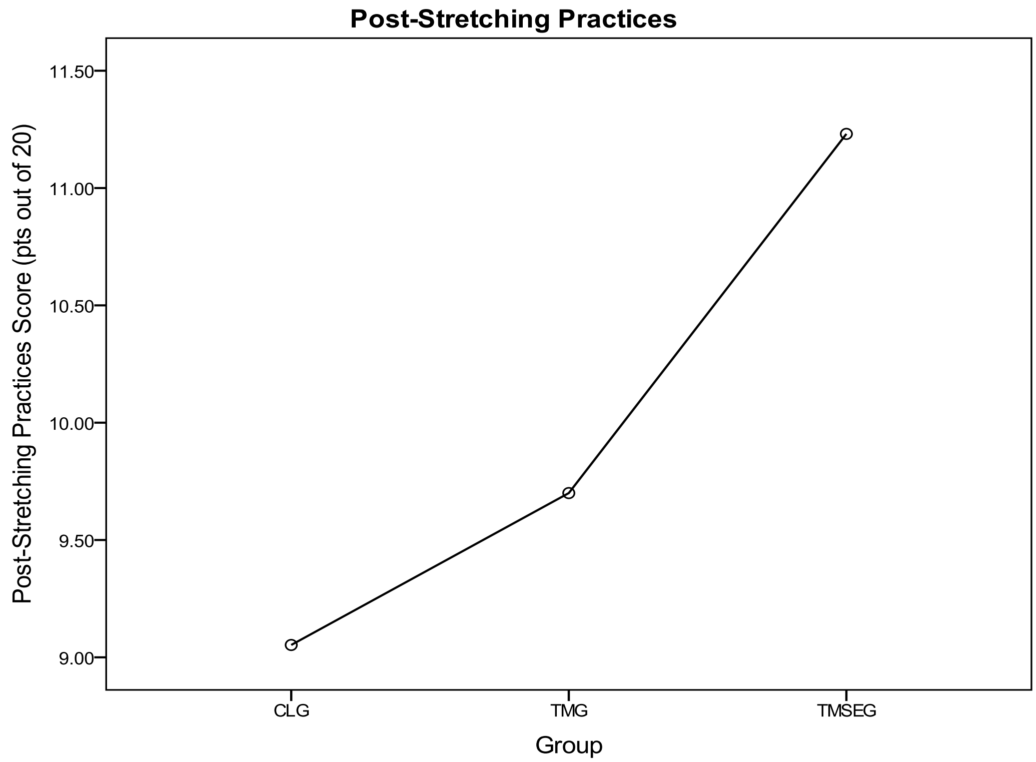
Results of self-regulation training group on post-test measures

Posttest Measures	*Df*	*F*	*P*	partial η^2
Left Upper Flexibility	2	0.77	0.45	.03
Lower Body Flexibility	2	6.41	0.00	.18
Stretching Practices	2	3.43	0.04	.10
Outcome Expectations	2	6.42	0.00	.16
Self Efficacy	2	3.63	0.03	.10

Self-Regulation Measures

Stretching practices. An analysis of variance was conducted to determine whether there were significant differences between groups for *stretching practices*. The findings from this analysis was significant, $F(2,65) = 3.43$, $p = .04$. The calculated effect size for stretching practices between the groups demonstrated a moderate effect (partial $\eta^2 = .10$). The results from the analysis of variance between subjects test may be found in Table 6. Trend analysis of post-stretching practices was also conducted. Findings from this analysis demonstrated a significant overall linear effect, $F(1,65) = 6.24$, $p = .02$. The linear trend of the dependent measure demonstrated an increase in stretching practices with an increase in self-regulation training. The results from the linear trend analysis appear in Table 4. Figure 5 presents visually the overall increase in stretching practices as a function of the self-regulatory training.

Figure 5. Trend analysis of *post-stretching practices* across treatment groups

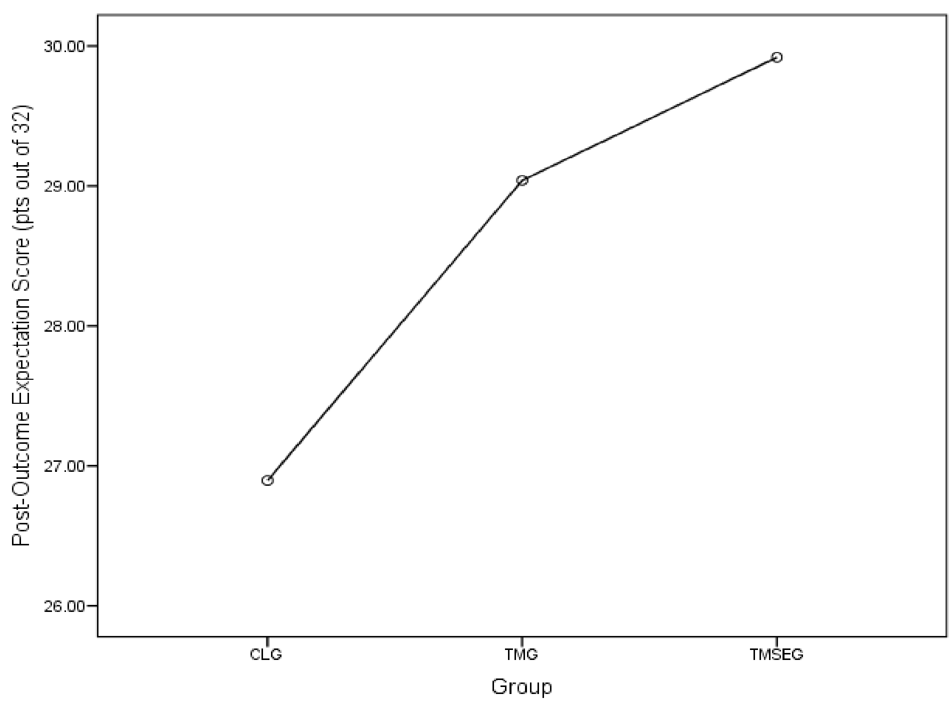


To compare the specific means of the groups in Figure 5, LSD pairwise comparisons were conducted, which demonstrated a significant difference between the students in the technique modeling and self-evaluation group (TMSEG) (group 3) and the control lecture group (CLG) (group 1). Results of the LSD pairwise comparisons between the three groups for stretching practices appear in Table 5.

