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Examining student engagement and its influence in a social contextual model of adolescent health behavior change

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Examining Student Engagement and Its Influence in a Social Contextual Model of

Adolescent Health Behavior Change

A Dissertation submitted in partial fulfillment of the requirements for the degree of
Doctor of Philosophy at Virginia Commonwealth University.

by

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Abstract

EXAMINING STUDENT ENGAGEMENT AND ITS INFLUENCE IN A SOCIAL

CONTEXTUAL MODEL OF ADOLESCENT HEALTH BEHAVIOR CHANGE

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A Dissertation submitted in partial fulfillment of the requirements for the degree of
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Current theoretical models of health behavior change frequently serve as the

theoretical backdrop to adolescent health promotion programs. Yet, despite that each

main theory was developed with adults and for adults, appropriate and necessary changes

for adolescents are often neglected. The unique values, priorities, and abilities of

adolescents are important and therefore necessary to consider during health promotion

efforts. The present study explored student engagement, a unique adolescent need that

has been shown to facilitate achievement in academic environments. Evidence from the

psychological and educational literatures suggests that engagement may uniquely

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influence the process of health behavior change for adolescents. Due to the paucity of related investigations, the current study first explored the structure of the student engagement construct, and second, tested student engagement as a predictor of behavioral intentions in three separate social contextual models of adolescent health behavior change. A mixed-method quasi-experimental design was used in the investigation. Data were gathered from a school-based randomized intervention program, *Building a BRIDGE to Better Health* (BRIDGE). BRIDGE was a 6 week life skills intervention program that was created to promote cancer-risk reduction among adolescents. It was based on a genealogy and health promotion/disease prevention model. An exploratory factor analysis (EFA) was performed to investigate the latent structure of the student engagement construct. Linear mixed models (LMM) were used to test student engagement as a novel predictor within social contextual models of health behavior change predicting student intentions to reduce fat consumption, conduct self-examinations, and exercise. The EFA yielded a one-factor solution that included six of the initial seven items. This finding did not support the hypothesis, which predicted that items would differentiate into behavioral, cognitive, and emotional types of student engagement. Results of the LMMs supported the hypotheses that student engagement would have a significant effect on student intentions to reduce fat consumption, conduct self-examinations, and exercise. Based on comparisons between student engagement and similar predictor variables, overall findings indicate mixed support for student engagement as a significant predictor in theoretically-based models of adolescent health behavior change.

Chapter 1

Introduction

The fields of medicine, public health, epidemiology, psychology and many other health-related disciplines have undergone incredible transformations during the past 100 years. Scientific advances and discoveries in multiple areas have contributed to an ever-growing body of knowledge that has been used to improve health. The average life expectancy in the United States at the turn of the 20th century was 47 years of age and the average is now over 80 years (Galor & Moav, 2005). The amount of information that is available to the general public and how quickly it can be accessed is staggering. The growing interest in various fields that conduct health-related research is hopeful, because by some estimates, help is needed more than ever. Extended life expectancy is impressive, but it appears to come with a cost. The health consequences of chronic disease become most apparent in what we call "middle age." Cancer is the number two leading cause of death in the U.S. (United States Cancer Statistics Working Group [USCSWG], 2006) and because of people's interest, research, and money, the scientific community has become aware that human behavior is the biggest cause of increased risk for cancer (American Cancer Society [ACS], 2007).

Efforts to combat the onslaught of chronic disease, specifically cancers, have yielded even more scientific evidence and valuable findings. For instance, specific risk factors have been identified as key contributors to specific cancers, such as smoking (Altman & Jackson, 1998), sedentary behavior (Bauman, 2004; Lowry, Wechsler,

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Galuska, Fulton, & Kann, 2002), high-fat and high-caloric intake (Lowry et al., 2002),

obesity (World Health Organization [WHO], 1998), and lack of physical activity

(Dubbert, 2002). In addition to identifying these specific links, health professionals have

turned their focus to youth because that is where habits and behaviors start, essentially

the roots of many cancers (Orlandi & Dalton, 1998).

As a result of knowing that individuals have the capability to make significant

strides toward protecting their own health, the focus of some research shifted again.

Whereas many of the greatest improvements in health made early in the 20th century were

done through social or public initiatives (e.g., sanitation), researchers, particularly in

psychology, began to see the potential benefit of understanding how individuals can

change their behavior (Glanz, Rimer, & Lewis, 2002a).

From the 1950's through the late 80's and 90's, theories of health behavior

change developed and flourished (Glanz, Rimer, & Lewis, 2002b). Azjen (1985),

Bandura (1977), and Prochaska and DiClimente (1983) were all prolific as they advanced

their models in many ways. Models of health behavior change, including the Health

Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior, and the

Transtheoretical Model were being applied to various clinical populations and the

evidence was generally positive.

Perhaps it was due to the success of the theories of health behavior change, but

the focus shifted slightly away from youth and adolescent health. Although these

theorists of health behavior change conducted research with youth and adolescents,

particularly with interventions targeting socially undesirable health behaviors, the next

breakthrough in health that had become customary during the 20th century, was nowhere to be found. Scientists continue to work hard and with innovative methods. Celebrities are also devoting significant time (e.g., Lance Armstrong), energy, and money in order to make a difference, however possible. Yet, as financial expenditures for cancer rise to record levels (Antos & Rivlin, 2007), and childhood obesity does the same, researchers conducting interventions, on the whole, continue to treat youth and adolescents with models that were not developed to meet their needs.

Although theories have not necessarily adapted to the needs of youth and adolescents, health programs and interventions have begun to address these needs. Health promotion programs, particularly those that employ a positive youth development framework, have attempted to provide interventions for young people that are important to them, developmentally appropriate (Breinbauer & Maddaleno, 2005), and above all, engaging. These efforts are promising, but as noted at the start, new answers such as these are still needed.

Researchers wanted to know how students spent their time during school; in a question, how engaged were they? Shernoff, Csikszentmihalyi and colleagues (2003) found that students spent over half of every class doing independent work, a third being passive, and only about 14% during interactive activities. Engagement was at its highest during autonomous interactive activities (Shernoff, Csikszentmihalyi, Schneider, & Steele Shernoff, 2003).

In general, although researchers using the recognized theories of health behavior change continue to produce statistically significant results, the alarming rates of obesity

and type II diabetes in young people continue relatively unabated (United States Department of Health and Human Services [USDHHS], 2007). Although the feasibility of implementing a less established approach can sometimes be difficult, innovative health-based community intervention programs that involve significant student engagement and activity may provide a previously unexplored opportunity.

Purpose of the Study

Current models of health behavior change frequently serve as the theoretical backdrop to adolescent health promotion programs, despite that each of the main theories was developed with adults and for adults. The unique values, priorities, and abilities of adolescents are important and therefore necessary to consider during health promotion efforts. The present study will explore student engagement, a distinctively adolescent need that has been shown to facilitate achievement in academic environments. This investigation will explore the role of student engagement within a social contextual model of health behavior change. There is theoretical support from the psychological and educational literatures to suggest that engagement, a multifaceted and subjective construct, may uniquely influence the process of behavior change for adolescents. Moreover, an extensive review of the literature did not reveal a published study that tested engagement in a theory of health behavior change during a health promotion program. Due to the paucity of related investigations, the overarching goal of the current study is to examine the predictive role of engagement in a social contextual model of adolescent health behavior change.

Significance

Adolescent health and wellness is an area of growing importance**.** Research has outlined many unique aspects of adolescent developmental, which should be considered when delivering health promotion programs. Although research has documented many adult theories of health behavior change, they have often been applied to adolescent populations without appropriate and necessary changes. In addition, programs that are adapted for youth or adolescents typically employ new models or frameworks that are not conducive to research investigations. Developing an understanding of how a program can adapt the most age-appropriate interventions is a worthwhile effort that often requires exploring new avenues of intervention and evaluation.

Research Questions

- How is the construct of student engagement organized?
  - Engagement is defined as the cognitive, behavioral and emotional investment of students during the intervention and measured by self-reported student perceptions.
  - How does the current study's measurement of student engagement compare to the theoretically-based description of the construct as outlined by Fredricks, Blumenfeld and Paris (2004)?
- Do students who are more engaged in the intervention demonstrate better outcomes than students who are less engaged?
  - Do students with different types of engagement have different outcomes?

Limitations

- Construct measurement does not use well-established and psychometrically sound instruments. Inadequate measurement limits the reliability and validity of outcomes. Results will be more difficult to interpret due to this limitation.

- Study design is retrospective. The investigation of student engagement was initiated after the BRIDGE program had already started. This post hoc approach requires that the research study adapt to the limitations of the method of the intervention rather than the intervention being dictated by the study.

- Students were not randomly assigned. Many statistical analyses require random assignment of cases; however, procedures have been chosen to account for this non-random assignment. Students were grouped within schools, which were randomly assigned. Thus, this is a less significant limitation.

Chapter 2

Review of Literature

Overview

The research described in this section provides relevant background information

to the current study, while also supporting the importance of conducting the investigation.

Literature from the fields of psychology, education, and public health are included in this

review. Starting with epidemiological data for cancers, public health research serves to

set the stage of the current health crises that are affecting adults as well as adolescents

and youth. As part of a continual effort to show how research from these fields is

intertwined, psychological factors of health behavior change are presented as part of the

solution, mainly focusing on individual health behavior change. Particular contributions

from the field of psychology to research on health include theoretically-based and

empirically-tested models of health behavior change.

As a complement to the models developed by psychologists, educational research

on developmentally-appropriate interventions for youth and adolescents have been

increasingly applied to health behavior research. Specifically, developmentally-

appropriate intervention programs for preventing disease among youth and adolescents

(e.g., positive youth development) are slowly becoming the norm rather than the

exception. A particular aspect of appropriate interventions for youth and adolescents that

is gaining increased attention in the psychological and educational literatures is student

engagement, which is the main construct of interest in the current study. Recent efforts to

improve the definition and measurement of student engagement are described along with findings showing that it is a strong predictor of achievement in academic environments. Last, student engagement research is described with the purpose of building a case for student engagement as a potential significant predictor of adolescent health behavior change, therefore supporting the aim of the current investigation.

Cancer Data

Cancer is the second leading causes of death in the U.S. and accounts for over half a million deaths every year (USCSWG, 2006). Millions of dollars have been spent on grant-funded research in an effort to understand causal factors, preventive methods, and even a cure (ACS, 2007). Many professionals work in different capacities on cancer-related projects, including physicians, public health officials, nurses, psychologists, and others. Laypeople also are interested in cancer; for example, close to a billion dollars has been donated to the Susan G. Komen for the Cure organization (About Komen, 2007).

The most recent available data from 2003 was gathered by the Centers for Disease Control and Prevention (CDC) and the National Cancer Institute (NCI), from the National Program of Cancer Registries (NPCR) and Surveillance, Epidemiology and End Results (SEERS). According to these updated statistics, one out of every four deaths is due to cancer (USCSWG, 2006). Approximately 1.3 million Americans are diagnosed with cancer every year, and in 50 years, the number is predicted to double.

The three most common cancers diagnosed in men are prostate, lung and colorectal. However, lung cancer accounts for the vast majority of cancer deaths (71%;

USCSWG, 2006). Among women, the most frequently diagnosed cancers are breast, lung and colorectal.

Differences exist between ethnic groups. Overall, American Indian/Alaskan Native men have the lowest incidence rates of cancer and Asian/Pacific Islander men have the lowest death rates (USCSWG, 2006). Although cancer rates continue to rise in all populations, in rural areas and among Blacks, the rates have increased faster than the national average (ACS, 2007).

According to 2003 data (USCSWG, 2006), the prevalence and incidence rates of cancer in Virginia are generally similar to national averages. The national incidence rate of all combined cancers for men was approximately 542 cases per 100,000 people and 404 cases for women. Virginia ranks slightly below the average for both men (534) and women (394). Regarding specific cancers, the national incidence rate for breast cancer was 119 cases per 100,000 people.

The national incidence rate of prostate cancer was 150 cases per 100,000 men as opposed to the 154 cases per 100,000 in Virginia. National incidence rates of colorectal cancer was 60 for men and 44 for women, but in Virginia, the rates were slightly lower, 57 and 43, respectively. In lung and bronchus cancer, national incidence rate for all men was 87; in Virginia, it was 90 cases per 100,000. For women, the national average (54) was approximately the same for women in Virginia. The national incidence rates of other cancers (e.g., pancreatic and skin) were relatively the same in Virginia (USCSWG, 2006).

The cancer death rates for men in Virginia were slightly higher than the national average, 77 cases per 100,000 compared to the national average of 72 cases per 100,000. For women the death rates were similar.

The cancer rates in children are drastically lower than adults (USCSWG, 2006). For males and females between the ages of 10 and 19, the national incidence rate for all cancers combined was 23 cases per 100,000 people. The cancer death rate in 2003 for the same age population was 6 per 100,000.

As expected, children constitute a very small percentage of cancer diagnoses and deaths. It is in adulthood that cancer is most likely to strike. However, cancer-related research has targeted both adults and children in an effort to investigate the effectiveness of different prevention strategies.

Determinants of Cancer

Researchers have investigated the causes of cancer by focusing in two general areas: genetics and lifestyle-related factors (USDHHS, 2000). About five to ten percent of all cancers are estimated to be the result of genetic factors (ACS, 2007). Research findings from studies of lifestyle-related factors show that the majority of cancers are not the result of genetics but are due to human behavior (ACS, 2007; USDHHS, 2000; WHO, 1998). Based on well-established scientific evidence, the development and maintenance of a healthy lifestyle, free from health-compromising behaviors, can help prevent disease, including cancer (Lohaus, Klien-Hessling, & Ball, 2004; Millstein, Peterson, & Nightingale, 1993; USDHHS, 2000). This has resulted in a greater emphasis being placed on the aspects of health that are controlled by an individual's own behavior (Lohaus et

al., 2004; Millstein et al., 1993; USDHHS, 2000). These results are important because individuals are able to assert control over their health, specifically with regards to lifestyle choices and engagement in health-promoting or health-compromising behaviors (Bandura, 2004). Recently, promoting healthy lifestyles has become a national priority and is an integral component of the recommendations outlined in Healthy People 2010 (USDHHS, 2000).

Results from research on lifestyle-related factors conclude that certain health behaviors can help prevent or delay the new onset of many different cancers. Adopting a healthy lifestyle, avoiding tobacco use, increasing physical activity, achieving optimal weight, and improving nutrition have all been found to help prevent cancer in general (USDHHS, 2007). Yet the majority of research has not focused on identifying health-enhancing behaviors as much as it has looked for risk factors for cancer. A recent literature review by Rice (2004) found that health-related research generally focuses on predicting risk factors, including smoking (Altman & Jackson, 1998), sedentary behavior (Bauman, 2004), high-fat and high-caloric intake (Lowry et al., 2002), obesity (WHO, 1998), and lack of physical activity (Dubbert, 2002).

Yet, not all cancers are influenced by the same factors. Research has attempted to identify the specific risk factors for specific cancers. The American Cancer Society (2007) reports these findings in their yearly *Facts and Figures* report. The strongest evidence of a causal effect is tobacco use (and being around others' smoke what is called the effects of second-hand smoke) as a risk factor for lung cancer.

Cancer researchers have also identified screening examinations as a method for early detection, which improves prevention and reduces cancer mortality rates. For example, breast cancer screening over the age of 40 has been shown to decrease chance of death by 20%-25% (United States Preventive Services Task Force [USPSTF], 2007). Colorectal cancer deaths can also be reduced with regular screenings (USPSTF, 2007). However, screening for people who are asymptomatic is not indicated for pancreatic, lung, testicular, and prostate cancers (USPSTF, 2007). Self-examinations for breast and testicular cancers are additional forms of screening that have previously been recommended, but due to lack of scientific evidence, breast self-examination (BSE) and testicular self-examination (TSE) are not government recommendations at this time (USDHHS, 2002).

Adolescent Health Behavior

Adolescence is a critical time for developing health behaviors because the habits learned during this period often persist into adulthood and are difficult to change (Breslau & Peterson, 1996; Cullen, Baranowski, & Rittenberry, 2000; Norman, Vaughn, & Roesch, 2004). Empirical evidence has shown that numerous health behaviors follow this pattern, such as smoking, fruit and vegetable consumption, breast and TSEs, substance abuse, physical activity, and sedentary behavior (Orlandi & Dalton, 1998; Trost, Owen, Bauman, Sallis, & Brown, 2002; Wing, 2000). These behaviors not only continue, but contribute to the cancers that appear later in life (Elders, Perry, Erikson, & Giovino, 1994; Fries et al., 2000; Schonfeld et. al., 1993).