Outcome expectations. An analysis of variance was conducted, following the intervention, to determine whether there were significant differences between groups for *outcome expectations*. The findings from this analysis demonstrated a significant effect of treatment, $F(2,69) = 6.42$, $p = .00$. The calculated effect size for outcome expectations between the groups demonstrated large effect (partial $\eta^2 = .16$). The results from the analysis of variance between subjects test may be found in Table 6. In addition, trend analysis was conducted for post-outcome expectations. Findings from this analysis demonstrated a significant overall linear effect, $F(1,69) = 12.48$, $p = .00$. The results of the trend analysis appear visually in Table 4. Figure 6 represents the overall increase in *outcome expectations* as a function of the self-regulatory training.

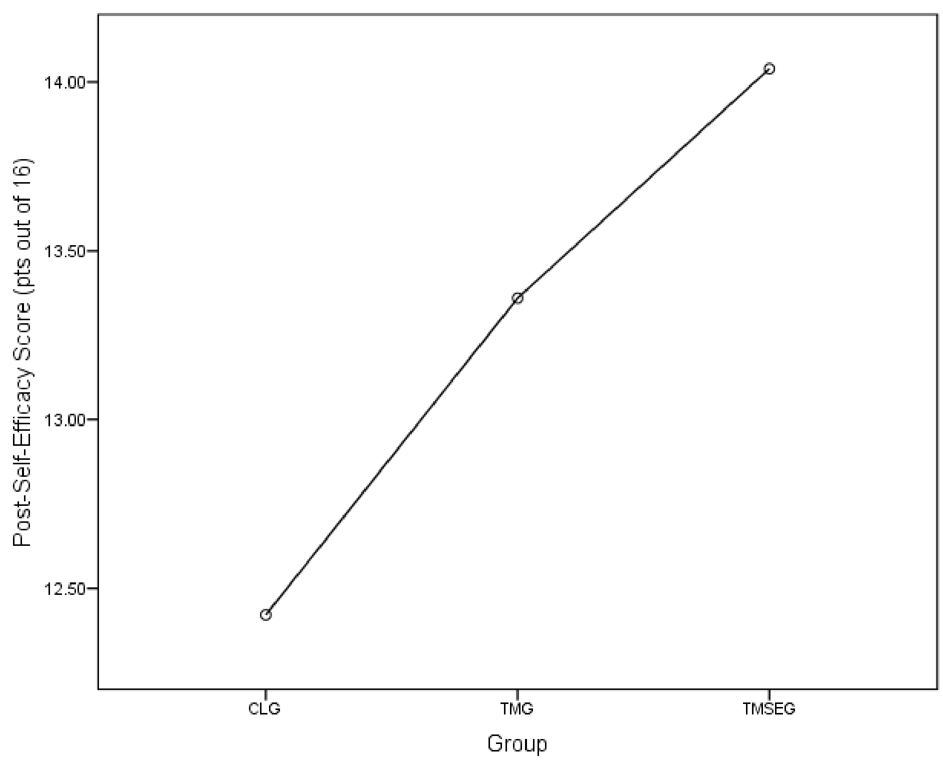
To compare the specific means of the groups in Figure 6, LSD pairwise comparisons were conducted, which demonstrated a significant difference between the students in the technique modeling and self-evaluation group (TMSEG) (group 3) and the control lecture group (CLG) (group 1). Further, the technique modeling group (TMG) (group 2) scored higher than the control lecture group (CLG) (group 1), and this difference was found to be significant. Pairwise comparisons between the three groups for *outcome expectations* appear in Table 5.

Figure 6. Trend analysis of post-outcome expectations across treatment groups



Self-efficacy. An analysis of variance was conducted to determine whether there were significant differences between groups for *self-efficacy*. The findings from this analysis demonstrated a significant effect of flexibility training, $F(2,69) = 3.63$, $p = .03$. The calculated effect size for self-efficacy between the groups demonstrated moderate effect (partial $\omega^2 = .10$). The results from the analysis of variance between subjects test may be found in Table 6. In addition, when trend analysis was conducted for post-self-efficacy measures, a significant overall linear effect was demonstrated, $F(1,69) = 7.26$, $p = .01$. The results from the trend analysis appear in Table 4. Figure 7 represents the overall increase in *self-efficacy* as a function of the self-regulatory training.

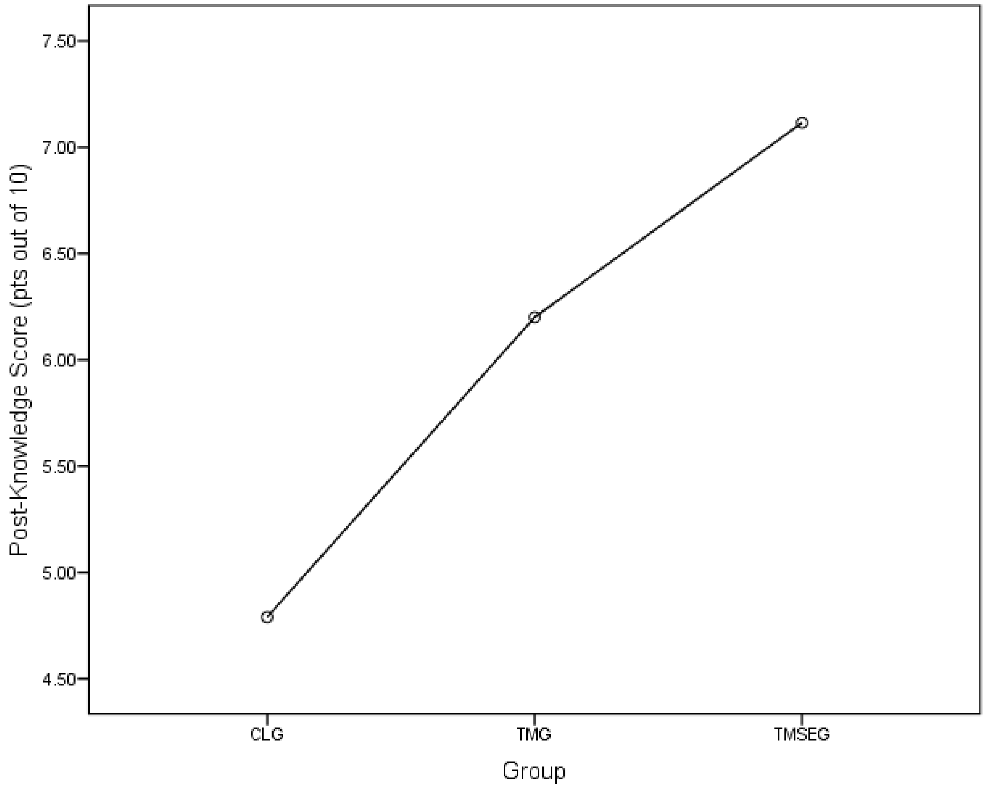
Figure 7. Trend analysis of post-self-efficacy across treatment groups



To compare the specific means of the groups in Figure 7, LSD pairwise comparisons were conducted, which demonstrated a significant difference in self-efficacy between the students in the technique modeling and self-evaluation group (TMSEG) (group 3) and the control lecture group (CLG) *(group 1*). Pairwise comparisons between the three groups for *self-efficacy* appear in Table 5.

Flexibility knowledge. An analysis of covariance was conducted for *post-test knowledge* measures, using pre-knowledge scores as a covariate. The findings from this analysis demonstrated a significant effect of treatment, $F(2,70) = 4.86$, $p = .01$. The calculated effect size for *knowledge of flexibility exercise* between the groups demonstrated a moderate effect (partial $\eta^2 = .13$) according to Cohen (1988). Table 3 lists the ANCOVA results. Trend analysis of *post-knowledge* scores was also conducted, which demonstrated a significant linear trend of *knowledge* scores increasing with an increase in self-regulatory training, $F(1,70) = 16.32$, $p = .00$, $\eta^2 = .20$. The effect size calculated for *knowledge of flexibility exercise* from the trend analysis revealed a large effect, according to Cohen's (1988) definition of large effect size as a partial $\eta^2 > .13$. The results from trend analysis appear in Table 4. Figure 8 presents the overall increase in *knowledge* as a function of the self-regulatory training. To compare the specific means of the groups in Figure 8, LSD pairwise comparisons were conducted, which demonstrated a significant difference for the students in the technique modeling and self-evaluation group (TMSEG) (group 3) and the control lecture group (CLG) (group 1). The technique modeling group (TMG) (group 2) scored higher than the control lecture group (CLG) (group 1), and this difference was also found to be significant. Pairwise comparisons between the three groups for knowledge appear in Table 5.

Figure 8. Trend analysis of *post-knowledge scores* across treatment groups



Correlation Analyses

Relations between Demographic Variables and Pre-test Flexibility Scores

Pearson correlation coefficients were generated to examine relationships between measures of demographic variables and the measures of pre-test flexibility scores. In general, demographic factors, such as age, gender, ethnicity, student status, and employment status, were not significantly related to pre-flexibility scores. However, the following demographic variables (reasons for exercising and types of exercises) were found to be correlated at the .01 significance level to specific pre-test flexibility measures: *exercising for psychological health* and *stretching practices* (r = .33), *exercising because of health concerns* and *flexibility knowledge* (r = - .35), *exercising to* *improve sports performance* and *right-upper body flexibility* (r = -.40), *exercising to improve sports performance* and *left-upper body flexibility* (r = -.35), *exercising to improve sports performance* and *self-efficacy* (r =.34), *aerobic exercise regime* and *self-efficacy* (r = .37) and *strength training regime* and *stretching practices* (r = .36), *flexibility exercise regime* and *stretching practices* (r = .47), and *exercise frequency* and *stretching practices* (r = .53). The results of these analyses may be found in Table 7.

It is interesting to note that the response "exercising to improve sports performance" was inversely related to upper body flexibility; perhaps the focus of the respondents is on strength training rather than flexibility exercises. However, the response "exercising to improve sports performance" was positively related to self-efficacy, possibly because the respondent is a member of a sports team and believes him- or her- self as capable. Strength training, usually conducted on a precise schedule, was correlated to stretching practices, as was flexibility training. Similarly, the response "exercising for psychological health" was correlated with stretching practices, representing perhaps scheduled relaxation exercises. Aerobic exercise regime, which typically includes a stretching warm-up and cool-down component, was correlated to flexibility self-efficacy. Lastly, "exercising because of health concerns" was inversely correlated to flexibility knowledge; health concerns may have arisen from illness, which may be related to misinformation or lack of information.

Table 7

Results of correlation analyses between demographic variables and pre-test flexibility scores

	RUBF	LUBF	Lower Flexibility	Stretching Practices	Outcome Expectations	Self-Efficacy	Knowledge
Age	.15	.15	.05	-.02	-.24	-.11	.09
Gender	.02	.08	.14	-.17	-.23	-.23	-.15
Ethnicity							
Caucasian	.14	.06	.15	-.04	.05	-.02	.24
Asian	-.01	.08	-.03	-.15	-.19	-.24	-.26
Black	.12	.02	.05	-.06	.01	.12	-.14
Hispanic	-.05	.02	-.07	.20	-.01	.07	.05
Other	-.24	-.24	-.09	.03	.25	.15	.18
Student Status	-.01	.01	-.04	-.21	-.03	-.11	-.06
Employment Status	.05	-.01	.04	-.09	-.19	.02	.30
Reasons for Exercising							
psychological health	.04	.09	-.19	.33**	.17	.23	.00
general health	.11	.14	.01	.19	.13	.17*	.00
health concerns	.12	.14	.24	.08	-.03	-.11	-.35**
sports performance	-.40**	-.35**	-.02	.07	.26	.34**	.14
improve flexibility	.07	.10	.07	.06	-.09	.05	.02
weight loss	-.22	-.19	.01	.17	-.03	.11	.18
Strength	-.05	-.14	-.15	.28*	.10	.27*	-.01
physical appearance	.09	.06	.14	.24*	.03	-.00	.09
muscle bulking	-.04	.05	-.15	.01	-.29	-.07	-.17
heart health	-.11	.02	.14	.02	.03	-.06	-.03
Exercise Type							
aerobic exercise	-.14	-.08	-.06	.22	.29*	.37**	-.06
strength training	.09	.10	.16	.36**	.07	.22	.14
flexibilty exercise	.01	.07	.17	.47**	.16	.28	.08
Exercise Frequency	.03	.06	.15	.52**	.09	.26	-.03

Cells contain zero order (Pearson) correlations. *Correlation is significant at the .05 level (two tailed). **Correlation is significant at the .01 level (two tailed). N = 67.