Data from the CDC's Youth Risk Behavior Surveillance System (YRBSS) provides the most recent information on high school students' behavior in the U.S. (USDHHS, 2006a). These data show that 9% of high school students reported smoking cigarettes on 20 or more days during the month, 23% smoked during the past month, and 54% reported having ever tried a cigarette. Only one out of five high school students reported consuming five fruits and vegetables on five or more days per week. The recommended physical activity standards were not met by 64% of high school students and 10% did not participate in any physical activity. Lastly, 13% were reported to be overweight and 16% were at risk for being overweight.

The YRBSS data revealed significant differences based on gender and ethnicity (USDHHS, 2006a). Female students were more likely to not participate in any physical activity and to not meet recommended levels of physical activity. Male students, however, were more likely to be overweight and to have smoked more than 10 cigarettes in a single day at least once. Regarding ethnicity, Black students reported smoking cigarettes less frequently and consuming more fruits and vegetables than white students. However, Black students reported less physical activity participation and a higher percentage were overweight, compared to white students.

Data measuring national estimates of youth health behaviors are used to measure progress toward national goals, as set by the Healthy People 2010 initiative (USDHHS, 2000). Relative to the specific Healthy People 2010 goals, the national youth health behavior estimates from the YRBSS 2005 show that high school students have not met

any of the proposed goals. Moreover, current data indicate that youth are 10 percentage points below most health behavior goals (USDHHS, 2006a).

Although controversial, adolescent health behaviors also include BSE and TSE as well as medical screenings (USDHHS, 2002). Evidence compiled from a meta-analysis done by the U.S. Preventive Services Task Force found that BSE was not effective as a method of early cancer detection or for reducing breast cancer mortality. Mammography screening after 40 years of age is the current recommendation. Moreover, BSE in women younger than 40 years old yielded higher rates of false positives. Although testicular cancer is very rare, it primarily occurs in men between 18 and 35 years of age (USDHHS, 2002). A review of available research shows that there is no clear indication that TSE or screenings reduce mortality rates. However, various medical organizations have outlined screening recommendations, especially for people with a family history positive for testicular cancer, but do not recommend TSE. Last, current recommendations also include being aware family history of breast and testicular cancer.

Research into cancer and health in general has advanced the scientific knowledge base immensely. The scientific community has amassed an incredible collective knowledge base of information about healthy living and disease prevention. Perhaps the most important discoveries have been the links between controllable behaviors and the health-enhancing or health-compromising effect they each have on cancer. These advances may not be relevant, however, unless the findings are shared with the general public and individuals behave in a manner consistent with the recommendations.

Health Education and Health Promotion

Health education is based on the principle that health information should be important, accurate, and relevant to people's behavior. Glanz, Rimer, and Lewis (2002a) summarize the five identified areas that health education has typically tried to address: intrapersonal, interpersonal, institutional or organizational, community, public policy. An additional factor inherent to each of the five is the concept of *reciprocal causation*, which describes the bi-directional influence between health behavior and environment.

Health promotion is a term frequently used to describe the process of attempting to increase healthy behavior among groups of people (Glanz et al., 2002b). Health education is a form of health promotion. Health promotion targets individuals, groups, and organizations. It can take many different forms, including publishing articles in health-related journals, distributing condoms in schools, delivering abstinence programming, persuading attitudes in favor of the human papillomavirus vaccine, advertising on the internet to promote milk, among others.

Professionals who work in the areas of health education and health promotion come from the diverse fields of Medicine, Public Health, Education, Genetics, Chemistry, Epidemiology, Biostatistics, Sociology, and Psychology. Glanz and colleagues (2002a) described psychology's major contribution being a long history of scientific investigation, particularly rigorous methodology. Despite disparate training backgrounds, professionals generally share a common interest in wanting to improve the health of others. Although professionals do not necessarily work in tandem, they often complement each other's work indirectly. The interconnectivity between these professionals is an example of reciprocal causation.

Interest in health-related issues has crossed into many subfields. For example, positive psychology has contributed to health education and health promotion by researching how positive affect and emotional states influence health (Seligman & Csikszentmihalyi, 2000). Positive psychology focuses on the strengths of people, rather than weaknesses. Laypeople's interest in health has paralleled professional interest. The proliferation of pharmaceuticals, medical Web sites, and political rhetoric about healthcare are all reflections of American's increased interest in health.

Interest in the field is also motivated by economic reasons. Estimates of the total financial costs of cancer indicate that over 206 billion dollars will be spent on cancer in 2006 (USCSWG, 2006). Moving away from a cure-based treatment system and toward a preventive medicine approach has been justified on the basis of economic affordability; Antos and Rivlin (2007) outlined precisely how it is less costly to develop and implement prevention programs than it is to perform medical procedures that treat chronic diseases. However, they also note the presence of many powerful and wealthy economic stakeholders who will resist change, in part because of their personal financial investments that rely on the current operating procedures.

Increased interest in health is also driven by advances in technology. Adolescents are especially attracted to these innovations (National Research Council [NRC], 2004). New modes of communicating information are useful for educating adolescents about health; thus, professionals in the field need to stay abreast of changes and adapt so they may best communicate their messages. Otherwise, the same communication media will

be used by others to propagate health information and beliefs that are ill-informed or -

intended (NRC, 2004).

Immense interest and varied perspectives in the areas of health education and

health promotion have led to the development of theories to explain the process of

behavior change. A variety of theories have arisen during the 20th century. Currently,

researchers are advocating for intelligible decision-making when designing a health

promotion intervention; this process includes thinking about the goals of the intervention

and the contextual variables of the situation (Glanz et al., 2002b). Moreover, researchers

have noted that unique circumstances often require integrating theories to achieve the

best outcome.

Theories of Health Behavior Change

Behavior change has been studied by researchers trained in many different

subfields of psychology. And these diverse perspectives have added richness and

complexity to our understanding of the behavior change process. Yet, theories of health

behavior change also share many key overlapping principles, most notably, cognitive,

social, and contextual elements.

The idea that behavior change progressed through stages was first proposed by

Kurt Lewin. Outlined in his famous Field Theory, Lewin's work laid the foundation for

current theories of health behavior change (Haggbloom, Warnick, & Warnick, 2002). The

Health Belief Model (HBM) followed Lewin's lead and was one of the first prominent

explanations of health behavior, which was initially developed by Rosenstock in 1966

and later expounded on by Becker and colleagues in the 1970s and 1980s (Glanz et al.,

2002b). It originated from behavioral and cognitive traditions, which were popular during its inception in the 1950's. The key concepts of the HBM are perceptions of susceptibility, severity, benefits, and barriers. These subjective evaluations operate as reinforcers. Also considered in the theory are cues to action, which can be anything that triggers a memory to act on a health belief. Self-efficacy was later added and has been shown to significantly predict intentions and behaviors (McClenahan, Shevlin, & Adamson, 2007). Yet, a literature review concluded that the most powerful single predictor across various health behaviors has been perceived barriers (Janz & Becker, 1984). The HBM has been most criticized for inconsistent measurement lacking reliable and valid instruments (Janz & Becker, 1984). Yet in the past decade specific measures have been developed to assess the constructs of the HBM for particular health behaviors (Janz & Becker, 1984).

The Theory of Reasoned Action (TRA) was developed based on the expectancy-value theory, which was derived from social psychology. The TRA was developed in part, due to the poor construction and understanding of the attitude-behavior research in social psychology and was created to predict behavior based on attitudes (Fishbein & Ajzen, 1975). Its three basic tenets are: (1) People have specific beliefs about objects or actions; (2) people assign values to the attributes and actions, and, people form expectations based on their beliefs and values; (3) simply, attitudes are a function of beliefs and values. Furthermore, attitudes stimulate motivation to form intentions, and later to act on intentions.

This theory received extensive attention in the literature and across multiple subfields of psychology (Fishbein & Cappella, 2006; Sheppard, Hartwick, & Warshaw, 1988). Although research has generally been promising, the TRA was criticized for not distinguishing intentions from expectations, goal intentions from behavioral intentions, and for not addressing the differing effect between few choices and numerous choices on behavioral outcomes (Sheppard et al., 1988).

The Theory of Planned Behavior (TpB) is an offshoot of the TRA. Using the same basic framework of the TRA, the TpB added the construct of perceived behavioral control (Ajzen, 1985). Unlike self-efficacy's limited focus on individual ability, perceived behavioral control includes consideration of contextual barriers to controlling behavior. Also designed to be as specific as possible, TpB has been widely applied in many different contexts, including health (Ajzen & Manstead, 2007). The model demonstrates that particular beliefs influence behavioral intentions, which influence actual behaviors.

In addition to behavioral beliefs and normative beliefs that overlap with TRA, there are two specific aspects of control beliefs: Beliefs about the presence of factors that may help or hinder performing a behavior and the perceived strength of those factors. The measurement of constructs in the TpB parallels the approach of the TRA. Ajzen has outlined extensive procedures and manuals for conducting research with the TpB (Ajzen, 2006), which includes precision and maintaining strong correspondence between variables.

The Transtheoretical Model (TTM) of behavior change was developed with the intention of integrating multiple theories, not theories of health behavior change, but theories of change in psychotherapy (Prochaska, 1979). The TTM was further developed on smoking behavior (Prochaska & DiClemente, 1983) and later with many other health behaviors (Prochaska et al., 1994).

TTM is a stage theory that assumes people progress linearly. It begins with *precontemplation* (absence of intention) and continues through *contemplation* (awareness and consideration), *preparation* (intending and planning), *action* (behavior initiated), and *maintenance* (sustained progress). According to this theory, people may move back and forth between stages during their efforts to change. The theory also stresses cost-benefit analysis, termed decisional balance, as well as self-efficacy (Bandura, 1982). The main constructs of TTM are relevant to health, which the literature supports (Prochaska et al., 1994; Prochaska, DiClemente, & Norcross, 1992). However, the theory has been fallible; despite extensive published literature using the model and its title claim of being a *trans*-theoretical theory, published research has not documented the validity of its constructs in comparison to the other models it purports to emulate.

Social Cognitive Theory (SCT) was developed by Albert Bandura (1977) as a synthesis of previously disparate areas of cognitive, emotional, and behavioral concepts. The theory contains many variables, but self-efficacy has received the most attention. Self-efficacy is an individual's evaluation of their ability to perform a specific behavior (Bandura, 1982). It has become a common variable in many theories of health behavior change where it has been predictive of a healthy lifestyle (Bandura, 2004; Lohaus et al.,

2004) and other performance outcomes, including cognitive development (Bandura, 1993). Although self-efficacy has often been used interchangeably with the TpB's construct of perceived behavioral control, they each have distinct qualities (Ajzen, 2006).

In SCT, Bandura (1977) also included important cognitive variables such as anticipating outcomes, analyzing experience, and self-regulating behavior and emotion. Social variables were also added, including observational learning and interpersonal reinforcement. However, SCT has been criticized for including too many constructs and therefore losing its focus (Baranowski, Perry, & Parcel, 2002). Researchers have suggested that it is important to be as specific as possible when designing interventions and measurement strategies for the theory. Yet, inclusiveness is a strength of the theory which makes it integrative and multidisciplinary. Moreover, by incorporating multiple variables, SCT provides ongoing opportunities for research investigations, particularly in the field of psychology (Baranowski et al., 2002). An additional criticism of SCT is that its constructs are subject to poor measurement and thus introduce excessive error into the model (Baranowski et al., 2002).

Ecological models of health behavior change have developed to specifically address the connections between people and their environment. This approach is a historical combination of Lewin's work, Skinner's behaviorism, and Bandura's SCT. Ecological models are also based on research pioneered by Urie Bronfenbrenner (1977, 1986) who is credited with popularizing the revolutionary perspective that the individuals (and their behavior) are best understood in multiple environmental contexts. Further,

throughout life, contexts overlap and interact, which affects human growth and development. Bronfenbrenner's ecological systems model is often represented visually.

Ecological models have made significant contributions to the area of health behavior change by introducing environmental variables that were previous ignored (Steinberg, Dornbusch, & Brown, 1992). Examples of important variables in an ecological model could be specific regional policies or regulations that affect aspects of health, such as perception of risk, evaluation of behavioral beliefs, or normative beliefs.

Theoretical similarities and differences. The theories of health behavior change discussed share a common genealogy, starting with Lewin's social psychology approach to studying the relationship between behavior and attitudes. Thus, current theories are variations of social psychology principles, such as attitude toward behavior, normative beliefs, relationship, cues to action, etc. The majority of these variables are also subjective in nature. Each theory, to a different degree relies on self-report and subjective perceptions to assess multiple variables. Fortunately, research findings have demonstrated average to strong predictive validity for the theories despite critiques of self-report measures (Glanz et al., 2002b). The TRA and the TpB are the theories that employ the most stringent and rigorous measurement expectations, while the HBM and ecological models have typically not employed strict standards.

An additional shared characteristic of each theory is motivation. This factor precedes actual behavior change and is rooted in values and beliefs (Ryan & Deci, 2000). Yet, motivation is not clearly defined or operationalized in any of the theories.The

emphasis on cognitive processing and perceptions throughout each theory may overshadow motivation.

There are also many differences between theories. The HBM uniquely incorporates perceived threat of disease, while perceived behavioral control is uniquely part of the TpB. The well-defined measurement principles of the TRA and the TpB are also different from other measures. Although self-efficacy initially set SCT apart from others, it has since been adopted as a fundamental principle of almost every theory.

Even though the TTM attempts to integrate behavioral change models, it was constructed with clear, linear, and distinct stages of change that make it unlike any other theory.

The theories of health behavior change have amassed a literature that is comparable in size to almost any area of psychology (Glanz et al., 2002b). Yet, specific theoretical adaptations, or even entirely new theories, have not developed to explain the unique process or aspects of adolescent health behavior change. Adolescence is a period when many youth begin to engage in problem behaviors, therefore appropriate prevention activities should begin at this time (Danish, 1996; Hamburg, 1997). The following section reviews theory-based and atheoretical interventions to improve adolescent health.

Interventions to Improve Adolescent Health

Behavior change in adolescence has generally been guided by the adult theories of health behavior change. Although some research is predicated on factors that are developmentally unique (Breinbauer & Maddaleno, 2005), the vast majority of research conducted with adolescents has employed a theory of behavior change without

developmental considerations (Glanz et al., 2002b). Given what we know about, it would seem that interventions that are developmentally appropriate would be more effective.

Many youth, particularly high-risk youth, are not responsive to traditional health promotion programs. There are several reasons for this: (1) Knowledge about health is important only if it is a motivating factor for a given individual (Millstein et al., 1993); (2) youth who have no goals for the future are not receptive to health messages (Millstein et al., 1993); (3) youth who perceive they are powerless in controlling their future do not value health; (4) youth in the lowest economic quartile are more likely to believe that goals are achieved through luck rather than effort (Hafner, Ingels, Schneider, & Stevenson, 1990).

The assessment of health behavior and health education in schools has largely been conducted by governmental organizations, which have collected and analyzed massive amounts of information. According to the most recent School Health Policies and Programs Study conducted by the CDC in 2006, school-based health promotion efforts have improved in some areas but are still in need of better outcomes. This study was the most comprehensive assessment of school health programs in the U.S. ever conducted (Kann, Brenner, & Weschler, 2006). It investigated eight main areas: health education, physical education and activity, health services, mental health and social services, nutrition services, healthy and safe school environment, faculty and staff health promotion, and family and community involvement.

Major findings of the survey show that selling junk food in vending machines has been banned in over 30% of states as well as over 30% of school districts in states where

such sales are allowed. More schools are selling water (46%), more salads are being offered, and cake-baked goods are being removed from vending machines. Anti-tobacco efforts were also implemented; over 82% of states and 64% of districts provided funds or opportunities for teacher development and training for anti-tobacco programs. Almost 25% of schools reported having tobacco prevention taught by professionals from outside the school (USDHHS, 2006b).

Although such efforts were positive steps forward, assessment of community partnerships for health revealed that schools were generally underinvolved in building relationships with parents and community resources for the promotion of health. The most promising results were that over 50% of teachers in health educations classes' assigned homework that required parental involvement and over 30% of physical education teachers did the same. Unfortunately, the study did not assess the quality of health promotion and education programs, only the frequency and type across multiple health domains (Kann et al., 2006).

The CDC also evaluated the percentage of Coordinated School Health Programs that collaborated with outside agencies, organizations, or universities toward planning health programs for physical education, tobacco prevention, and nutrition. The majority reported collaborating outside of their own school. Physical education was most common subject to involve outside collaborators, followed by nutrition, and then tobacco (USDHHS, 2006c).

The National Network of Partnership Schools has been investigating the overlapping influence of three spheres: home, school, and community (Epstein &

Sheldon, 2006). They posit that influence occurs through six main routes: parenting, communicating, volunteering, learning at home, decision making, and collaborating with the community (Epstein & Sheldon, 2006). Specific research has shown that academic achievement is strongly related to family involvement, particularly for homework assignments (Van Voorhis, 2003, 2004). This research is linked to other findings on engagement, an important developmental factor that is facilitated by parents and leads to positive outcomes.