Relations between Post-test Flexibility Scores

Pearson correlation coefficients for the dependent measures are reported in Table 8. The following physiological dependent measures were found to be significantly correlated: *right upper body flexibility* and *left upper body flexibility* (*r* =.88), *right upper body flexibility* and *lower body flexibility* (*r* =.43), and *left upper body flexibility* and *lower body flexibility* (*r* =.34). The following self-regulatory dependent measures were found to be significantly correlated: *outcome expectations* and *stretching practices* (*r* = .48), *stretching practices* and *self-efficacy* (*r* = .44), *outcome expectations* and *self-efficacy* (*r* =.50) and *knowledge* and *outcome expectations* (*r* =.42). In general, physiological measures were correlated to one another, while self-regulatory constructs were correlated to one another. It is interesting to note that, although most of the self-regulatory constructs were influenced by the treatment, they did not correlate significantly with the physiological measures.

Table 8

Results from zero-order correlation analysis of post-test measures

Post-Dependent Measures	1	2	3	4	5	6	7
1. Right Upper Body Flexibility	1.0	.88**	.43**	.08	.12	.15	-.06
2. Left Upper Body Flexibility		1.0	.34**	.06	.12	.13	.02
3. Lower Body Flexibility			1.00	.23	.16	.10	.18
4. Stretching Practices				1.00	.48**	.44**	.23
5. Outcome Expectations					1.00	.50**	.42**
6. Self-efficacy						1.00	.24
7. Knowledge							1.00

Cells contain zero order (Pearson) correlations. * Correlation is significant at the .05 level (two-tailed). ** Correlation is significant at the .01 level (two-tailed). N = 55

As stated above, a significant relationship (*r* = .44, $p < .01$) was found in this study between self-efficacy and exercise (stretching practices), as was the case in the research conducted by Sollerhed, Apitzsch, Rastam, and Ejlertsson (2008); Motl et al. (2005); and Rovniak, Anderson, Winett and Stephens (2002). Similarly, Petosa, Suminski and Hortz (2003); Scholz, Sniehotta, Achuz, and Oeberst (2007); and Sniehotta, Schulz, Schwarzer, Furhmann, Kiwus, and Voller (2005) reported in their research that both self-efficacy and outcome expectancy were significant predictors of exercise. In alignment, this research study also demonstrated a significant relationship between outcome expectations and stretching practices (*r* = .48, $p <.01$).

CHAPTER 5

DISCUSSION

General Discussion

The purpose of this research was to determine if two self-regulatory processes, technique modeling alone and combined with self-evaluation, had an impact on college students' self-regulation of motoric flexibility as measured through physiological assessments, surveys of stretching practices, and appraisals of outcome expectations, self-efficacy, and knowledge of proper flexibility exercise procedures. The results of the research demonstrate that self-regulation training, which consisted of technique modeling combined with self-evaluation (TMSE), had a significant impact on college students' right upper body motoric flexibility, stretching practices, outcome expectations, self-efficacy and flexibility procedural knowledge compared to that of students exposed to a traditional health class, utilizing a lecture format. Self-regulation training, specifically TMSE, also resulted in greater left upper body flexibility scores and greater lower body flexibility scores compared to lecturing, but these differences were not found to be significant.

Findings from this study also demonstrated a significant effect of technique modeling (TM-) alone on college students' *flexibility outcome expectations* and *knowledge* compared to traditional lecturing. Further, TM demonstrated improvements in right upper body flexibility, stretching practices, and self-efficacy in comparison to lecturing, however, these differences were not found to be significant.

Hypotheses that were Tested

Hypothesis 1

This first hypothesis posited that there would be a significant linear trend between students' exposure to three levels of self-regulation training (no self-regulation lecturing, technique modeling alone and with self-evaluation) on students' right upper body flexibility. The findings from the trend analysis indicated a statistically significant linear effect of self-regulatory training on *right upper body flexibility*. Further, the LSD pairwise comparisons demonstrated that the technique modeling and self-evaluation group (TMSEG) scored significantly higher as compared to the control lecture group (CLG). Thus, hypothesis one was confirmed.

This result is a minor breakthrough in the field of health and physical education. Several prior studies have not had success in demonstrating a significant change in flexibility status post-intervention (Aggeloussis, Derri & Petraki, 2004; Cardinal & Spaziani, 2007; Faigenbaum et al., 2009; and Sallis, McKenzie, Alcaraz, Kolody, Faucette, & Hovell, 1997).

Hypothesis 2

This second hypothesis posited that there would be a significant linear trend between students' *left upper body flexibility* and students' exposure to self-regulation training. The findings from trend analysis did not reveal a statistically significant linear trend among the groups, and thus, hypothesis two was not confirmed.

Hypothesis 3

This third hypothesis posited that there would be a significant linear trend between students' *lower body flexibility* and students' exposure to self-regulation training. The findings from trend analysis did not reveal a statistically significant linear trend among the groups, and as a result, hypothesis three was not confirmed.

Hypothesis 4

This hypothesis posited that there would be a significant linear trend between students' *stretching practices* and students' exposure to self-regulation training. The findings from the trend analysis indicated a statistically significant linear effect of self-regulatory training on stretching practices. Furthermore, LSD pairwise comparisons demonstrated that the technique modeling and self-evaluation group (TMSEG) scored significantly higher as compared to the control lecture group (CLG). The findings from the trend analysis demonstrated that with additive features of self-regulatory training [i.e. from control lecturing to technique modeling (TM) and to technique modeling combined with self-evaluation (TMSE)], greater stretching practice scores occurred. Thus, hypothesis four was confirmed.

This finding is in alignment with prior research, which demonstrated significantly the predictive effect of self-regulation techniques on exercise practices (Faigenbaum & Mediate, 2006; Petosa, Suminski & Hortz, 2003; Rovniak, Anderson, Winett & Stephens, 2002; and Winters, Petosa & Charlton, 2003). In addition, Lutz, Karoly and Okun (2008) reported a significant correlation between the self-regulation technique of monitoring and exercise practices ($r = .53$, $p < .05$).

Hypothesis 5

This hypothesis posited that there would be a significant linear trend between students' *flexibility outcome expectations* and students' exposure to self-regulation training. The findings from the trend analysis indicated a statistically significant linear effect of self-regulatory training on outcome expectations. LSD pairwise comparisons demonstrated that the technique modeling and self-evaluation group (TMSEG) scored significantly higher as compared to the control lecture group (CLG). More specifically, students in the technique modeling and self-evaluation group (TMSEG) scored 3.025 points higher on the outcome expectations posttest as compared to the control lecture group. In addition, LSD pairwise comparisons demonstrated that the technique modeling group (TMG) scored significantly higher as compared to the control lecture group (CLG). The findings from the trend analysis demonstrated that the additive features of self-regulatory training [i.e. from control lecturing to technique modeling (TM) and to technique modeling combined with self-evaluation (TMSE)], led to significantly greater outcome expectation scores. Thus, hypothesis five was confirmed.

Furthermore, this research study demonstrated a significant relationship between outcome expectations and stretching practices (r = .48, p <.01). This finding appears to be congruent with other studies that show outcome expectancy to be a significant predictor of exercise (Petosa, Suminski & Hortz, 2003; Scholz, Sniehotta, Achuz, & Oeberst, 2007; and Sniehotta, Schulz, Schwarzer, Furhmann, Kiwus, & Voller, 2005).

Hypothesis 6

This hypothesis posited that there would be a significant linear trend between students' flexibility *self-efficacy* and students' exposure to self-regulation training. The findings from the trend analysis indicated a statistically significant linear effect of self-regulatory training on self-efficacy. Furthermore, LSD pairwise comparisons demonstrated that the technique modeling and self-evaluation group (TMSEG) scored significantly higher when compared to the control lecture group (CLG). The findings from the trend analysis demonstrated that additive features of self-regulatory training produced a linear effect on students' self-efficacy scores. Sniehotta, Scholz, Schwarzer, Fuhrmann, Kiwus, and Voller (2005) had similar self-efficacy results, when using diaries to enable self-evaluation. Thus, hypothesis six was confirmed.

Hypothesis 7

This seventh hypothesis posited that there would be a significant linear trend between students' self-regulatory training and their *flexibility knowledge*. The findings from trend analysis indicated a statistically significant linear effect of self-regulatory training on flexibility knowledge. LSD pairwise comparisons demonstrated that the technique modeling and self-evaluation group (TMSEG) scored significantly higher as compared to the control lecture group (CLG). Thus, hypothesis seven was confirmed.

Limitations of the Study

Although there were differences in motoric flexibility following self-regulatory instruction, they attained significance regarding only right upper body flexibility, but not regarding the other two physical measures: left upper body flexibility and lower body flexibility. It is unclear why the latter two physical measures were not impacted by self-regulatory training. It could be that students were mainly right-handed and that they implemented the stretching procedure more effectively with their right upper body flexibility. Unfortunately, students' handedness was not recorded in the present study, and thus, answers to this hypothesis must await future research.

Future researchers should also focus more carefully on the implementation of the stretching practices to see if they are being learned properly. It should also be noted that expecting changes in physical functioning is a very demanding criterion of success for a research study of limited duration. Changes in personal beliefs are perhaps the easiest to effect; changes in behavior are more demanding. However, changes in physical functioning depend on significant changes in both health beliefs and healthful behavioral functioning. Future researchers should consider mounting longer interventions that would be more likely to produce an effect on physical functioning.

A third shortcoming of the present research concerns seasonal influences. It was conducted over a winter intercession, in which students met daily, excluding weekends, over a three-week period. A few subjects refused to participate in the physiological measurement component of the study because it required removing shoes or boots, which they found to be uncomfortable during this winter season. Participation and results may improve if research is studied during a season that lends itself more easily to sit and reach lower body flexibility measurements.

It should also be noted that the *flexibility knowledge* measure had low reliability (Cronbach's alpha test of reliability = .43), and the reliability of the *self-efficacy* measure was moderate (Cronbach's alpha test of reliability = .64). Both of these scales were composed of relatively few items, 10 and 4 respectively. Given the fact that reliability was not ideal, additional items should be added to these measures in future research.

Educational Implications

Together technique modeling and self-evaluation were found to significantly enhance right upper body flexibility, stretching practices, flexibility outcome expectations, flexibility self-efficacy, and flexibility knowledge in comparison to lecturing. This is important information for health and physical education instructors. Modeling conveys information on proper technique, which is especially important in activities that involve physical body movements. This technique, when combined with self-evaluation enables participants to monitor their progress, form expectations, make adjustments, shape beliefs, and sustain motivation. In the present study, the flexibility, which results from increased stretching practices, can afford the individual increased muscular and joint function, improved coordination and balance, and reduced risk of injury. These physical improvements can also impact individuals' performance in other exercises and sports, while simultaneously supporting good health.

Educators should consider supplementing health lectures with self-regulatory opportunities. Self-evaluation and technique modeling can be useful in regulating health behaviors, such as weight management and diet adherence. Health instruction modeling, in particular, should include a method of student self-evaluation of health behavior.

Conclusion

This research study demonstrated that self-regulatory instruction that consists of technique modeling alone was insufficient to raise college students' flexibility significantly according to a variety of cognitive and behavioral measures. However, the addition of self-evaluation to technique modeling during instruction significantly enhanced students' flexibility, stretching practices, and self-efficacy, as well as their outcome expectations and flexibility knowledge compared to lecturing. It appears the self-evaluation component is essential to significantly impact these health outcomes. This finding is supportive of cyclical views of health self-regulation (e.g., Winne, 1998, Zimmerman, 2000) with their emphasis on the importance of self-evaluation processes.

APPENDIX A

RECRUITMENT ANNOUNCEMENT

Gloria McNamara is a doctoral student in the Educational Psychology Ph.D. Program at The Graduate Center of the City University of New York (CUNY). She is recruiting students from the *Introduction to Health* course (HED 100) at BMCC to participate in a research study, entitled *"Training Students' Self-regulation of Motoric Flexibility: The Effects of Modeling and Self-evaluation."*

The study plans to investigate whether students can be trained to increase their physical flexibility by using self-regulatory strategies. It would entail getting data on one's exercise routines as well as one's beliefs about exercise through the collection of a 2-page questionnaire. In addition, upper and lower body flexibility measurements will be obtained, utilizing the *thumb reach* and *sit and reach* tests recommended by the National Athletic Health Institute. Procedures are in place to keep the information confidential; students will be assigned an anonymous code to use on the material.

The risks from participating in this study may include, during the initial stage of stretching, slight tension. The benefits from participating in this study may include greater flexibility and a reduction in injuries, such as backaches. If one does not wish to participate, then one does not need to. Pregnant women and minors will be excluded from recruitment. Subjects must be 18 years old to participate.

Those of you interested in participating in the research study must attend an orientation session; consent forms will be distributed at this time. Volunteer recruits must acknowledge and sign the consent form before research commences.

For more information, contact Gloria McNamara at gmcnamara@bmcc.cuny.edu or (212) 220-7213.

APPENDIX B

CONSENT FORM

Gloria McNamara is a student in the Educational Psychology Ph.D. Program at The Graduate Center of the City University of New York (CUNY) and the Principal Investigator of this project, entitled *"Training Students' Self-regulation of Motoric Flexibility: The Effects of Modeling and Self-evaluation."* This research study plans to investigate whether students can be trained to increase their physical flexibility by using self-regulatory strategies. The study is expected to provide information about the effectiveness of instructor modeling and self-evaluative judgments on students' flexibility status as well as flexibility practices and beliefs.