A recent trend in the field of health promotion has been toward finding evidence-based health education and health behavior interventions (Rimer, Glanz, & Rasband, 2001). This is typically a complex and difficult problem; it requires understanding the interaction of various factors, which is difficult and not often conducive to the separate training backgrounds of professionals. Early intervention, education, and prevention programs targeting adolescents have typically focused on reducing health-compromising behaviors and/or increasing health-enhancing behaviors. A variety of health behaviors have been investigated (Breinbauer & Maddaleno, 2005), such as sexual behavior, substance use, dietary habits, physical activity.

Programs in the area of positive youth development (PYD) have begun to be more theory-driven (Walker, Marczak, Blyth, & Borden, 2005). These programs are purported to be developmentally appropriate, engaging, and have a goodness of fit between the learning opportunities and the individuals. More specifically, Walker and colleagues outlined an ethos of positive youth development, noting six principles: designed with developmental needs in mind, include choice and flexibility, autonomy and engagement,

tangible and concrete learning examples, present a big picture not just details, and build assets for youth. Similar results were obtained from collaborations between adolescents and adults (Larson, Walker, & Pearce, 2005), while still acknowledging the importance of adults to continue to imbue programs with structure and content (Camino, 2005).

A review of PYD programs found that they are generally well received by parents and students, but the perceived value of the program was less universal (Warwick et al., 2005). Factors that influenced favorable perceptions of PYD programs were three of its basic principles (Damon, 2004): quality of social relationships, quality of teaching, and extent of parent and student involvement. In addition to retrospective analyses, researchers have had success with prospective collaborations (e.g., focus groups) between adolescents and parents, where gathering information and incorporating it into a forthcoming diabetes education program was shown to produce better outcome effects (Waller, Eiser, Heller, Knowles, & Price, 2005).

Over the past 15 years, the Life Skills Center at Virginia Commonwealth University has been devoted to designing, implementing, and evaluating PYD intervention programs (Danish, 1997; Danish, Forneris, & Wallace, 2005; Forneris, Danish, & Scott, 2007; Harmon et al., 2005; Meyer, Nicholson, & Danish, 2000; Stanton, Fries, & Danish, 2003). The Life Skills research team is devoted to creating intervention programs for the purpose of promoting health and enhancing personal development, particularly for youth and adolescents. The Center has successfully earned millions of dollars in grant funding to deliver and evaluate its programs. The programs are designed to meet developmental needs, be active and engaging, and teach concrete skills. For

example, the BRIDGE program, which the current is examining, taught ninth graders to research their family health history and how to conduct BSEs and TSEs (Harmon et al., 2005). Preceding BRIDGE was the Goals for Health program, a peer-led intervention that promoted healthy eating and included goal-setting activities (Meyer et al., 2000).

Another example of PYD was the Healthy Hawaii Initiative (Maddock et al., 2006), a coordinated school health program that targeted nutrition, physical activity and tobacco prevention. One arm of the project targeted schools using the YRBSS. The psychosocial questions used in the study were adopted from theories of behavior change, including the transtheoretical model, the theory of reasoned action, and social cognitive theory. The brief, short-term and long-term results for adolescents in the study did not yield significant findings and even demonstrate worse health behavior in certain areas. The researchers attribute these outcomes to lack of leadership and poor coordination of services, which in their estimation require additional time to build and demonstrate an effect.

In a study of adolescents with cancer, researchers sought to identify a new method of communicating health information – video games. The intervention group that received a video game about cancer information was significantly more knowledgeable than the control group after three months (Beale, Kato, Marin-Bowling, Guthrie, & Cole, 2007). The video game component is a good example of meeting the developmental needs of adolescents, however, even though increased knowledge is a positive outcome, there were no increases in any variable related to behavior change.

In a review of intervention studies that employed a model of health behavior change, Breinbauer and Maddaleno (2005) reported that more than 250 studies targeted sexual and reproductive health, tobacco, drug, or alcohol use. Only 44 investigations addressed nutrition or physical activity. Of these 44 there was a wide array of health behavior change theories used. This lack of consistent intervention models for adolescents is an accurate reflection of how interventions are applied to this population.

The most up-to-date and one-of-a-kind model designed specifically for adolescents is called the Youth Choices and Change Model (Breinbauer & Maddaleno, 2005). There are six steps to the model: Identify the target group, identify adolescent needs and wants, identify levels of intervention, identify other actors' needs and wants, identify the theories that will support the design of the intervention, and translate theory into practice. For example, in the step related to identifying adolescent's needs and wants, *needs* might include having a loving and ongoing nurturing relationship, acceptance, developmentally appropriate experiences and success, and opportunities and guidance. Examples of *wants* might include having autonomy, social interaction, grownup experiences, novelty, humor and fun, and media outlets. Although this model appears to be developmentally appropriate and on the cutting edge of community interventions for adolescents, it has yet to be empirically tested. At best, it provides a framework for prospective health promotion-based community interventions for adolescents.

Youth and adolescent development appear to present unique challenges and considerations for the current models and approaches to health behavior change. Dissatisfied with the theories of health behavior change currently available, some

researchers are calling for greater inclusion of qualitative methods of investigation (e.g., semi-structured interviews, focus groups, story/dialog workshops) in order to uncover the missing steps within adolescent health behavior change (Simpson & Freeman, 2004). Others argue that change continues to require active learning and engagement, which takes time, effort, and engagement from those who deliver the intervention (Glanz et al., 2002b).

Adolescent Health Behavior Change: Development Neglected

Most school-based health promotion interventions are designed to do more than impart information, but these additional efforts have not been achieving the desired results. Adolescent development is a process of learning how to learn; this quality appears to be absent from most health promotion programs designed for adolescence.

Developing a relationship and teaching skills are essential components for creating an engaging environment where students have the opportunity to learn and grow from the experience. It is a mistake to assume that because adolescents have the capacity for formal operations (Piaget, 2002) that: (1) Students will choose to use their abilities in the way an adult would; or (2) they have developed sufficient ability to meet the demands of the intervention (Coenen, 2003). Methods that encourage experiential learning and self-regulated learning (Zimmerman, 1989) are developmentally and contextually appropriate for increasing student engagement and facilitating health behavior change. A one-dimensional approach to health behavior change in the classroom will also make it more difficult to engage students with learning (Befford, 2006), especially when their cognitive styles do not match the presentation (Sternberg, 1997).

Health promotion programs that appeal to the interests of adolescents are likely to produce better outcomes. This is precisely how self-determination theory is applied in an educational context (Deci & Ryan, 2000; Deci, Vallerand, Pelletier, & Ryan, 1991; Ryan & Deci, 2000). School-based interventions can increase students' intrinsic motivation (which improves outcomes) by ensuring that students have some autonomy, receive competence feedback, and experience relatedness.

Engagement

Defined. The specific construct of school engagement has recently been conceptualized in the educational psychology literature by Fredricks, Blumenfeld, and Paris (2004). They describe it as three-pronged, including behavioral engagement, emotional engagement, and cognitive engagement. Prior to the publication of this study by Fredricks and colleagues (2004), the literature on engagement was scattered, difficult to identify, and past research has generally approached the investigation of engagement in an unsystematic and haphazard manner. However, after an extensive literature review and investigation, the authors were able to distill the disparate studies to identify these three main areas. These descriptive components of school engagement are convenient for future research to build upon and contribute to a needed foundation (Fredricks et al., 2004).

Behavioral engagement is highly focused on participation, as well as on student involvement in academic, social and extracurricular activities. Behaviors are considered to be the key component of engagement that is most responsible for positive academic outcomes. Emotional engagement includes both positive and negative emotions,

including reactions to classmates, students, schoolwork, and the school as a whole. These emotions are believed to be highly responsible for building a sense of connectedness to the school, which then facilitates a willingness to work hard while in school. Cognitive engagement is similar to mental investment or commitment. Attention, persistence, and general thoughtfulness are key elements of this component.

Although still a burgeoning construct, research has identified key findings about engagement. It has been shown to predict higher achievement in academic environments (Fredricks et al., 2004). The lack of engagement in school has been shown to predict dropping out of school, yet this conclusion has been challenged (Yazzie-Mintz, 2007).

Engagement has been described primarily in educational contexts. In education, "The student's psychological investment in and effort directed toward learning, understanding, or mastering the knowledge, skills, or crafts that academic work is intended to promote" (Newmann, Wehlage, & Lamborn, 1992, p. 12). Also in the school context, "The student's relationship with the school community: the people (adults and peers), the structures (rules, facilities, schedules), the curriculum and content, the pedagogy, and the opportunities (curricular, co-curricular, and extracurricular)" (Yazzie-Mintz, 2007, p. 1). Without offering a specific definition, other researchers have called for changes, such as a greater emphasis on an ecological perspective (Elliott, Hufton, Willis, & Illushin, 2005).

Distinguishing constructs. Research from different fields of study has contributed to the construct of engagement and therefore created a multifaceted *catch all* that has not been well-defined, operationalized, or measured in the literature. Aside from Fredricks

and colleagues' (2004) recent clear and working definition, the construct continues to be confused with many others. The published variables that share similar qualities include: enjoyment (Blunsdon, Reed, McNeil, & McEachern, 2003), enthusiasm (Pekrun, Goetz, Titz, & Perry, 2002), flow (Csikszentmihalyi, 2000), happiness (Buss, 2000), interest (Lazarus, 2000), joy (Jackson, 2000), passion (Vallerand et al., 2003), pleasure (Seligman & Csikszentmihalyi, 2000), and sport enjoyment (Scanlan & Simons, 1992). A few notable distinctions are worth describing.

Lazarus classified the word interest as a *pre-emotion*, along with curiosity, anticipation, and alertness (Lazarus, 2000). Based on the work of Deci and colleagues (1991, 2000) on self-determination theory, Vallerand and colleagues (2003) defined two types of passion. Harmonious passion is described as the assimilation of activity into an individual's identity, without conditions or compulsions. On the other hand, obsessive passion is a control or compulsion toward activity, which has conditions for achieving self-esteem and pleasure.

Although not technically a definition, evolutionary psychologist David Buss (2000) has studied the evolution of happiness. He believes that humans are disposed toward happiness, as evidenced by mating, deep friendship, close kinship, and cooperation. In contrast however, he believes other factors curtail happiness, such as environmental differences, natural selection, and inherent distress. Jackson (2000) separated the constructs of joy, fun, and enjoyment. Joy was described as an intense happiness and a central positive emotion. Fun was described as a source of enjoyment (i.e., enjoyment is the process of having fun or experiencing emotion).

The construct of sport enjoyment is more specific than global positive affect but more general than specific constructs (e.g., happiness). Scanlan and Simons (1992) described it as, "a positive affective response to the sport experience that reflects generalized feelings such as pleasure, liking and fun" (pp. 202-203). They conceptualized it as a component of a motivational model of sport commitment, and assert that it is not synonymous with intrinsic motivation.

In the area of positive psychology, Seligman and Csikszentmihalyi (2000) reported that enjoyment differed from pleasure because pleasure is the satisfaction of a basic human need (e.g., hunger, thirst, sex), while enjoyment can be an optimal experience. Finally, Csikszentmihalyi's (1990, 1997, 2000) construct of flow is probably the closest approximation of student engagement, yet there are certain differences. The construct of flow is broader and better defined than student engagement. Flow is a perceptual experience of being immersed and engaged in the situation, moment, or the here-and-now that can occur practically at any time. Csikszentmihalyi has described it as enjoyable and with a heightened internal locus of control. Additionally, prior to calling it flow, Csikszentmihalyi used the term autoletic. In *Beyond Boredom and Anxiety* (2000), he wrote:

> The simple goal of this study is to understand enjoyment, here and now—not as compensation for past desires, not as preparation for future needs, but as an ongoing process which provides rewarding experiences in the present…Instead of approaching enjoyment as something to be explained away in terms of other conceptual categories like 'survival function' or 'libidinal sublimation,' we try to

look at it as an autonomous reality that has to be understood in its own terms.

(p.9-10)

Measurement. According to Fredricks and colleagues (2004) each aspect of student engagement is measured separately. Behavioral engagement can be measured in the following general categories: conduct, work involvement, participation, and persistence (e.g., homework assignments, absent or tardy, complying with school rules). Emotional engagement is a self-reported assessment of feelings, such as boredom, frustration, interest, anger, and satisfaction. Emotion related to student-teacher relations and work orientation is also assessed. Cognitive engagement includes assessments of learning, flexible problem-solving, independent work styles, coping with perceived failure, preference for challenge and independent mastery, and commitment to understanding the work. Despite a long list of variables, a measure of student engagement has not yet been psychometrically developed and tested (Fredricks et al., 2004).

In previous studies, student engagement was assessed using a single item for concentration, interest, and enjoyment (Shernoff et al., 2003). Within Fredricks and colleagues' (2004) framework, concentration falls under the cognitive engagement and interest and enjoyment are both measures of emotional engagement.

Student engagement has been measured among college students with the National Survey of Student Engagement (NSSE) each of the past 10 years (National Survey of Student Engagement [NSSE], 2007). It was initially developed as a tool to rank the good practices of colleges and universities and it claims to have been psychometrically developed and evaluated on a yearly basis (NSSE, 2007). Data are collected through

universities that voluntarily pay a fee for access to the materials as well as for data summary and organization capabilities. The NSSE also offers additional engagement surveys for specific populations, including high school students.

The 2006 High School Survey Student Report (HSSSR; Yazzie-Mintz, 2007) provides an overview and background of the survey, data on the respondents, questions on the survey, results, and discussion. The format was self-report and students responded to questions pertaining to motivation to go to school, boredom and engagement, dis-engagement, time and priorities, support from adults, school structures and safety, and one open-ended non-directive free question. The development of the HSSSR was reportedly based on the same procedures used to develop the NSSE.

Variables closely resembling engagement or a component of engagement have also been measured. Enjoyment was assessed with three questions, two 4-point Likert scale items and one qualitative item (Blunsdon et al., 2003). Analysis of the Physical Activity Enjoyment Scale (PACES) revealed evidence of a single factor of enjoyment (Motl et al., 2001).Other researchers constructed a multidimensional instrument of academic emotions, which included an item titled "enjoyment of learning" in the category of positive activating emotions (Pekrun et al., 2002).

Antecedents of engagement. The antecedents of engagement were summarized by Fredricks and colleagues (2004) into three categories. They are school level factors, classroom context and individual needs. School level factors include voluntary choice, clear and consistent goals, small size, student participation in school policy, and staff and student cooperative endeavors (NRC, 2004). Classroom contact includes variables such

as teacher support, peers, classroom structure, autonomy support, and task characteristics. Based on the research of Ryan and Deci (2000), the category of individual needs consists of needs for relatedness, autonomy, and competence. Research has shown that students who do not meet the needs in this final category are at higher risk for poor cognitive processing and achievement (Baumeister, Twenge, & Nuss, 2002) as well as learned helplessness and negative emotions (anxiety, embarrassment, and humiliation) (Nolen-Hoeksema, Girgus, & Seligman, 1986).

Antecedents were also identified by other researchers (Heine, Lehman, Markus, & Kitayama, 1999): Student satisfaction with performance and work rate, valuing effort, valuing education (NRC, 2004), and displaying a high level of engagement. Humor was noted to increase attention and enjoyment (James, 2001). Johnson, Crosnoe, and Elder (2001) found that students were more likely to be engaged in school if they were female, from an intact family, and had parents with higher educational attainments and greater academic expectations. Lastly, fun was identified as a contributor to engagement by relieving pressure, reducing boredom, and increasing persistence (Newmann et al., 1992).

Engaging and Achieving

In education. The Brookings Institution recently conducted a cross-national study investigating the relationship between educational achievement and three psychological variables –self-confidence, enjoyment, and relevance – which they defined as *the happiness factor* (Loveless, 2006). This research was spurred by skepticism about whether the strong cultural emphasis in the U. S. to make learning interesting, enjoyable, and relevant was actually producing higher achievement. Using data gathered from 46

countries, eighth grade students perceptions (*the happiness factor* variables) of math were correlated with scores of math achievement. As hypothesized, results within each country showed that math achievement was positively correlated with each happiness factor variable. However, between countries (predominantly Asian countries), inverse relationships were evidenced between math achievement and each happiness factor variable (correlation range of -.52 to -.75). These results show that greater amounts of happiness relative to others in the same country are related to higher math scores. However, greater happiness relative to other countries is indicative of lower math scores.

To explain these differences, the authors concluded, 1) Asian families value education more and therefore spend more time studying, 2) Asian parents are less satisfied with average performance, which stimulates active encouragement to improve, 3) collective emphasis versus individualist value, and 4) Asian cultures emphasize effort rather than fixed ability. However, earlier studies within the U.S. challenged the traditionally held beliefs about East versus West differences in academic achievement (Steinberg et al., 1992). Researchers assert more specific group differences between White, Hispanic, Asian-American, and African American youth regarding factors that contribute to high and low academic achievement. Steinberg further asserts that cultural trends in the U.S. toward education account for differences between East and West, such as parental disengagement, acceptance of poor grades, peer cultural scornful of academic excellence, and time spent after-school toward socializing, leisure, and/or employment.

The changing emphasis on fun in education was also illustrated by Evers and Clopton (in Ravitch, 2005) who compared the index of the letter F of a 1973 algebra

textbook and a 1998 contemporary mathematics textbook. The earlier text included words

not found in the recent text, such as factors, factoring, fallacies, finite decimal, finite set,

formulas, fractions, and functions. The 1998 textbook also contained unique words,

including fast food nutrition data, fat in fast food, feasibility study, feeding tours, Ferris

wheel, fish, fishing, flags, flight, floor plan, flower beds, food, football, and Ford

Mustang. Obviously, this change shows the increased emphasis on relevance, interest,

and engagement as compared to description and abstract terminology.

In a cross-cultural investigation of fifth and eighth grade students in Germany,

Russia, and the U.S., researchers looked at perceptions of school as being enjoyable,

demanding, and rewarding (Elliott et al., 2005). Less than 10% of all but one group of

students reported interest/enjoyment as their main reason for wanting to work hard in

school. Approximately 23% of Russian fifth grade students reported interest/enjoyment

as their primary reason for wanting to work hard in school.

Students in the U.S. and Germany reported their main reasons for preferring a

certain subject was because they were strong in the area or found it easy. Students in the

U.S. and Germany both valued the practical utility of education, while the Russian youth

demonstrated a stronger emphasis on education for its own sake. The economic

opportunities available in the U.S. and Germany may be an important variable underlying

the longstanding difference between countries (Merton, 1938).

The perceptions of fifth and eighth grade student's enjoyment and interest have

also been investigated in northeast England (Centre for Public Policy, 2003). Relevant

findings indicate that 46% of fifth graders, but only 15% of eighth graders enjoy school

'most of the time'. Only about 18% of students enjoyed class lessons 'most of the time' and an even smaller minority (about 13%) found them interesting 'most of the time.' Approximately 51% of students reported enjoyment as an inspiration to work hard, however, this statistic declined with each older age group, paralleling the U.S. trend (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). Achievement was noted by 48% as a motivator for wanting to learn. Students reported that motivation to work hard increased with extrinsic rewards (39%) as well as from being told that working hard is important (49%). In general, motivation and engagement decreased with age (Jacobs et al., 2002).

Students also responded to what influences them not to work hard (Jacobs et al., 2002). These included the following perceptions: not being good enough (71%), no reward for effort (67%), working hard will not help get a job (62%), being told working hard is unimportant (55%), qualifications not being worthwhile (41%), not enjoying lessons (24%), and not wanting to learn more (8%). Lastly, overall findings indicated that student engagement was positively correlated with self-confidence and self-efficacy. Approximately 50% of students who viewed the environment as positive were engaged fully, compared to only 6% of those who rated the environment as negative.

An investigation into the daily engagement habits of U.S. students yielded significant results. Students spent over half of class time doing independent work, a third being passive, and about 14% during interactive activities. Engagement was highest during autonomous interactive activities (Shernoff et al., 2003).

Educational achievement motivation was studied in African American youth (Walton & Cohen, 2007). Research showed that social belongingness was a unique

motivating variable for African Americans and that it was not shared by any other ethnic group. It is also important for educators to continuously build intercultural competence (Kritskaya, 2001).

During his time, Dewey (1974) wrote extensively about the importance and value of critical thinking, problem-solving, diversity, science, the scientific method, and objectivity, which are manifest in modern day laboratory schools where they follow a *learning-by-doing* model. These messages are still communicated, particularly in current resources on teaching, which expound on the virtue of increasing student interest, passion, and engagement (Moultrie Turner, 2007). High-interest activities can be playful, humorous, imaginative, or self-expressive. These creative assignments have unique benefits such as easier preparation, more class spirit, being short and fast, they can make all unit activities more purposeful, provide a meaningful context for reviewing curriculum, and provide outlets for intense student work (Ellis, 2005).

Teachers were surveyed about their beliefs about what makes a great teacher. The majority (45%) indicated that these teachers make learning fun and interesting as opposed to 11% who believed that great teachers produce "high student achievement" (Snider, 2006). However, 44% of teachers believed that both were possible. Snider proposes a hypothesis to explain the underlying source of this "almost pathological need" to make lessons fun and interesting – society is to blame. According to Snider (2006), "Initial learning of a skill or concept is rarely fun. It's the fluent performance and application in a new context that is enjoyable" (p. 46). Snider's characterization of learning as fun is based on three premises that she says are faulty and harmful: learning should be

effortless, entertainment will motivate and reduce misbehavior, and hands-on learning is more appropriate for certain types of learners. Others, like Snider, have argued for a critical skepticism of enjoyment as a necessary prerequisite for learning. Hare (1973) believes that enjoyment does not ensure learning or education, and perhaps only provides entertainment and amusement.

Engagement is Learning

Researching transfer theory in play, Allien (2003) notes that the enjoyment of unstructured play facilitates information transfer, which leads to academic achievement. However, traditional didactic instruction dichotomizes schoolwork and play, which also dichotomizes learning and enjoyment. These false separations create the perception that learning is restricted to classrooms, and enjoyment is restricted to play. However, Allien's research demonstrates that during play children inherently seek greater coherence and flexibility of previously learned information, through exploration, new associations, and building interconnections (i.e., inherent qualities of play that form the basis of learning).

This perspective was also noted over a century earlier. In 1901 Groos (1976) focused primarily on the nature of play and stated that it is a natural human inclination that can be the source of learning and teaching. Groos (1976) described the importance of play, "We have repeatedly found in the course of this inquiry that even the most serious work may include a certain playfulness" (p. 400). Essentially, Groos was advocating for balance between work and play.

Based on his construct of flow, Csikszentmihalyi (2000) has also strived toward eliminating false differences between *work* and *play*. Echoing Max Weber, Csikszentmihalyi further asserts that any difference is illusory and a social construction based upon the protestant ethic. Over 100 years ago Max Weber (1958) first shared this perspective when he wrote, "In the field of its highest development, in the United States, the pursuit of wealth, stripped of its religious and ethical meaning, tends to become associated with purely mundane passions, which often actually give it the character of sport" (p.182). This perspective equates the underlying motives of sport and work as both extrinsically motivated, which Weber also noted, can lead to entrapment in an *iron cage*. However, Csikszentmihalyi's research affirms a more integrated perspective of enjoyment, engagement, and interest in the workplace and does not relegate these experiences solely to leisure activities. Another key element of this last point is that flow experiences are characterized by an internal locus of control, which, when absent, particularly in the environment of work, can lead to lack of purpose and motivation. On making learning fun, Csikszentmihalyi (2000) states,

> If educators were to start with the question 'How can learning be made more enjoyable?' the students' gains in performance should increase tremendously. It is crucial to remember, however, that one does not make learning more enjoyable by trivializing it—by making it easy, or pleasant, or 'fun'…In theory, it is simple enough to make any learning task enjoyable: find out what the student's skills are and what their level is—not only in the three Rs but in the other modalities of human action; then devise limited but gradually increasing opportunities for the

expression of those skills. The learning will then become intrinsically motivated.

(p. 205)

The experience of flow, as documented by Csikszentmihalyi (1997), served as a model for further investigation of engagement in schools. He found that engagement was increased when the perceived challenge of the task and their own skills were high and in balance, the instruction was relevant, and the learning environment was under their control.

Literature Review Summary

The literature discussed in this section is the background supporting the current study. In general, research was drawn from three major fields of study: Psychology, education, and public health. Specifically, public health research was first cited to outline the current health crises that are occurring in adults as well as youth and adolescents. Epidemiological studies described the prevalence and incidence of cancer in the U.S. and Virginia, specifically. Psychological literature was cited next and it overlapped with public health efforts to combat disease. Theories of health behavior change were an important contribution to understanding the psychological factors that underlie health behavior. Educational research contributed to understanding the unique developmental needs of youth and adolescents. Based on these efforts, psychological and public health efforts have started to incorporate more developmentally-appropriate interventions to prevent disease among youth and adolescents (e.g., positive youth development). Last, educational and psychological research was presented for student engagement, the main construct of interest in the current study. Recent efforts to improve the definition and

measurement of student engagement were described along with findings showing that it is a strong predictor of achievement in academic environments. The purpose of describing this research was to build a case for student engagement as a potential significant predictor of adolescent health behavior change, which should therefore be further investigated.

Hypotheses

1. Summarizing research on student engagement, Fredricks, Blumenfeld and Paris (2004) identified three types of student engagement: cognitive, behavioral, and emotional. The latent structure of student engagement will be explored by testing multiple items from the survey used during BRIDGE, a health promotion intervention program, which resemble previous measurements of student engagement; a factor structure that resembles Fredricks and colleagues' description is predicted to emerge.

2. Based on results of the factor analysis, the new measure of student engagement will be tested within a theoretically-based model as a predictor of adolescents' behavioral intentions. Above and beyond other predictor variables (behavioral beliefs, behavioral self-efficacy, cancer knowledge, risk perception, and subjective norms), student engagement will significantly increase student's intentions to perform positive health behaviors.

   a. Student engagement will significantly increase student's intentions to reduce fat intake.

   b. Student engagement will significantly increase student's intentions to perform self-examinations.

    c.   Student engagement will significantly increase student's intentions to be physically active.

3. In the predictor model for student's intentions to perform self-examinations, the cumulative variance accounted for by the predictor variables (behavioral beliefs, behavioral self-efficacy, cancer knowledge, risk perception, subjective norms, and student engagement) will be greater than the cumulative variance accounted for in each other respective model, intentions to reduce fat intake and intentions to increase physical activity.

4. As a predictor of student's intentions to perform self-examinations, student engagement will show an effect size greater than that in each other respective model, intentions to reduce fat intake or increase physical activity.

5. Adolescent health behavior data show that generally speaking, boys are more physically active than girls, and that Caucasians are more physically active than African Americans (USDHHS, 2006a). These gender and ethnic differences are expected to emerge from the predictor model for physical activity, but not from the other predictor models for intentions to reduce fat intake and intentions to perform self-examinations.

Chapter 3

Methodology

Design

This research was conducted as part of a grant funded by the National Cancer

Institute (NCI). The current study employs a quasi-experimental design to evaluate the

construct of student engagement and to examine its influence within a social contextual

theory of adolescent health behavior change. Data were gathered from a school-based

randomized intervention program, *Building a BRIDGE to Better Health* (BRIDGE), with

multi-level evaluation at baseline, post-intervention, and 3-month follow up. This was a

multi-site study of six high schools in Chesterfield County, VA randomly assigned to an

intervention (3) or wait-list control (3) condition. Assessment using student surveys was

conducted three times: prior to the intervention, a week following the intervention and 3

months following the intervention. Surveys included self-reported questions of health

beliefs, behaviors, intentions, and attitudes. Student evaluations of BRIDGE were

reported only at post-intervention. Data gathered at post-intervention from students who

participated in the BRIDGE program will be used to evaluate student engagement and its

affect in the social contextual model of health behavior change.

Sampling and Recruitment of Participants

Participants were ninth grade students who were recruited from health and

physical education classes at six suburban high schools in central Virginia. A control

school that was initially included in the data collection was dropped from the data set due

to a substantially lower response rate of less than 15 percent. A substitute control school was recruited during the study. A total of 1,726 students from six schools received parental consent and personally assented to complete the BRIDGE survey at baseline.

Materials

BRIDGE survey. The BRIDGE survey is an aggregate measure of multiple health-related questions that was first administered during a pilot study (Harmon et al., 2005). Items were derived from multiple sources: the Youth Risk Behavior Surveillance System (YRBSS; USDHHS, 2006a), the Goals for Health (GFH) questionnaire (Fries et al., 2000), questions developed specifically for the BRIDGE program by the research team at the Life Skills Center, Virginia Commonwealth University, and from additional sources. As the measurement of health-enhancing behaviors and risk factors has been quite variable across positive youth development programs (Catalano, Berglund, Ryan, Lonczak, & Hawkins, 2004), some of the constructs in the current investigation demonstrate sound psychometric properties, whereas others do not. However, as researchers recommend (Catalano et al., 2004), the current study employs a streamlined measurement of constructs, making the interpretation of results more transparent and allowing for comparisons with the outcomes of other programs. Furthermore, Ajzen (2006) contends that the quantity of items used to measure a predictor of health behavior change is of lesser importance; instead, primary importance should be on increasing the correspondence between constructs. According to Ajzen (2006), this is accomplished when measurement is specific to the context of the investigation and that questions are worded similarly across predictors.

Questions on the BRIDGE survey assessed students' demographic information, family health genealogy, genealogy knowledge, cancer knowledge, self-efficacy, behavioral intentions, health behavior, family history of cancer, family health attitudes, and family closeness. The current investigation will examine the following variables: intentions to perform health behaviors (fat intake, self-examinations, and physical activity), predictors of health behavior change (behavioral beliefs, self-efficacy, cancer knowledge, demographics, risk perception, and subjective norms), and student engagement, an under-investigated predictor of health behavior change. Variables in the current study were selected from the BRIDGE survey based on their relatedness to the theory of planned behavior. See Appendix A for a complete list of the items used to measure each construct.

Behavioral intentions. Student's intentions to perform health behaviors (fat intake, self-examinations, and physical activity) were each assessed with a single item, which were based on the 2003 YRBSS (USDHHS, 2006a), but slightly modified to measure the specific information taught during the BRIDGE program. For example, "I plan to lower the amount of fat in my diet next month." Responses were recorded on a five-point Likert scale, anchored by *strongly disagree* and *strongly agree*. The format, phrasing, and range of these questions are comparable to recommendations and previous assessments of intentions in the health behavior change literature (Ajzen, 2006; Francis et al., 2004). Data from the BRIDGE pilot study indicated that student's behavioral intentions to conduct BSEs and TSEs increased significantly ($p < .001$) from pre to post assessments (Harmon et al., 2005). However, intention to consume a low fat diet only

approached significance (Harmon et al., 2005). According to theories of health behavior change, such as the theory of planned behavior (Ajzen, 1985), these significant findings mirror the expected change and thus provide evidence of content validity for these behavioral intentions questions.

Predictors of health behavior change. Many variables have been investigated as predictors of health behavior change and therefore the current study examines multiple variables. Student's reported *behavioral beliefs*, which measured their personal beliefs that a specific health behavior can help reduce cancer risk. Each specific health behavioral belief was assessed using a single item that corresponded to the specific behavioral intention. For example, "Eating a low fat diet can help reduce my risk of getting cancer." The questions were formatted on five-point Likert scales, ranging from *strongly disagree* to *strongly agree*. These questions were developed by the research team and patterned off of the behavioral belief questions used in the theory of planned behavior (Francis et al., 2004). Previous studies of adolescent health behavior have used one or two items (French et al., 2005; Gordon, 1990) to assess the behavioral beliefs of similar health behavior constructs. Psychometric data for the behavioral belief questions used in the current study are not available.

Students also reported *self-efficacy* to perform specific health behaviors, which were each assessed with a single corresponding item (fat intake, self-examinations, and physical activity). For example, "I am sure I can switch to eating foods that are lower in fat." These questions were formatted on five-point Likert scales, ranging from *strongly disagree* to *strongly agree*. Previous research has also frequently measured self-efficacy

for a specific health behavior using a single item (Luszcynska & Schwarzer, 2005). The format, phrasing, and scale of these questions are comparable to recommendations and previous assessments of self-efficacy in the health behavior change literature (Ajzen, 2006; Francis et al., 2004). The self-efficacy questions also correspond to the other constructs in the investigation. Self-efficacy questions were borrowed from items in a previous health promotion study (Fries et al., 2000). These items were also pre-tested in a pilot study (Harmon et al., 2005). Results from the pilot study showed that student's self-efficacy to perform BSEs and TSEs increased significantly from baseline assessment to post intervention measures, *p <.001* (Harmon et al., 2005). However, self-efficacy for eating foods lower in fat only approached significance (Harmon et al., 2005). Further psychometric data for the self-efficacy questions are not available.

A total of 10 true-false questions assessed students' *cancer knowledge*. The questions were created by the research team during the development of the BRIDGE program, and were designed to correspond to the cancer information taught during the BRIDGE program. Questions were based on information published by the CDC (USCSWG, 2006). For example, "Cancer is the second leading cause of death in the United States." Although these questions were included in the BRIDGE pilot study, psychometric data are currently not available for this measure of cancer knowledge.

As a predictor of adolescent health behavior change, knowledge about health has typically been a nonsignificant factor (Millstein et al., 1993). However, researchers have recently demonstrated that knowledge attained through an engaging and developmentally appropriate manner (i.e., educational video games for adolescents) can significantly

influence health behavior change (Beale et al., 2007). Thus, cancer knowledge is included in the current study as a predictor of adolescent health behavior change.