Ms. McNamara would like permission to ask you about your exercise routines as well as your beliefs about exercise through your completion of a 2-page questionnaire. The questionnaire should take approximately 15 minutes to complete. It will be administered at the beginning of the study and again at the conclusion of the study. Additionally, upper and lower body flexibility measurements will be obtained at these times, utilizing the *thumb reach* and *sit and reach* tests recommended by the National Athletic Health Institute. You must be 18 or older to participate in this study. Participants may be requested to incorporate stretching exercises into their daily routines at home. Pregnant students will be excluded from participation.

All information gathered will be kept confidential and will be stored in a locked file cabinet to which only Ms. McNamara and her advisor have access. At any time you can refuse to answer any questions or refuse to participate in certain aspects of the study or end participation in the study.

The risks from participating in this study may include, during the initial stage of stretching, slight tension. The benefits of participation in this study may include greater flexibility and a reduction in injuries, such as backaches. Additionally the provision of evidence for the effect of self-regulation on motoric flexibility will contribute to the field of health education.

There will be approximately 60 participants involved in this research. Results of this study may be published, but names of people, or any identifying characteristics, will not be used in any of the publications. If you would like a copy of the study, please provide the principal investigator with your address, and a copy will be sent to you in the future. If you do not want to participate, you do not need to do so.

If you have any questions about this research, you can contact Ms. McNamara at (212) 220-8000 ext. 7213 or gmcnamara@bmcc.cuny.edu, or her advisor Dr. Barry Zimmerman at (212) 817-8291 or bzimmerman@gc.cuny.edu. If you have any questions about your rights as a participant in this study, you can contact Dr. Janice Walters, IRB Chair/Administrator at BMCC, City University of New York at (212) 220-1226 or jwalters@bmcc.cuny.edu.

You will receive a photocopy of this form for informational purposes and future reference. Thank you for your consideration.

If you are 18 or older **and** agree to participate in the study, entitled *Training Students' Self-regulation of Motoric Flexibility: The Effects of Modeling and Self-evaluation,* please sign below.

Student's Signature	Date	Investigator's Signature	Date

Identification Code

APPENDIX C

STRETCHING PRACTICES

1. Currently, I perform stretching exercises:
   a) never ……………………… 1 pt
   b) one to two times a week……2 pts
   c) three to four times a week….3 pts
   d) five to six times a week…….4 pts
   e) once a day…………………..5 pts
   f) twice a day………………….6 pts

2. When I perform stretching exercises, I typically hold the stretch for:
   a) not applicable because I do not perform stretching exercises
   b) 5 to 10 seconds …………….1 pt
   c) 11 to 15 seconds……………2 pts
   d) 16 to 20 seconds……………3 pts
   e) 21 to 25 seconds……………4 pts
   f) 26 seconds or longer……….5 pts

3. When I perform stretching exercises, I repeat each stretch:
   a) never (I only do each stretch once during my workout) …1 pt
   b) twice during my workout…………………………………2 pts
   c) three times during my workout…………………………...3 pts
   d) four times during my workout……………………………4 pts
   e) more than four times during my workout ………………..5 pts

4. The stretches I do target:
   a) no area (I don't not do stretching exercises) …..1 pt
   b) upper body only………………………………...2 pts
   c) lower body only………………………………...2 pts
   d) both upper & lower body……………………….3 pts

APPENDIX D

Outcome Expectations **Code____________**

Record your level of agreement with the following statements.

	Strongly agree	agree	disagree	Strongly disagree
	4	**3**	**2**	**1**
1) I believe flexibility is determined by one's physical anatomy and can **not** be changed.	**4**	**3**	**2**	**1**
2) I believe flexibility can develop over time by regularly stretching.	**4**	**3**	**2**	**1**
3) I believe stretching can reduce injury.	**4**	**3**	**2**	**1**
4) I believe flexibility has **no** significant impact on health.	**4**	**3**	**2**	**1**
5) I believe stretching can relieve joint pain from excess weight.	**4**	**3**	**2**	**1**
6) I believe flexibility can improve one's sports performance.	**4**	**3**	**2**	**1**
7) I believe stretching can facilitate relaxation.	**4**	**3**	**2**	**1**
8) I believe stretching increases blood circulation to the muscles.	**4**	**3**	**2**	**1**

Self -efficacy Beliefs

1) I am capable of choosing exercises that will increase my flexibility.	**4**	**3**	**2**	**1**
2) I am capable of performing stretching exercises five times a week .	**4**	**3**	**2**	**1**
3) I am capable of knowing when my muscles are sufficiently stretched.	**4**	**3**	**2**	**1**
4) I am capable of avoiding injury and muscle soreness when exercising.	**4**	**3**	**2**	**1**

APPENDIX E

RESEARCH STUDY: TRAINING STUDENTS' SELF-REGULATION OF MOTORIC FLEXIBILITY: THE EFFECTS OF MODELING AND SELF-EVALUATION

Flexibility Knowledge **Code_______**

1) The goal of performing flexibility exercises is to
   a) increase muscle strength.
   b) increase heart and lung efficiency
   c) optimize range of motion in the joints
   d) increase muscle endurance.

2) Which of the following activities has the greatest potential for increasing flexibility?
   a) jogging
   b) push-ups
   c) sit-ups
   d) yoga

3) According to Insel and Roth (2010), flexibility exercises should be performed:
   a) 2 times a week
   b) 4 times a week
   c) 6 times a week

4) Stretching exercises should be performed in all the following ways **except**:
   a) to the point of mild tension.
   b) by holding each position for 15 to 30 seconds
   c) with a swinging bouncing motion.
   d) by extending the joints to their full range of motion.

5) Flexibility is best described as:
   a) the ability to move without pain during exercise.
   b) the ability to move the joints through their full range of motion.
   c) sustained motion without resistance.
   d) the ability to move rapidly during exercise.

Continue answering questions on the back of this sheet.

6) The stretch reflex occurs when:
   a) the target heart rate is reached.
   b) normative flexibility standards are reached.
   c) muscle fibers are stretched too far, such as by bouncing.
   d) the feeling of tension is relieved.

7) Stretching is done as part of a “cool down”:
   a) to make muscle more pliable for the intended activity.
   b) to increase recovery time.
   c) to provide resistance to the muscle.
   d) to return muscles to normal resting lengths.

8) Stretching is done before exercising:
   a) specifically to enhance muscle contraction
   b) to prevent blood pooling
   c) to increase the temperature within muscles
   d) to rid muscles of waste products.

9) The “quadricep stretch” targets the flexibility of:
   a) the inner thigh.
   b) the front of the thigh.
   c) the back of the thigh.
   d) the outer thigh.

10) The “hamstring stretch” targets the flexibility of:
   a) the inner thigh.
   b) the front of the thigh.
   c) the back of the thigh.
   d) the outer thigh.

APPENDIX F

Demographic Information Sheet

1. Indicate your code in the space provided. ____________________
2. Indicate your age by circling the appropriate response.
    a. 18 to 25 years
    b. 26 to 32 years
    c. 33 to 46 years
    d. 47 years or more

3. Indicate your gender identification by circling the appropriate response.
    a. Male b. Female

4. Indicate your race or ethnicity by circling the appropriate response.
    a. White, non-Hispanic
    b. Asian or Pacific Islander
    c. Black, non-Hispanic
    d. Hispanic/Latino
    e. Not listed here.

5. Indicate student category by circling the appropriate response.
    a. part-time (less than 12 hours/credits per semester)
    b. full-time (12 hours/credits or more per semester)

6. Indicate employment status by circling the appropriate response.
    a. less than or equal to 10 hours per week
    b. less than or equal to 21 hours per week
    c. less than or equal to 35 hours per week
    d. more than 35 hours per week

7. How often do you exercise?
    a. never
    b. one to two times a week
    c. three to four times a week
    d. five to seven times a week

8. What type of exercises do you engage in? (Please circle those that apply.)

walking	jogging	running	jump-roping
aerobic dancing	calisthenics	pilates	yoga
weight training	stretching	martial arts	other: ________________________

9. Do you engage in any flexibility exercises? Yes or No
10. If so, please specify which flexibility exercises ________________________________
11. If you do exercise, why do you exercise? (Please circle top 3 reasons.)

for psychological health	to lose weight
for general physical health	for strength
because of health concerns	for physical appearance
to enhance sports performance	to build muscle
to improve flexibility	for heart health
other: ____________________	

APPENDIX G

1) Abdominal Stretch
- Stand
- Interlace fingers above head, palms upward
- Push arms slightly back and up
- Breathe easy
- Hold – 15 seconds
- Relax

2) Chest Stretch
- Stand
- Put arms behind you
- Interlace fingers
- Push arms away from behind
Hold - 15 seconds
- Relax
- Repeat exercise

3) Mid-Back Stretch
- Stand (feet placed shoulder width apart) with hands on hips
- Gently twist torso at waist (towards right) until stretch is felt
- Hold 15 seconds (Keeps knees slightly flexed)
- Relax
- Repeat on other side.
- Stand with hands on hips
- Gently twist torso at waist (towards left) until stretch is felt
- Hold 15 seconds (Keeps knees slightly flexed)
- Relax

4) Overhead Arm Pull
- Stand (feet placed shoulder-width apart) with right hand on hip
- and raise left arm overhead
- Lean torso towards the right bending a bit at the waist
- Left arm should be curving overhead, fingers pointing towards right foot
- Tilt head towards right so right ear is near right shoulder
- Hold 15 seconds
- Relax
- Repeat on other side
- Stand (feet placed shoulder width apart) with left hand on hip and
- raise right arm overhead
- Lean torso towards left, bending a bit at the waist
- Right arm should be curving overhead, fingers pointing towards left foot
- Tilt head towards right so left ear is near left shoulder
- Hold 15 seconds
- Relax

6) Hamstring Stretch
- Stand with feet shoulder-width apart
- Keep heels flat, toes pointed straight ahead
- With knees slightly bent, bend forward at hips
- Keep arms and neck relaxed
- Hold 15 seconds
- Do not lock knees or bounce
- Keep knees slightly bent as you return to upright position

7)Thigh (Quadricep) Stretch
- Place hand on desk for support
- Grasp top of right foot with
right hand
- And stand straight
- Pull heel toward buttock
- Hold 15 seconds
- Relax
- Place hand on desk for support
- Grasp top of left foot with left
hand
- And stand straight
- Pull heel toward buttock
- Hold 15 seconds

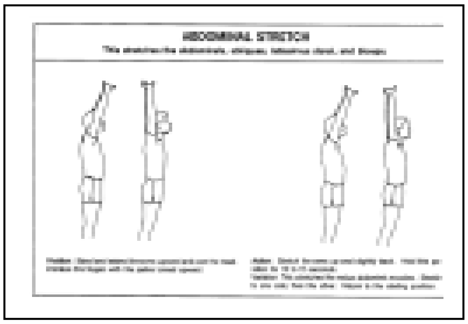
8) **Groin Stretch**

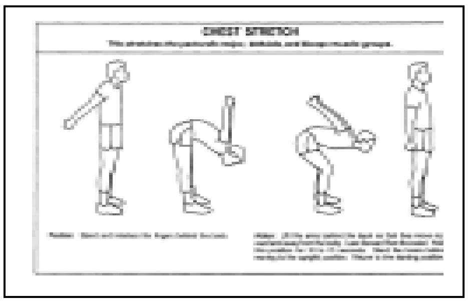
- Stand with feet pointed straight ahead
- A little more than shoulder-width apart
- Bend right knee slightly and
- move left hip downward toward right knee
- Hold 15 seconds
- Relax
- Repeat on other side
- Stand with feet pointed straight ahead
- A little more than shoulder-width apart
- Bend left knee slightly and move right hip downward toward right knee
- Hold 15 seconds
- Relax

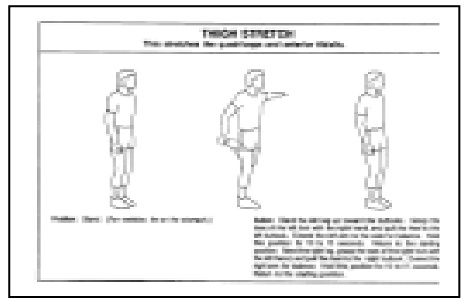
9) Calf Stretch

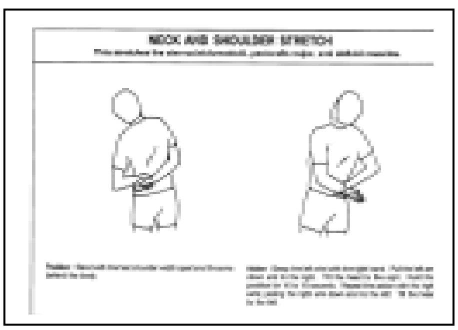
- Place hand on desk for support
- Rise up on toes as high as possible
- Hold for 15 seconds
- Relax