Students were asked on the BRIDGE survey to provide d*emographic* information pertaining to their gender and ethnicity. These questions were adopted from the YRBSS, which is a CDC measure that is administered annually to adolescents nationwide (USDHHS, 2006a).

Student's *risk perception*, an appraisal of worry about developing cancer, was assessed using one global question: "I worry that I will get some type of cancer in my lifetime." It was formatted on a five-point Likert scale that ranged from *strongly disagree* to *strongly agree*. This measure of risk perception is based on a related construct in the Health Belief Model that has been shown to be a predictor of health behavior change (Janz & Becker, 1984). In contrast, previous research with adolescents has shown that increased risk perception generally does not deter risky health behaviors (Gerrard, Gibbons, Benthin, & Hesslin, 1996). More specific measurements of the frequency and intensity of risk perception have recently been conducted (McCaul, Mullens, Romanek, Erickson, & Gatheridge, in press). Using a single item for each construct, McCaul and colleagues (in press) report that the frequency and intensity of risk perception are inter-correlated (alpha = .87) and modestly correlated with a psychometrically validated measure of global worry (r = .31). They note that further research is necessary to demonstrate the relationship between intensity and frequency.

Subjective norms were assessed through student's self-reported perceptions of their family's health beliefs and behaviors pertaining to fat intake, self-examinations, and

physical activity. Health beliefs and behaviors were each assessed using a single item that was formatted on five-point Likert scale ranging from *strongly disagree* to *strongly agree*. For example, the family fat intake beliefs question, "My family thinks it is important to eat foods that are low in fat," corresponded to the family fat intake behavior question, "When I have meals with my family our meals are usually low in fat." Questions about self-examinations and physical activity followed the same pattern. Previous research by Smith and colleagues (2007) measured subjective norms using similar questions. They demonstrated that student's subjective norms are significantly inter-correlated with their attitudes, perceived risks, perceived control, and perceived prevalence. Psychometric data for the items assessing subjective norms in the current study are not available.

Student engagement. The BRIDGE survey includes seven items that appear to measure a related aspect of student engagement, and thus, were therefore selected for investigation. Six of the items are specific evaluations of the BRIDGE program that were measured on a 5-point Likert scale with the following choice options: 1 *not at all,* 2 *a little bit*, 3 *somewhat*, 4 *quite a bit*, and 5 *very much*. The questions include, "How much did you like the Bridge program?", "How important to you were the topics in the Bridge program?", "How much fun was the Bridge program?", "How much did you learn from the BRIDGE program?", "I think other students my age should be introduced to the BRIDGE program", and "I feel that a program like BRIDGE enables me to talk openly with my family and relatives." These items were originally developed by the Life Skills Center research team to gather student evaluations of Goals for Health, an intervention

program that resembled and preceded the BRIDGE program (Forneris, Fries, & Danish,

2006). Data from student evaluations of the Goals for Health study was analyzed for

reliability and demonstrated a Cronbach's α of .89 (Forneris et al., 2006). In addition to

the evaluation questions, one item assessing student's behavioral intentions to set a goal

for their health, "I plan to set a goal to achieve within the next month," will also be

included as a measure of student engagement.

Fredricks, Blumenfeld and Paris (2004) recently synthesized the literature on

student engagement in which they revealed a three-pronged conceptualization of the

construct including cognitive, emotional, and behavioral categories. The student

engagement questions in the BRIDGE survey that are described above resemble previous

measurement efforts used to assess different types of student engagement (Carter,

McGee, Taylor, & Williams, 2007; Fredricks et al., 2004). For example, having fun is

emotional (Skinner & Belmont, 1993) and goal setting is behavioral (Finn, 1993).

However, despite these comparisons with previous research, the validity and reliability of

the student engagement items on the BRIDGE survey have not been evaluated; thus, a

priori assumptions about the type of engagement they measure will not be made. Instead,

the current study will investigate student engagement using an exploratory analysis, while

being mindful of framework proposed by Fredricks and colleagues (2004). That is, results

will be discussed in the context of established student engagement theory and evidence.

Procedure

The data for this study were obtained as part of the data collection efforts for the

Building a BRIDGE to Better Health program. BRIDGE was a six (6) week life skills

intervention program that was created to promote cancer-risk reduction among adolescents. It was based on a genealogy and health promotion/disease prevention model that had two main components: 1) teaching the use of genealogy to increase adolescents' motivation to be their own health historians while increasing their awareness of cancer risks, and 2) teaching life and health skills (e.g., setting goals, performing self-examinations, exercising, using sunscreen, increasing body awareness, and becoming or remaining tobacco free) to increase students knowledge, self-efficacy, and behavioral intentions for healthy behaviors that help prevent cancer.

The BRIDGE program was delivered in fall 2004 and spring 2005 during health and physical education classes. Students were administered surveys by Life Skills Center staff on three occasions: one week before intervention (pre), one week after intervention (post), and three months following the intervention (follow up). The BRIDGE intervention was delivered over the course of 6 weeks between pre and post surveys. Each of the six workshops was taught by an expert on the particular topic. The workshops included, "Introduction to Genealogy: You and Your Family," "Discovering Your Family's Health History," "Genes and Cancer," "Environment and Behavior: How Lifestyle Influences Cancer," "Screening and Prevention: Check It Out!," and "Setting Goals for a Healthier Life." The workshops included didactic and participatory learning techniques. Students were given a BRIDGE manual to complete homework assignments such as, interviewing their parents about the prevalence of cancer in their family.

Data Analysis (TENSE CHANGED IN THIS SECTION)

The current study tested the proposed hypotheses by analyzing the BRIDGE survey data collected at post intervention. The data collected at post intervention uniquely assessed the self-reported student evaluations of the BRIDGE program, which were not assessed during the pre or follow up data collections.

Pre-analysis data preparation. Frequencies for the demographic variables of gender and ethnicity were generated. Descriptive statistics were calculated for the behavioral intentions (fat intake, self-examinations, and physical activity), traditional predictors of health behavior change (cancer knowledge, self-efficacy, risk perception, behavioral beliefs, and subjective norms), and the nontraditional predictor of health behavior change (i.e., student engagement). These data were examined for outliers, inconsistencies, and other abnormalities. Steps were taken to remedy problems with the dataset that could misconstrue the results.

Factor analysis. The subfield of counseling psychology has embraced the use of factor analytic techniques in applied research (Kahn, 2006). More specifically, factor analysis has been efficacious for exploring the latent structure of a construct as well as toward testing theoretically-based hypotheses about the preexisting structure of a construct (Russell, 2002; Thompson, 2004). In the current study, an exploratory factor analysis was performed to investigate the latent structure of the construct, student engagement. A total of seven items of student engagement from the BRIDGE survey were used. A principle-axis factoring (PAF) method, which computes the shared variance between items (i.e., communiality) and is preferable to both the principal components analysis and the maximum likelihood method (Kahn, 2006) was employed to identify

factors. Each item was selected for its resemblance to one of the subtypes of student engagement as outlined in a recent typology (Fredricks et al., 2004), thus, guarding against the *garbage in, garbage out* precaution when conducting factor analyses, which posits that worthless variables yield worthless factors (Kahn, 2006). Furthermore, according to previous sample size recommendations for the total number of cases or the ratio of cases to variables (Comrey & Lee, 1992; Gorsuch, 1983), the current sample of 1,101 was strong.

The primary goal of this factor analysis was to identify the latent factor structure of student engagement. Determining the appropriate number of factors was a complex process of interpreting multiple criteria and using careful judgment. Relevant statistics toward this goal included correlation matrices, eigenvalues, factor structure coefficients, and the explained variance within factors. Additionally, Kaiser's criterion, the scree plot, and factor rotation provided further information to assist the process. It was difficult to predict the result from the factor analysis and thus, a discussion explaining each potential outcome was neither helpful nor feasible. Following Kahn's (2006) recommendation, parsimony was the overarching principle guiding the interpretation of data in the current study. A final part of determining factors included naming the factor(s). Names were based on the retained variables that have strong structure coefficients (i.e., with a minimum of .40) and by examining the commonality between these variables (Kahn, 2006). All relevant data was reported (e.g., sample characteristics, variable means and standard deviations, squared multiple correlations, eigenvalues, percentage of explained variance, rotation statistics). Finally, results from the exploratory factor analysis

contributed to further analyses. The items shown to reflect the factor structure of student

engagement defined how the construct was measured and therefore provided the data that

was subsequently tested as a predictor variable in the health behavior change models.

Mixed models. Linear mixed models (LMM) were used to test three social

contextual models of health behavior change. A unique model was used to test students'

behavioral intentions for fat intake, self-examinations, and physical activity. The LLM

was an effective procedure that statistically incorporated both random and fixed effects

into the model (Goldstein, 1995). In the current study, students were nested within

schools and schools were randomly selected, making school a random effect. This

grouping variable was primarily why a mixed model was preferable to regression

(Goldstein, 1995). The fixed factors of gender and ethnicity were also important because

previous empirical and theoretical research has shown that student engagement varies by

gender and ethnicity (Lowry et al., 2002). Additionally, the LMM supported multi-level

analyses; thus, variables were manipulated so that a priori hypotheses about the nature of

the relationships between variables were tested.

Hierarchical linear modeling was the specific statistical procedure conducted with

LMM that was used to test each model. This procedure was in accordance with the

recommendations for model testing in the theory of planned behavior resource book

(Francis et al., 2004). To obtain optimal results, the continuous dependent and

independent variables were first transformed using group mean centering, which is a

standard procedure for LMM analyses (Goldstein, 1995). In each model, behavioral

intentions served as the dependent variable. The first step in the model included the fixed

factors of gender and ethnicity, as well as the random factor of school. Next, the

traditional predictors of health behavior change were entered in the second step. The third

and final step included the nontraditional predictor of health behavior change, student

engagement.

Chapter 4

Results

Preliminary Data Management

  Data assumptions. All statistical procedures assume that the data being analyzed must possess or conform to specific qualities. These assumptions help ensure that valid and reliable evidence of the tested relationships between variables are reflected in the statistical outcomes. The exploratory factor analysis (EFA) assumes (Thompson, 2004): variables of analysis were selected without bias, outliers are absent, data are interval, data are linear, data have homoscedasticity, and variables have moderate to moderate-high intercorrelations without multicollinearity. Linear mixed models (LMM) assume (Snijders & Bosker, 1999): random groupings, independent observations, adequate sample size, similar group sizes, and normally distributed data. In general, the data met most of the assumptions for each analytical technique. Descriptive as well as statistical explanations of the data assumptions accompany the presentation of results of the EFA and LMM, respectively.

  Missing data: Decisions and analyses. In accordance with how data have been prepared in previous factor analytic research on student engagement (Appleton, Christenson, Kim, & Reschly, 2006) as well as in research on models of health behavior change (Ajzen & Manstead, 2007), missing data were identified and missing response patterns were examined. Missing values were present in 36 of 37 variables included in the analyses (school was the only variable without a missing value). The mean number of

missing values per variable was 23, ranging from 9 (ethnicity) to 65 (sum of student engagement questions). Out of the 40,737 expected responses in the data (1,101 participants * 37 items), there were a total of 832 missing responses, or approximately 2% of the response data. A total of 205 cases were identified as having at least one missing value, constituting 18.6% of cases. See Table 1 for further information on missing values data.

Table 1

Totals and Percentages of Variable Missing Data (N = 1,101)

Item	*n*	No. of missing values	% missing
Demographics			
Gender	1,089	12	1.1
Ethnicity	1,092	9	<1.0
Intentions			
I plan to lower the amount of fat in my diet in the next month	1,091	10	<1.0
I plan to conduct a breast/testicular exam in the next month	1,079	22	2.0
I plan to exercise for 30 minutes five days a week in the next month	1,089	12	1.1
Self-efficacy			
I am sure I can switch to eating foods that are lower in fat	1,089	12	1.1
I am sure I conduct a breast or testicular self-examination	1,080	21	1.9
I am sure that I can exercise 30 minutes a day that will make me sweat/breathe hard	1,090	11	<1.0
Behavioral beliefs			
Eating a low fat, high fiber diet can help reduce my risk of getting cancer	1,091	10	<1.0
Performing regular self-examinations can help reduce my risk of getting cancer	1,087	14	1.3
Exercising regularly can help reduce my risk of getting cancer	1,091	10	<1.0

Normative beliefs and behaviors

Table 1 continues

My family thinks it is important to eat			
foods that are low in fat	1,080	21	1.9
My family thinks it is important to			
self-screen for breast cancer	1,071	30	2.7
My family thinks it is important to			
self-screen for testicular cancer	1,060	41	3.7
Sum of family importance to self-screen	1,050	51	4.6
My family thinks it is important to exercise	1,079	22	2.0
When I have meals with my family			
our meals are usually low in fat	1,075	26	2.4
In my family, women screen for breast cancer	1,076	25	2.3
In my family, men screen for testicular cancer	1,069	32	2.9
Sum of family behavior of screening for cancer	1,065	36	3.3
My parents exercise regularly	1,084	17	1.5

Cancer worry

I worry that I will get some type of			
cancer in my lifetime	1,081	20	1.8

Cancer knowledge

Sum of 10 cancer knowledge items	1,042	59	5.4

Student engagement

How much did you like the BRIDGE program?	1,054	47	4.3
How important to you were the topics			
in the BRIDGE program?	1,052	49	4.5
How much fun was the BRIDGE program?	1,056	45	4.1
How much did you learn from			
the BRIDGE program?	1,055	46	4.2
I think students my age should be introduced			
to the BRIDGE program	1,055	46	4.2
I feel that a program like BRIDGE enables me to			
talk openly with my family and relatives	1,052	49	4.5
I plan to set a goal to achieve within the			
next month	1,090	11	<1.0
Sum of six student engagement questions	1,044	57	5.2
Sum of seven student engagement questions	1,036	65	5.9

Two methods of handling missing data were not appropriate for the current study – mean substitution and casewise deletion. Mean substitution was not used to replace missing values because it has the potential to reduce variance and alter the correlations between variables, which are both crucial to obtaining accurate results (Snijders & Bosker, 1999). Casewise deletion of missing data, the complete removal of cases with any missing values from the dataset, was not employed either. This method would have resulted in 205 deleted cases or 18.6% of the dataset, which is considerably larger than the recommended 5% (Graham & Hoffer, 2000). Although casewise deletion was not employed as an overall solution for missing data, it was used as an adjunctive method for specific preliminary analyses of the student engagement EFA.

Pairwise deletion of missing cases, the removal of cases with missing values specific to each analysis, was primarily used. That is, analyses were conducted using cases with valid data for the specific variables being analyzed. The practical implication of choosing pairwise is that each analysis included more cases, which increased statistical power as well as item variance, and generally made the analyses more robust (Thompson, 2004). Previous research has noted that this method is acceptable when the total percentage of missing data is low (i.e., less than 10%) and when the missing values are randomly distributed between cases and variables (Kahn, 2006).

To examine the data for systematic differences, missing data analyses were conducted for each of the 36 variables with missing data. Most variables contained less than 4% missing data, yet nine variables had missing data greater than 4%: total cancer knowledge, subjective norms to conduct self-examinations, six of the seven student

engagement questions (excluded was intention to set a goal), and the aggregate of student engagement. The percentage of missing data in each variable ranged from 4.1% to 5.9%. These variables were further examined for systematic differences in missing data. The nine variables were included in a matrix that demonstrated the percentage of missing data between two variables.

In order to understand the different missing data percentages between variable pairings, it is important to note: Each pairing's missing data percentage did not include cases where data were missing on both variables; that is, cases with missing data on both variables were excluded from the matrix via casewise deletion. Moreover, the percentages of missing data shown in Table 2 represent the total percentage of cases with missing data on either one of the paired variables, but not both. This analysis was conducted based on the premise that missing data for the student engagement items were systematically different from missing data on total cancer knowledge and subjective norms to conduct self-examinations, respectively. Table 2 provides evidence of a pattern of systematic differences.

As displayed in Table 2, there were marked differences in the total percent of cases with missing data across certain variable pairings. The percentage of missing data between non-student engagement items (total cancer knowledge and subjective norms to conduct self-examinations) was 8.0%. Similarly, the percentage of missing data involving a non-student engagement variable and a student engagement variable ranged from 7.2% (subjective norms to conduct self-examinations and one specific student engagement question) to 8.7% (total cancer knowledge and the aggregate of student engagement).

However, substantially smaller percentages, ranging from 0.2% to 0.9%, were found in pairings of two student engagement items. These data appear to indicate that students who answered the engagement questions, answered most, if not, all of them; conversely, students who failed to answer the engagement questions, failed to answer most, if not, all of them.