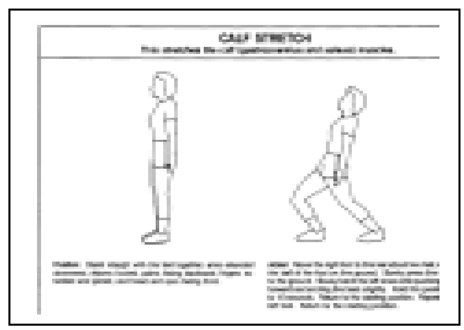
APPENDIX G

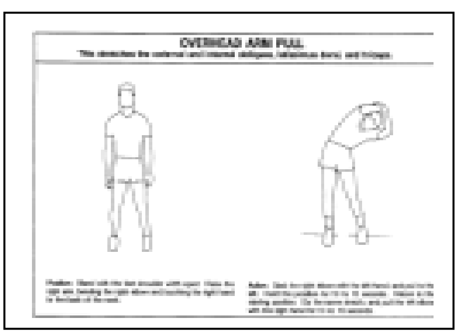












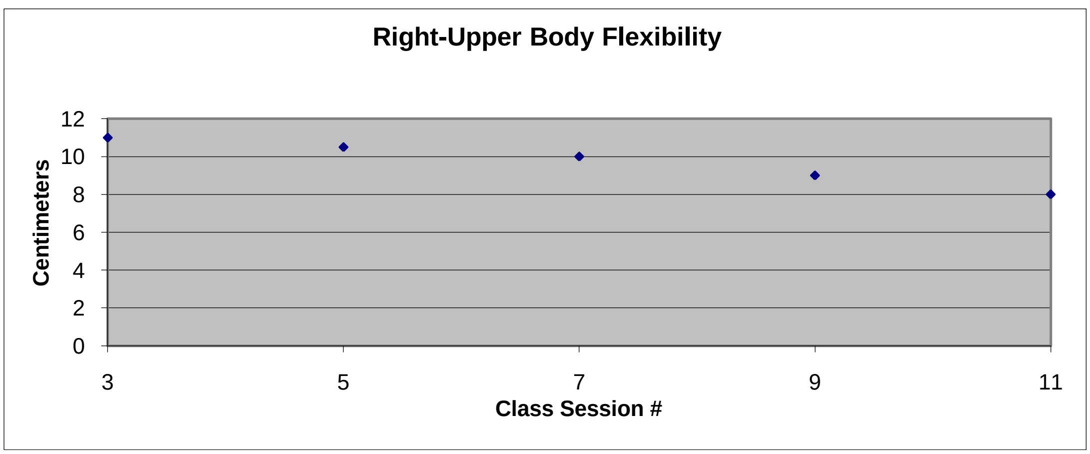
Source: United States Army (2005), *United States Army Fitness Handbook*, www.physicallytrained.com

APPENDIX H

Code:____________

Comparative Norms: Average Range of Motion 8-9 cm
Excellent Range of Motion 0-1 cm
Source: Jones & Rikli, 2002; Reid & Thomson, 1985

Measurements are recoded during data entry to present direct relationship to flexibility.

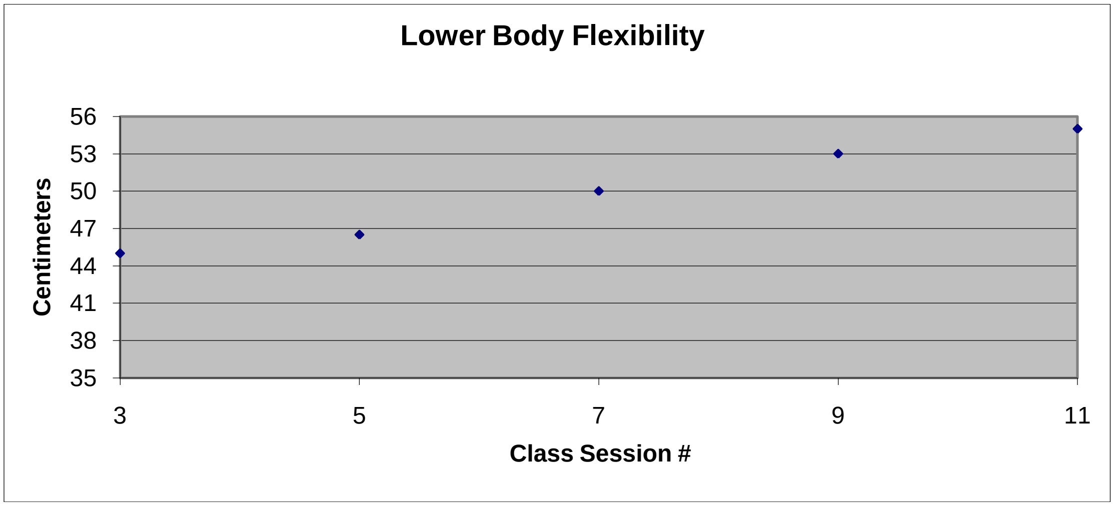


Comparative Norms: Average Range of Motion 8-9 cm
Excellent Range of Motion 0-1 cm
Source: Jones & Rikli, 2002; Reid & Thomson, 1985

Measurements are recoded during data entry to present direct relationship to flexibility.

APPENDIX H

Code:____________



Comparative Norms: Average Range of Motion 12.5-25 cm (5-10 in.)
Above Average Range of Motion 40-50 cm (16-20 in.)
Excellent Range of Motion ≥ 52.5 cm (≥ 21 in.)
Source: Davis, Bull & Roscoe (2000)

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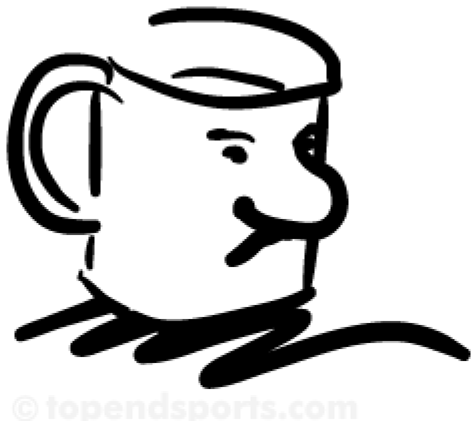

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