Table 2

Two Matrices of Mismatched Missing Values Percentages for Variables with Greater Than 4% Missing Values: Student Engagement Items and Mixed Variables

Student engagement items matrix[a]

	Variable						
Variable	1	2	3	4	5	6	7
1. *How much did you like the BRIDGE program?*	4.3						
2. *How important to you were the topics in the BRIDGE program?*	0.5	4.5					
3. *How much fun was the BRIDGE program?*	0.2	0.4	4.1				
4. *How much did you learn from BRIDGE?*	0.3	0.6	0.3	4.2			
5. *I think students my age should be introduced to the BRIDGE program*	0.5	0.6	0.3	0.4	4.2		

Table 2 continues

6. *I feel that a program like BRIDGE enables me to talk openly with my family and relatives*	0.4	0.9	0.5	0.5	0.6	4.5	
7. *Sum of seven student engagement questions*	1.6	1.5	1.8	1.7	1.7	1.5	5.9

Mixed variables matrix

	Variable			
Variable	1	2	3	4
1. *The aggregate of seven student engagement items*	5.9			
2. *How much did you learn from the BRIDGE program?*	1.7	4.2		
3. *Total cancer knowledge*	8.7	7.2	5.4	
4. *Behavioral beliefs for conducting self-examinations*	8.4	7.2	8.0	4.6

[a] One student engagement item, *I plan to set a goal to achieve within the next month*, was omitted from the matrix as an individual variable due to its missing value percentage of less than 1%.
Note: Data on the diagonals are not mismatched percentages. They are the percentages of missing data for individual items.

Additional results from missing data analyses support the conclusion that in general, student engagement items were answered completely or not at all. Additional tests further examined the systematic differences of missing data in the aggregate of student engagement and total cancer knowledge variables. For each variable, Student's *t* tests compared cases without missing data and students with missing data on 21 different

variables included in the current study. Due to the increased risk of a Type 1 error from conducting numerous tests, a more stringent significance level of .01 was observed. When statistical significance emerged between groups defined by student engagement data, further Student's t tests were performed for each individual student engagement item.

Results showed that students without missing data on student engagement items ($M = 8.0$) had a significantly higher total cancer knowledge score than students with missing data ($M = 7.3$). Follow up analyses showed similar findings in six of the individual items; students who responded to each student engagement item had greater cancer knowledge than students who did not respond to that item.

Additional results showed that the behavioral belief related to fat consumption ("Eating a low fat, high fiber diet can help reduce my risk of getting cancer") was significantly different between students without missing data ($M = 3.9$) and students with missing data ($M = 3.5$) for student engagement. Each follow up analysis of individual student engagement items showed, students without missing data reported significantly stronger behavioral beliefs that reducing fat consumption can help reduce cancer risk. Further outcomes of behavioral beliefs related to fat consumption were statistically significant. Students without missing data on total cancer knowledge ($M = 3.9$) held significantly stronger beliefs than those with missing data ($M = 3.3$). Results for the behavioral belief related to fat consumption indicate that students who responded to student engagement and cancer knowledge questions, respectively, reported stronger behavioral beliefs than students with missing data. Overall, findings from missing data

analyses indicate that systematic differences are present in the data. The implications of these findings will be included as part of the general discussion of results pertaining to the research hypotheses.

An additional missing data analysis was conducted prior to the EFA that examined student engagement items as outcome measures. Listwise and casewise deletions of missing data were used in tandem to perform this analysis. Initially, listwise deletion removed 65 cases from the analyses with missing values on any student engagement item. From the remaining 1036 cases, casewise deletion identified 140 cases in the dataset with at least one missing value on any variable in the study. Excluding the 65 listwise cases initially removed, *t* test analyses then compared students without missing data ($N = 896$) to students with missing data ($N = 140$) across seven student engagement items (see Table 3). Results showed no statistically significant differences between groups on the six student engagement questions evaluating the program. However, significant differences were evident for intentions to set a goal, the additional student engagement item; students without missing data showed greater intentions to set a goal (3.96) than students with missing data (3.74), $p < .05$. Although these findings precede the standard EFA results, the data show that one student engagement item is significantly different from the remaining six. This distinction is relevant to the structure of student engagement as a construct and therefore will be discussed in the context of subsequent analyses.

Table 3

Independent Samples t Tests Comparing Students with Missing Data and Students without Missing Data on Seven Student Engagement Items

_____

	Students without missing data (*n* = 896)		Students with missing data (*n* = 140)			
Item	*M*	*SD*	*M*	*SD*	*t*	*p*

_____

Item	*M*	*SD*	*M*	*SD*	*t*	*p*
1. How much did you like the BRIDGE program?	2.86	1.23	3.01	1.37	-1.34	
2. How important to you were the topics in the BRIDGE program?	3.20	1.19	3.28	1.30	-0.73	
3. How much fun was the BRIDGE program?	2.69	1.28	2.79	1.35	-0.89	
4. How much did you learn from BRIDGE?	3.42	1.17	3.47	1.20	-0.53	
5. I think students my age should be introduced to the BRIDGE program	3.34	1.27	3.47	1.38	-1.10	
6. I feel that a program like BRIDGE enables me to talk openly with my family and relatives	2.64	1.27	2.79	1.48	-1.09	
7. Sum of seven student engagement questions	3.96	0.95	3.74	1.06	2.29	*

_____

Note: Listwise case deletion removed 65 cases with missing values on student engagement items from the analysis; *df* = 1,034
* *p* < .05.

Sample Characteristics

The total sample was comprised of 1,101 ninth grade students who participated in the BRIDGE intervention program. The data are based on self-reported student responses to the post test survey that each student completed one-week after the program. The students were from three different high schools in central Virginia. The sample was 53% female. Student ethnicities were also reported: White/Caucasian (63%), Black/African American (22%), 3% Asian/Asian American, 3% Hispanic or Latino, 1% American Indian/Alaska Native, 1% Native Hawaiian/Other Pacific Islander, and 6% multi-ethnic/-racial. Table 4 contains further sample characteristics for gender and ethnicity and Table 5 shows the distribution of students at each school by gender and ethnicity.

Table 4

Demographic Characteristics of Gender and Ethnicity in the Total Sample ($N = 1,101$)

Variable	n	$\%$
Gender		
Female	575	52
Male	514	47
Ethnicity		
American Indian / Alaskan Native	14	1
Asian / Asian American	28	3
Black / African American	245	22
Hispanic or Latino	37	3
Native Hawaiian / Other Pacific Islander	13	1
White / Caucasian	693	63
More than one ethnicity	62	6

Note: Demographic statistics differ from the total sample of students due to missing data across measures.

Table 5

Gender and Ethnicity of Students within Schools[a]

_____

	School A (n = 340)	School B (n = 274)	School C (n = 475)
	_____	_____	_____
	n (%)	*n (%)*	*n (%)*
Gender			
Female	177 (52)	135 (49)	263 (55)
Male	163 (48)	139 (51)	212 (45)
Ethnicity			
American Indian / Alaskan Native	4 (1)	4 (1)	6 (1)
Asian / Asian American	11 (3)	6 (2)	11 (2)
Black / African American	81 (24)	28 (10)	136 (29)
Hispanic or Latino	7 (2)	13 (5)	17 (4)
Native Hawaiian / Other Pacific Islander	2 (1)	8 (3)	3 (1)
White / Caucasian	213 (63)	208 (75)	272 (57)
More than one ethnicity	22 (7)	9 (3)	31 (3)

Note: Demographic statistics differ from the total sample of students due to missing data across measures.
[a] Raw data and percentages are relative to the total sample of students gathered from each particular school.

Exploratory Factor Analysis

  Selecting items. Student engagement items were selected by the researcher from self-report questions on the BRIDGE survey. Items were primarily selected because they appeared similar to previous measurements of student engagement (Fredricks et al., 2004). It was also important that items had face validity, clear wording, and an apparent ease of interpretation. More generally, item selection for measuring student engagement

was guided by the overarching principles to be comprehensive, pertinent, and parsimonious (Kahn, 2006).

A total of six items pertaining to student evaluations of the BRIDGE program were initially identified. Each question resembled previous measurements of student engagement in definition and response structure. For instance, the Rochester School Assessment Package (RAPS), a comprehensive instrument measuring students' engagement in school, includes emotional engagement questions which are defined as measuring enthusiasm, optimism, curiosity, and interest (Wellborn & Connell, 1987). Similarly defined items in the current study include student perceptions of "fun" and "liking" for the BRIDGE program. However, based on the definition of emotional engagement used in the RAPS, additional items from the current study may also measure emotional engagement. Three items were identified which measure student perceptions of BRIDGE for topic importance, recommending the program, and the program's influence on increasing family communication. Although these were initially characterized as measurements of cognitive or behavioral engagement, they appear to overlap with emotional engagement as defined and measured by the RAPS. The final EFA item yet to be described, "How much did you learn from the BRIDGE program?," approximates previous assessments of cognitive engagement that measure self-reported student perceptions of attained knowledge (Miller, Greene, Montalvo, Ravindran, & Nichols, 1996). Further, all items in the EFA were measured on a 5-point Likert scale, which is similar to the 4-point Likert scale of items in the RAPS (Wellborn & Connell, 1987).

A broader search of the BRIDGE survey for possible items was conducted after the initial six items were chosen. After conferring with senior research advisors, one item was added – intentions to set a goal for health. Although this item was distinct from the program evaluation questions, goal setting for health resembled prior measurements of student engagement (Wolters, Yu, & Pintrich, 1996) and was theoretically related to the behavioral and cognitive types of student engagement summarized by Fredricks and colleagues (2004). Moreover, the goal setting item was face valid, clearly worded, and interpretable. The item for intentions to set a goal was also chosen because it was positively scored and had a response scale of one through five, which were similar to the program evaluation items.

Overall, the similarities between items, especially between the program evaluation items, increased the eventual ease of interpreting data. Yet, the questions appeared broad enough to encompass each type of student engagement (behavioral, cognitive, and emotional). These qualities justified the research hypothesis predicting that a multifaceted structure of student engagement would emerge.

Factor solutions overview. A variety of relevant statistics were generated in order to aid interpretation and subsequent decision making. These included descriptive data, inter-item correlations, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy, Bartlett's Test of sphericity, communalities, eigenvalues, cumulative variances, scree plots, factor loadings, regression coefficients, as well as rotated data (when appropriate). Results were interpreted for the most parsimonious, thorough, and relevant factor structure possible.

Overall, findings show a clear and decisive one-factor solution for the construct of student engagement. This conclusion is based on an extensive decision making process of analyzing and interpreting three separate exploratory factor analyses (EFA). The first factor solution tested included seven items and generated one factor, the second factor solution tested included the same seven items and produced two factors, and the third and final factor solution included six items (minus intention to set a health goal). The process of identifying the best solution required many steps, such as conducting statistical analyses, interpreting data, comparing results, and making decisions based on clearly described rationale. The multiple steps taken to achieve the final factor solution are presented chronologically and described in sufficient detail for the purposes of transparency and study replication.

First solution: Seven items, one factor. The initial EFA used principle-axis factoring and included seven student engagement items: Six items evaluating the BRIDGE program and one item assessing students intentions to set a health goal. Descriptive data for the seven items were generated for number of cases, means, standard deviations, variance, skewness, and kurtosis (see Table 6). From these initial statistics, differences between the six program evaluation items (Q1-Q6) and the intention to set a goal item (Q7) were already apparent. Mean scores for Q1-Q6 ranged from 2.65 to 3.42, while the mean of Q7 was 3.92, an apparent outlier. This patterned difference was also reflected in the skewness statistic: Q1-Q6 ranged from -.002 to -.382 while Q7 reported a disproportionate skew of -.919. Furthermore, the kurtosis of items Q1-Q6 were all negative, ranging from -.768 to -1.036, whereas, Q7 was positive (.87). Finally, the total

number of Q7 cases (n = 1090) was greater than any Q1-Q6 total (ranging from n = 1052

to 1056). The marked differences in descriptive data between items Q1-Q6 and Q7 are

indicative of a pattern supported by further results.

Table 6

Descriptive Results of Seven Student Engagement Items

_____

Variable	n^a	*M*	*SD*	Variance	Skewness	Kurtosis
1. How much did you like the BRIDGE program?	1,054	2.88	1.25	1.25	-.002	-.943
2. How important to you were the topics in the BRIDGE program?	1,052	3.21	1.21	1.21	-.250	-.799
3. How much fun was the BRIDGE program?	1,056	2.70	1.29	1.29	.198	-1.036
4. How much did you learn from BRIDGE?	1,055	3.42	1.17	1.17	-.382	-.768
5. I think students my age should be introduced to the BRIDGE program	1,055	3.35	1.29	1.29	-.313	-.945
6. I feel that a program like BRIDGE enables me to talk openly with my family and relatives	1,052	2.65	1.30	1.30	.234	-.994
7. I plan to set a goal						

Table 6 continues

to achieve within the next month	1,090	3.92	.96	0.96	-.919	.869

[a] Sample sizes varied due to pairwise deletion of cases.
Note: The range of scores for all variables was four(4), with a minimum of one(1) and a maximum of five(5).

Inter-item correlation coefficients (Pearson's *r*) of student engagement items also revealed differences between Q1-Q6 and Q7 (see Table 7). The inter-item correlations for items Q1-Q6 range from .58 to .79, while correlations between Q7 and Q1-Q6 items range from .23 to .33. Based on previous correlation coefficient benchmarks in EFA (Kohn, 2006), the former are in the mid to high range while the latter are in the low range. These results show a distinct difference between the intentions to set a goal item and the six other items, yet, by itself, this evidence was not sufficient to justify removing Q7 from the factor solution.

Table 7

Correlation Matrix of Seven Student Engagement Items

_____

	Variable						
Variable	1	2	3	4	5	6	7
1. *How much did you like the BRIDGE program?*	–						
2. *How important to you were the topics in the BRIDGE program?*	.73	–					
3. *How much fun was the BRIDGE program?*	.79	.64	–				
4. *How much did you learn from BRIDGE?*	.67	.71	.65	–			
5. *I think students my age should be introduced to the BRIDGE program*	.71	.68	.67	.68	–		
6. *I feel that a program like BRIDGE enables me to talk openly with my family and relatives*	.61	.59	.62	.58	.64	–	
7. *I plan to set a goal to achieve within the next month*	.27	.30	.23	.33	.30	.26	–

[a] All Pearson's *r* correlation coefficients are statistically significant at the .01 level.
Note: Sample sizes varied due to pairwise deletion of cases.

Beyond the descriptive statistics and correlation coefficients that remained

constant across the three factor solutions tested, estimates of the first EFA confirmed that

data were suitable for analysis. The KMO statistic, which is a measure of sampling

adequacy that estimates the proportion of variance in the variables that might be

accounted for by underlying factor(s) (Kahn, 2006), was satisfactory (.908). Additionally,

Bartlett's Test, an indicator that factor analysis may be useful for the current data, was

statistically significant ($p < .01$) and thus further evidence of adequate data (Kahn, 2006).

Based on these results, additional statistics (i.e., communalities, eigenvalues, cumulative

variance, scree plot, factor loadings, and regression coefficients) of a seven-item factor

solution for student engagement were examined.

To determine the amount of variance explained by underlying factor(s), the initial

as well as extracted statistics for eigenvalues, percent of variance, and cumulative

variance were examined (see Table 8).

Table 8

Total Variance Explained for Three Tests of Student Engagement Factor Structure

Tests of factor structure	Initial eigenvalues		Extracted sums of squared loadings		Rotation sums of squared loadings	
	Total	% of variance	Total	% of variance	Total	% of variance
First[a]						
7 items-1 factor						
Factor 1	4.47	63.81	4.12	58.87	–	–
Second						
7 items-2 factors						
Factor 1	4.47	63.81	4.16	59.42	2.47	35.28
Factor 2	0.88	12.50	0.22	3.19	1.91	27.34
Third						
6 items-1 factor						
Factor 1	4.33	72.14	4.00	66.69	–	–

[a] The first test of factor structure only generated a single factor due to a minimum cutoff for eigenvalues of 1.0.

The largest single factor generated from the analysis produced an eigenvalue of 4.47 and accounted for 63.8% of the variance in the factor solution. Extracted data from this factor were slightly less. The initial eigenvalue of the next largest factor was 0.86 and accounted for 12.5% of the variance. The cumulative variance accounted for by the two largest factors was 76.3%. Additional factors reported eigenvalues less than 0.50 and variance estimates less than 7%. These data support a single factor solution underlying

student engagement. Moreover, as shown by the graphed eigenvalues of the scree plot in

Figure 1, there appears to be visual evidence as well for a single factor solution.
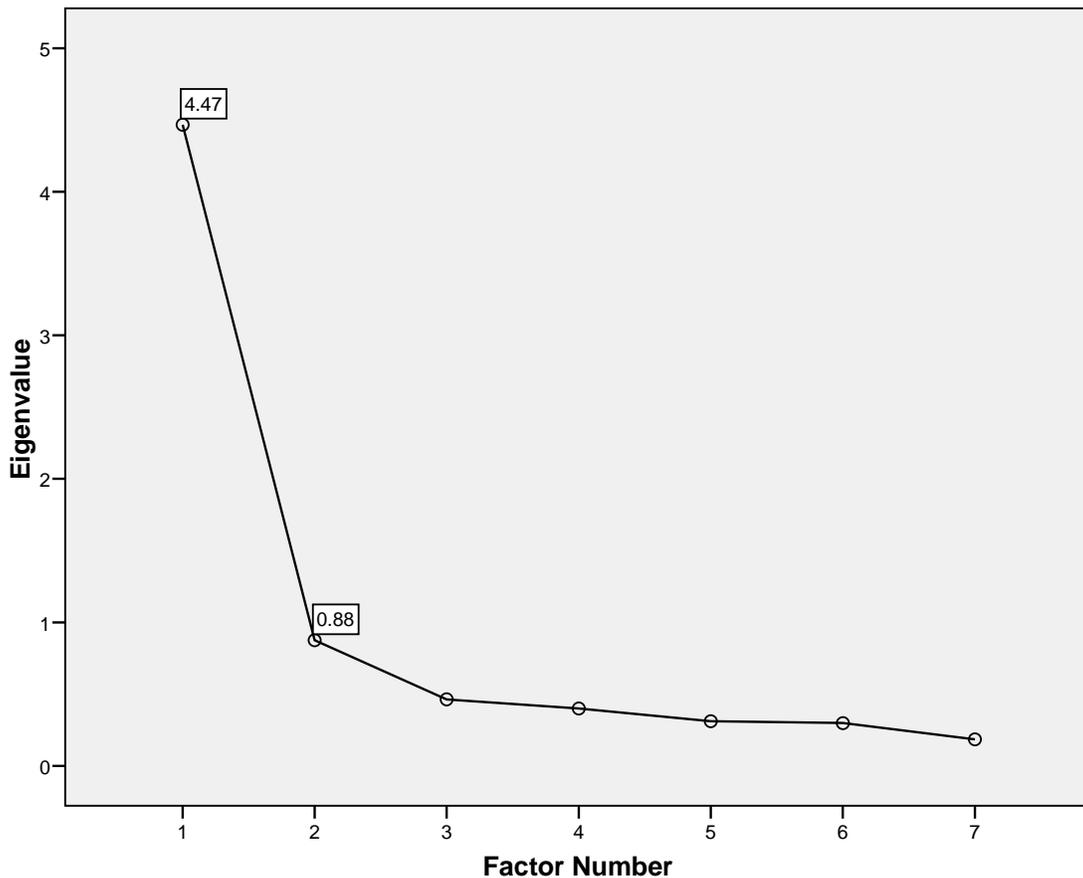
Figure 1. A Scree Plot for Seven Items Measuring Student Engagement

The pattern of differences between Q1-Q6 and Q7 is also evident in additional

EFA results. Based on extracted data for a one-factor solution, the item communalities,

that is, the variances in each item accounted for by the single factor comprising the

factor-solution, ranged from .53 to .76 for Q1-Q6. However, the Q7 communality (.12)

was substantially less. These results also support a single factor solution while further

differentiating items Q1-Q6 from Q7. Communalities are further displayed in Table 9.

Table 9

Communalities of Student Engagement Item Scores from Three Tests of Factor Structure Using Principal Axis Factoring

_____

	Tests of factor structure		
	First	Second	Third
Variable	7 items-1 factor	7 items-2 factors	6 items-1 factor
1. *How much did you like the BRIDGE program?*	.76	.79	.77
2. *How important to you were the topics in the BRIDGE program?*	.69	.70	.68
3. *How much fun was the BRIDGE program?*	.68	.82	.69
4. *How much did you learn from BRIDGE?*	.66	.70	.65
5. *I think students my age should be introduced to the BRIDGE program*	.70	.69	.69
6. *I feel that a program like BRIDGE enables me to talk openly with my family and relatives*	.53	.52	.53
7. *I plan to set a goal to achieve within the next month*	.12	.16	–

Factor loadings are the correlation coefficients between an individual item and factor. They directly measure how well a single item matches (i.e., loads on) a particular factor (Kahn, 2006). The factor loadings of items Q1-Q6 ranged from .73 to .87, substantially greater than Q7 (.35). Discrepant results between items Q1-Q6 and Q7 are also demonstrated in factor score coefficients (i.e., coefficients used to generate estimates of the factor scores). Q1-Q6 coefficients ranged from .12 to .26 whereas Q7 was .03. Results of factor loadings and factor score coefficients are further displayed in Tables 10 and 11, respectively.

Table 10

Factor Loadings for Student Engagement Item Scores from Three Tests of Factor Structure Using Principal Axis Factoring

	Tests of factor structure				
	First	Second			Third
	7 items-1 factor no rotation	7 items-2 factors Orthogonal Varimax rotation			6 items-1 factor no rotation
		unrotated		rotated	
Variable	I	I	II	I	II	I
1. *How much did you like the BRIDGE program?*	.87	.87	-.15	.76	.46	.88

Table 10 continues

2. *How important to you were the topics in the BRIDGE program?*	.83	.83	.12	.54	.64	.83
3. *How much fun was the BRIDGE program?*	.82	.85	-.32	.85	.31	.83
4. *How much did you learn from BRIDGE?*	.81	.82	.18	.50	.67	.81
5. *I think students my age should be introduced to the BRIDGE program*	.83	.83	.09	.57	.61	.83
6. *I feel that a program like BRIDGE enables me to talk openly with my family and relatives*	.73	.72	.03	.53	.50	.73
7. *I plan to set a goal to achieve within the next month*	.35	.35	.20	.13	.38	–

Table 11

Factor Score Coefficients for Student Engagement Item Scores from Three Tests of Factor Structure Using Principal Axis Factoring

_____

	Tests of factor structure			
	First	Second		Third
	7 items-1 factor no rotation	7 items-2 factors Orthogonal Varimax rotation		6 items-1 factor no rotation
		unrotated	rotated	
Variables	I	I	II	I

_____

Variables	I	I	II	I
1. How much did you like the BRIDGE program?	.26	.34	-.04	.27
2. How important to you were the topics in the BRIDGE program?	.19	-.05	.34	.19
3. How much fun was the BRIDGE program?	.16	.72	-.46	.18
4. How much did you learn from BRIDGE?	.19	-.14	.44	.17
5. I think students my age should be introduced to the BRIDGE program	.20	-.01	.29	.20
6. I feel that a program like BRIDGE				

Table 11 continues

enables me to talk openly with my family and relatives	.12	.02	.13	.12
7. *I plan to set a goal to achieve within the next month*	.03	-.07	.13	–

Overall, results from the initial factor analysis support a clear pattern of differences between the program evaluation items (i.e., Q1-Q6) and the intention to set a health goal item (i.e., Q7). However, the current results are not entirely comprehensive. A default setting in SPSS 15.0 specifies that only factors with initial eigenvalues equal to or greater than 1.0 get extracted. Thus, due to the second factor's eigenvalue (0.86), data for a two-factor solution were not automatically produced (e.g., extracted eigenvalues, variances, and factor loadings, as well as rotated data). The default factor extraction method in SPSS is not definitive; researchers should ultimately decide what tests are necessary in order to obtain the most definitive results (Kahn, 2006).

In an effort to follow previous researchers' recommendations that factor analyses be comprehensive and parsimonious (Costello & Osborne, 2005; Kahn, 2006; Tinsley & Tinsley, 1987), an additional factor analysis was conducted. The second factor analysis aimed to be more comprehensive by producing extracted data for a two-factor solution. It also aimed to be more accurate by conducting a factor rotation to assist data interpretation (Costello & Osborne, 2005; Kahn, 2006).

Second solution: Seven items, two factors. The second EFA was conducted in a manner that was practically identical to the first, with minor changes. The method of extracting factors was changed from an absolute eigenvalue score equal to or greater than 1.0, to a predetermined specification to extract two factors. Extracting two factors was primarily based on statistical results from the first factor analysis indicating that a second factor, with an eigenvalue slightly below 1.0, may possibly contribute to the optimal factor solution of student engagement. Based on recommendations from Counseling Psychology research (Kahn, 2006; Tinsley & Tinsley, 1987), a varimax orthogonal rotation was included to examine additional results.

As noted earlier, the second factor analysis did not alter the following data: descriptive data, correlations, the KMO statistic, Bartlett's Test, and initial eigenvalues and percentages of variance. The factor rotation applied to the second factor analysis produced a large factor transformation matrix score of .655. This above average result indicates that a substantial factor rotation was applied in order to produce the rotated data. A significant rotation often makes data interpretation more difficult and it can produce results that inaccurately reflect the construct's underlying structure (Kahn, 2006).

Results from the second factor analysis (seven items-two factors) were somewhat consistent with the first factor analysis, while at times divergent and less indicative of the clear pattern shown by earlier results. The extracted communalities from the second factor analysis paralleled previous results (see Table 9). Data for items Q1-Q6 were similar, ranging from .52 to .82, whereas Q7 remained an outlier at .16. The extracted

data for the first factor were consistent across both analyses (see Table 8); the extracted

eigenvalue of the first factor (4.12) remained greater than 4.0 and its percent of variance

(58.9%) decreased by less than 5%.

Although the extraction of an additional factor produced new results, prior to

rotating the factors, extracted data were relatively unexceptional. The second factor's

extracted eigenvalue was .22, it accounted for only 3.2% of the variance, and it was

comprised of factor loadings that ranged from .03 to -.32 (see Table 10). Results

following the factor rotation, however, were substantially different from these data.

The varimax orthogonal rotation (i.e., rotating the factor axes) was employed to

maximize the variance of factors by positioning the student engagement items in a

manner that differentiates each of them as much as possible (Kahn, 2006). This step

produced additional, rotated, data for eigenvalues, percentages of variance, factor

loadings, and factor score coefficients.

The first factor was dramatically altered due to the rotation. Compared to initial

estimates, the first factor's rotated eigenvalue (2.47) decreased by 2.0 and its rotated

percent of variance (35.28) decreased by approximately 19%. Conversely, the rotated

second factor showed a substantially greater eigenvalue (1.91) accounting for 27.3% of

the factor solution variance (see Table 8 to compare data across EFA tests).

Results of the rotated factor loadings of the first factor are also notably different

compared to earlier results. The rotated first factor continued to have high factor loadings

on Q1-Q6 (ranging from .50 to .85) and low on Q7 (.13). However, Q1 (*How much did

you like the BRIDGE program?*) and Q3 (*How much fun was the BRIDGE program?*)

displayed particularly high loadings of .76 and .85, while the range of items Q2 and Q3-Q6 (.50 to .57) was notably less.

The rotated factor loadings for the second factor were substantially different from the previous unrotated factor loadings. Overall, the second factor's rotated factor loadings ranged from .31 to .67. Items with the highest loadings included Q4 (.67; *How much did you learn from the BRIDGE program?*), Q2 (.64; *How important to you were the topics in the BRIDGE program?*), and Q5 (.61; *I think students my age should be introduced to the BRIDGE program*). The remaining items, including Q7, ranged from .31 to .50 and appear to be distributed evenly. Lastly, the two rotated factors have a shared variance (i.e., covariance) of .231.

Results from the second factor analysis made the process of identifying an optimal factor solution more comprehensive by producing rotated data that were markedly different. However, results were difficult to interpret, they were not easily interpretable, and a parsimonious solution was unidentifiable. Yet, additional evidence remains to be interpreted that can assist comparisons between one- and two-factor solutions for student engagement.

Rotated data of factors one and two appear to share common or overlapping results. For instance, across both factors, almost all rotated factor loadings of Q1-Q6 ranged from .50 to .85. Despite different high factor loading items, the next highest or secondary factor loading items for both rotated factors are similar; the secondary items have factor loadings that are moderately high (above .45), in a similar range, and are separated from the primary factor loadings by approximately .20 in each factor. These

data indicate that the rotated factor solution does not represent a well-differentiated solution for two factors.

According to these overlapping results, evidence does not appear to support the existence of two relatively independent and distinct underlying components of the current EFA for student engagement. Further, the scree plot for the two-factor rotated solution shows a clear distinction between the first and second factors, as well as a clear similarity between factor two and each additional factor. Moreover, the estimate of shared variance between factors (.231) supports a conclusion of greater convergence rather than clear divergence. Lastly, the orthogonal rotation was estimated to be above average (.655), an uncommonly large adjustment. Based on the interpretation of multiple sources of data generated from a uniquely large rotation, it appears that the evidence for a two factor solution is minimal at best, and at worst, impossible to interpret. Thus, a two factor solution (rotated or unrotated) is unlikely to represent the most accurate structure of the seven student engagement items under investigation.

Again, results were interpreted in a manner that intended to be more comprehensive, parsimonious, and accurate. Despite evidence that supported a two-factor solution, there was overwhelming evidence obscuring, as well as refuting, the presence of two clearly distinct and independent factors. A single factor appears to be the best and most appropriate solution; however, a one-factor solution does not appear to be best represented by seven variables. The intention to set a goal item (Q7) displayed a repetitive pattern of being a statistical outlier relative to the other six items (Q1-Q6). Although this pattern was not as clearly evidenced throughout the rotated two-factor

results, it remained present. Additionally, thorough discussions and significant consideration were initially given as whether the item should even be included. Despite a theoretical justification for including it in the initial factor analyses, compelling statistical evidence exists to justify its removal from the final factor analysis.

Final solution: Six items, one factor. The third factor analysis included six student engagement items. By removing Q7 and essentially ruling out the possibility of a two-factor solution, this was intended to be the most parsimonious, comprehensive, and accurate test of student engagement. Overall, the results show a pattern generally consistent with the overarching aims of the factor analytic investigation of student engagement.

The new test produced descriptive data and inter-item correlations which were identical to preceding analyses. Although not identical, the KMO statistic and Bartlett's Test were relatively the same, continuing to indicate the presence of adequate data for factor analysis. The extracted communalities, factor loadings, and factor score coefficients for a one-factor solution remained very similar to results from the first factor analysis (see Tables 9, 10 and 11).

Results of explained variance were shown to occasionally vary from initial factor analysis results. Regarding the first factor, eigenvalues, initial (4.33) and extracted (4.00), both closely resembled the results from the initial factor analysis. Although eigenvalues remained relatively constant, the percentage of variance accounted for by the first factor, initial (72.14%) and extracted (66.69%), increased by 8.33% and 7.82%, respectively. Regarding the second factor, its eigenvalue (0.46) decreased by 0.41 from the first factor

analysis and its amount of explained variance (7.73%) decreased by 4.78% compared to

the first factor analysis. Figure 2 displays a visual representation of the one-factor model

for six-items as indicated by the graphed eigenvalues in the scree plot.
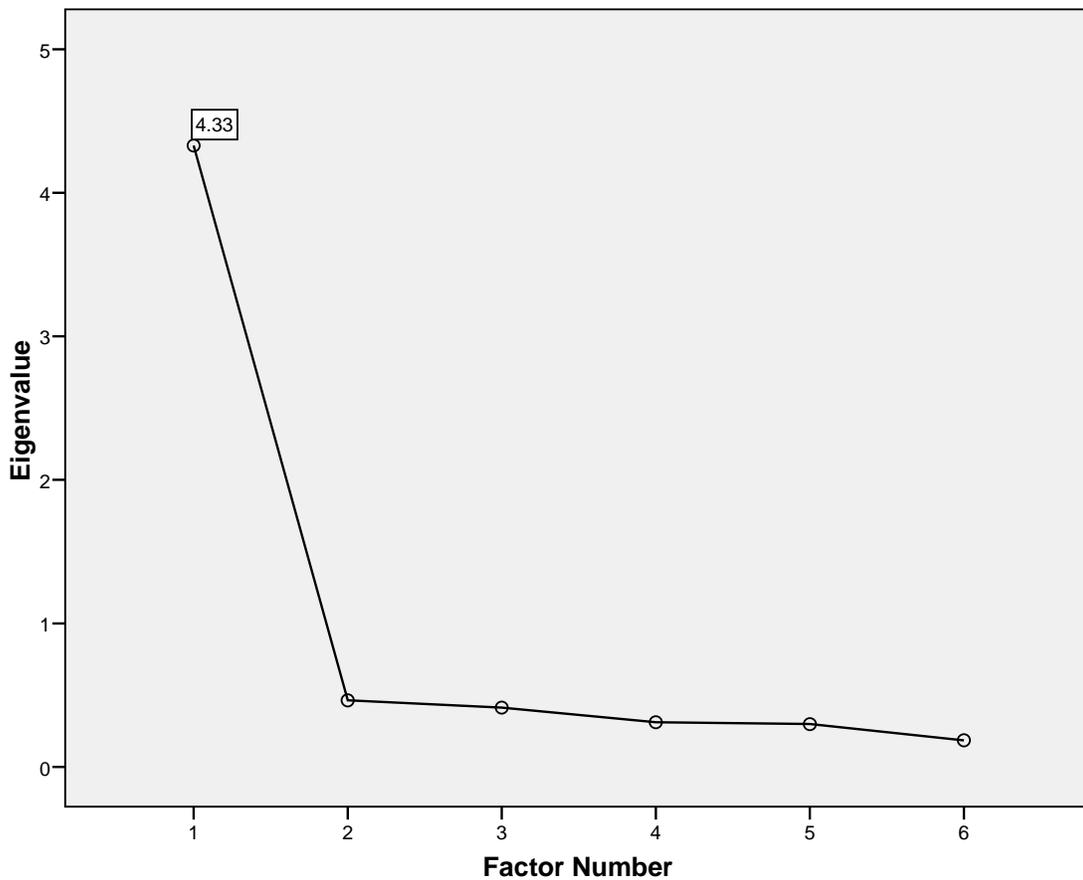
Figure 2. A Scree Plot for Six Items Measuring Student Engagement

Based on the interpretation of results from three progressive EFA tests, the

underlying structure of student engagement, as measured by a total of six items, is best

represented by a one-factor solution. This model is visually represented in Figure 3.

Based on this final solution, an aggregate measure of student engagement was tested prior

to being implemented in subsequent mixed model analyses. Cronbach's α was calculated

to measure the internal consistency of the six-item student engagement assessment and

not the underlying structure or dimensionality of the construct (Helms, Henze, Sass, &

Mifsud, 2006). A reliability coefficient of .92 was calculated. This is a relatively strong

estimate of internal consistency that supports using the aggregate measure of student

engagement as a predictor variable in the subsequent mixed model analyses.
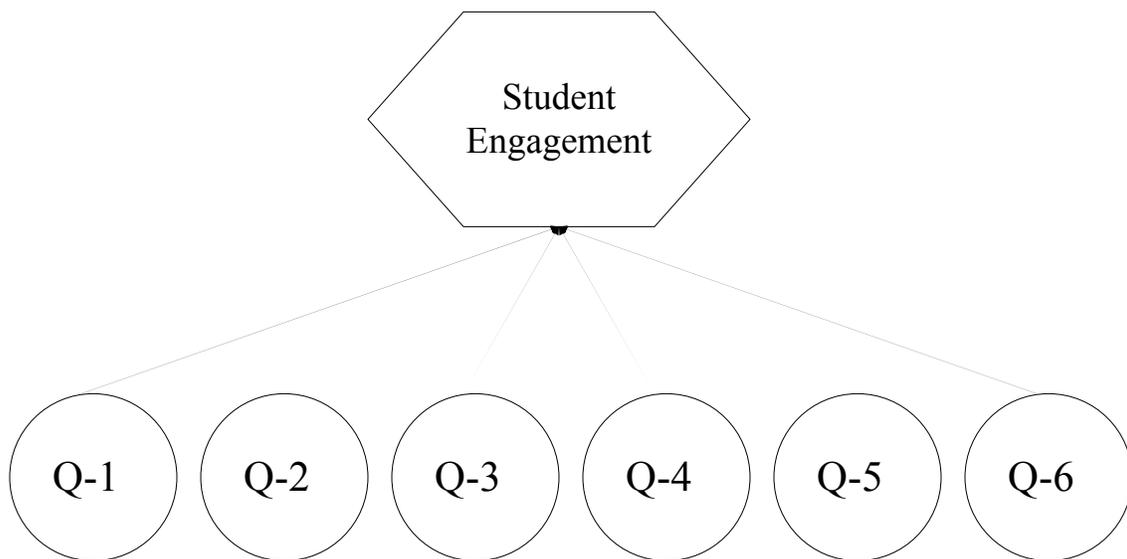
Figure 3. The Final One-Factor Solution for the Factor Analysis of Six Student
Engagement Items

Mixed Model Analyses

   Model assumptions. Three separate linear mixed models (LMM) were used to test

the research hypotheses for students intentions to reduce fat consumption, conduct self-

examinations, and exercise. To ensure that results were valid and reliable, it was

important to first establish that key assumptions regarding the LMM statistical procedure were met. The model assumes that cases are distributed within groups which were selected at random (Hox, 2002). The three schools in the current study were selected at random from the public high schools in a central Virginia county. Independent observations are not assumed in LMM, which is why multi-level modeling is recommended when intraclass correlation exists (Hox, 2002). Other statistical procedures have different assumptions. Ordinary least squares regression assumes error terms are independent and have equal error variances, whereas with hierarchical data, individual-level observations from the same upper level group will not be independent but rather will be more similar due to such factors as shared group history and group selection processes. LMM also assume that groups are similar in size. When sample sizes within groups are unbalanced, tests of parameters and of overall fit will have inflated Type I error (Hox, 2002). The current sample is large enough to support balanced groups for the planned analyses and prevent an inflated Type I error. Furthermore, Table 12 presents sample characteristics and descriptive data supporting the conclusion that model assumptions have been adequately met.

Table 12

Descriptive Statistics for Student Respondents (*N* = 1,101)

_____

Variable	Frequency	%	Mean	SD
Gender	1,089			
Female	575	53		
Male	514	47		
Ethnicity	1,092			
Black	245	22		
White	693	64		
Other	154	14		
School	1,101			
A	346	32		
B	277	25		
C	478	43		
Intentions:				
Reduce fat consumption	1,091		3.49	1.11
Conduct self-examinations	1,079		3.53	1.05
Exercise	1,089		3.88	1.02
Self-efficacy:				
Reduce fat consumption	1,089		3.63	0.98
Conduct self-examinations	1,080		3.82	1.00
Exercise	1,090		3.98	0.98
Behavioral beliefs:				
Reduce fat consumption	1,091		3.89	0.92
Conduct self-examinations	1,087		3.87	1.08
Exercise	1,091		3.94	0.96
Subjective norms:				
Reduce fat consumption	1,074		3.42	0.88
Conduct self-examinations	1,044		3.11	0.69
Exercise	1,072		3.51	0.90
Cancer worry	1,081		3.24	1.14
Cancer knowledge	1,042		8.00	1.56

Table 12 continues

Student engagement	1,044	18.25	6.39

Note: Demographic statistics differ from the total sample of students due to missing data across measures.

Justifying mixed model analyses. LMM In addition to meeting key assumptions, it is important to reiterate the key reasons for choosing LMM over other statistical tests, such as regression and a general linear model (GLM). A LMM approach was chosen to examine individual level change for students above and beyond the influence of the particular school that each student is nested within. Thus, LMM was selected so that school could be treated as a random factor, allowing for the examination of individual change within each random grouping (i.e., school). Furthermore, the LMM is able to estimate the level of change in the dependent variable based a variety of combinations of independent variables, including random factors, fixed factors, and covariates (McQueen, Swank, Bastian & Vernon, 2008). The flexibility afforded by LMM is an essential quality for the current analyses of health behavior change models which have multiple predictor variables including random factors, fixed factors, and covariates. Additionally, mixed models are capable of providing an estimation of model effect size (McQueen et al., 2008), which is specifically needed to test one of the key hypotheses.

The primary reason for not choosing regression to analyze the current data was due to the way it handles cases that are grouped or nested. Regression does not properly account for differences that would be expected between groups; simple regression ignores group effects and violates the assumption of independence of observations

(Snijers & Bosker, 1999). This leads to subsequent problems such as low estimates of standard error, higher rates of Type I error, and more narrow confidence limits. Regression examines the fixed effects of variables where sampling error is taken into account only for the base level (e.g., student), and ignored at higher levels (e.g., school). Information from fewer units at the upper level is wrongly treated as if it were independent data for the many units at the base level. This leads to over optimistic estimates of significance. In contrast, LMM employs separate intercepts and slopes for individuals in each higher level (i.e., school) where the grouping variable is treated as a random effect (McQueen, Swank, Bastian & Vernon, 2008).

Relative to the listwise deletion of cases used in GLM, LMM effectively accommodates missing data by including incomplete cases in each individual analysis (Snijers & Bosker, 1999). GLM is also limited because it requires each model to include all possible interactions. However, LMM lets the researcher specify the interactions of interest. Similar to the limitation of regression, GLM supports random effects but estimates their parameters as if they were fixed effects, which again, is inappropriate because the assumption of independent observations is violated. In contrast, LMM treats random effects as random, and fixed effects as fixed. Lastly, because LMM is a flexible statistical procedure, it also makes fewer assumptions about data composition than GLM (Snijers & Bosker, 1999).

There are additional facets of LMM that add to its usefulness in the current study. LMM is particularly helpful in the analysis of covariance when data are sparse. Groups that are poorly represented will have estimates that rely considerably on pooled data,

however, the advantage is that the pooling involved in LMM affords a "borrowing of strength" that supports statistical inference in situations where no inference would be possible using traditional methods (Hox, 2002). It is important to note a particular drawback of LMM. As a result of the inherent flexibility to LMM, outcomes may be less generalizable due to the complexity of specified models and therefore only relevant for the data set being analyzed (Hox, 2002).

Centering. Based on recommendations from previous researchers to center predictor variables when using LMM (Enders & Tofighi, 2007), the data were centered prior to testing each model. For the non-categorical predictor variables, group mean centering (GRP) was chosen over grand mean centering (GRN). This decision was made because GRP removes all between-cluster variation from the predictor variable and yields a slope coefficient (Enders & Tofighi, 2007). Thus, an easily identifiable and therefore interpretable coefficient is created for the *pure* within-school regression of one variable on another (Enders & Tofighi, 2007). On the other hand, centered scores under GRN contain both within- and between-cluster variation, resulting in a muddied regression slope with undesirable variance that makes interpretation more difficult. In contrast, GRP assures that student scores are uncorrelated with school, so the resulting regression coefficient is a pure estimate of the relationship between student and school.

To illustrate the potential statistical changes that can result from different forms of centering, Table 13 provides an example based on the current study; included in the table are the means and correlations of three variations of the variable, student engagement: the raw metric, with GRP, and with GRN. The dependent variable of students' intentions to

conduct self-examinations is also included in the correlation matrix to show that

centering affects the relationship between independent and dependent variables. Although

the correlation differences between GRP and GRN are relatively small (.012 and .084), it

is clear that each school has a different raw mean for student engagement as well as a

different mean for the dependent variable. The mean differences of each school show that

GRP and GRN differentially influence statistical outcomes (e.g., correlations).

Table 13

School Means and Correlations for Student Respondents Under Different Forms of Centering

School	Intentions to conduct self-examinations	Student engagement $_{raw}$	Student engagement $_{grn}$	Student engagement $_{grp}$
A	3.74	21.60	3.35	0
B	3.33	18.25	0	0
C	3.50	15.65	-2.60	0

Variables	1	2	3	4
1. Intentions	–			
2. SE $_{raw}$	.340	–		
3. SE $_{grn}$	.340	1.00	–	
4. SE $_{grp}$	.328	.916	.916	–

Note: RAW = original metric; GRN = grand mean centered; GRP = group mean centered within school; Intentions = students intentions to conduct self-examinations; SE = student engagement.

Interpreting mixed model results. The simultaneous modeling of fixed and

random effects creates a mixed model with results that are distinctive. Research shows

that accurately interpreting mixed model results is complex and a challenge even for published researchers (Long & Pellegrini, 2003; McQueen et al., 2008); for example, misinterpreting mixed model results is one reason that explains how erroneous conclusions are reached. The current investigation strives to accurately understand the mixed model outcome data, drawing conclusions that are based on accurate and justifiable interpretations of the results.

In order to make accurate interpretations, it is important to understand the unique results produced by models with fixed and random effects. For instance, the mixed models being tested in the current investigation each include one random factor and multiple covariates modeled as fixed effects. It is important to understand, that because of the random effect, change in the dependent variable attributed to covariates was uniquely measured within the student population of three different school (i.e., within levels of the random factor). Change in the dependent variable is therefore interpreted as a function of the unique responses of students within three separate school environments, and not as a general effect across all students.

To simplify the interpretation of mixed model results, recommendations from the literature were followed for centering the predictor variables (Enders & Tofighi, 2007). As noted earlier, group mean centering was preferred over grand mean centering. Centering data by schools led to analyses with covariate parameter estimates that were unique to the student population in each school. This process removed error variance due to differences across schools, which increased the precision of model outcome data.

To understand the outcome data of the covariates included in the current study's three models, it is important to understand what nested terms are and how their results are interpreted. A nested term involves referencing one variable within another (Hox, 2002). Nested variables are often created when the cases in a dataset belong to higher-level groups (e.g., students in schools) that the researcher believes vary systematically, which is a significant threat to internal validity that can be addressed with nested terms.

The current study built nested terms for each covariate predictor using the grouping variable, school; each covariate was a student-level measured variable predicting health behavior change that was nested within schools, which was an upper-level variable with three categories. Results from the nested covariates modeled as fixed effects included parameter estimates, t scores, and significance levels of the covariates influence on the dependent variable for each level of the nesting variable (i.e., school). However, pairwise comparisons between levels of the nesting variable for the covariate's effect on the DV are not provided by the mixed model results (Snijders & Bosker, 1999).

Outline of steps for describing model testing and presenting results. Results of the mixed model analyses are presented so that the common and unique steps taken to conduct each mixed model analysis procedure are transparent, understandable, and therefore, replicable. The analyses are discussed in three distinct subsections. First, the general steps of model testing that were conducted for each LMM are described. This section emphasizes the overarching principles (e.g., comprehensiveness, parsimony) guiding this approach to LMM analysis. Second, the specific steps taken for each particular LMM are described in detail. This section focuses on being accurate and

transparent. Third, relevant results from each specific LMM are outlined and further described in tables and figures. This section emphasizes the importance of congruence between the study's general research questions, specific hypotheses, and the presentation of results that clearly demonstrate the study's outcomes.

General model testing steps. To test the previously stated hypotheses and examine the dependent variables, each LMM required multiple iterations to achieve an optimal model. Specific modifications were made after analyzing the results of each tested model. Hox (2002) outlined a stepwise progression of model testing that partially served as a guide for obtaining the most comprehensive and parsimonious predictor model. Hox's guidelines were not strictly followed because of preexisting theoretical guidance from the health behavior change literature which has established models fit for testing (Ajzen, 1985; Ajzen & Manstead, 2007; Bandura, 1977; Prochaska & DiClimente, 1983).

The first step of testing each model was to include relevant variables and specify each variable's place in the model. Each model tested a single dependent variable of students behavioral intentions in the next month (reduce fat consumption, conduct a self-examination, or to exercise for 30 minutes five days a week). Each initial model contained a single random factor of school. Modeling school as a random effect determined that student outcomes would be able to be interpreted apart from the effects of school. An accurate reflection of individual-level change, apart from any interfering school variance, would thus be evident in the results.

Each model included three fixed factors, gender, ethnicity and the interaction term, gender by ethnicity. These variables are fixed factors because student responses,

generally, reflect all possible categories. As fixed effects, the results will show the relationship between each term and the dependent variable as measured within the context of each school.

An additional six variables, each nested within school, were included as covariates and modeled as fixed factors. These variables were entered as covariates because they possess interval or continuous data, not categorical. By nesting each variable within school, the results show the general effect a covariate had on the dependent variable within schools, but results demonstrate the specific effect each covariate had in each school. All models contained three shared covariates and three that were unique to each model. The covariates shared by each model were cancer worry, cancer knowledge, and student engagement. The covariates unique to each model belonged to three general categories (self-efficacy, behavioral beliefs, and subjective norms) but were aligned with the specific health behavior being tested in each model. For instance, in the LMM testing students intentions to reduce fat consumption, the unique covariates were self-efficacy for reducing fat consumption, behavioral beliefs about reducing fat consumption, and subjective norms for reducing fat consumption. The covariate predictor variables were modeled as fixed effects because they are base level measurements (i.e., student), not upper level measurements (i.e., school). Each of the first LMM tested included the same number of variables, the same modeling of variables, and therefore an overall structure that was identical, save for the unique dependent variables and aligned covariates.

Additional model specifications, including sums of squares type, covariance structure and estimation method were shared by each LMM and purposefully chosen to obtain interpretable and parsimonious results. Tests of fixed effects were set to generate Type III sums of squares, the default method in SPSS. This is a common method that is especially useful with unbalanced models with no missing cells (Snijders & Bosker, 1999). The covariance structure type, that is, the shape of the covariance matrix specified for random effects, was set to variance components (Snijders & Bosker, 1999), which is also the default option in SPSS. This method assumes no within-subject correlation of error terms and assigns a unique structure to each random effect (i.e., each school) so that it is not simply treated as a fixed effect. In order to produce goodness-of-fit statistics that were useful for evaluating both random and fixed effects, the parameter estimation method was set to Maximum Likelihood (ML) rather than Restricted Maximum Likelihood (REML; Snijders & Bosker, 1999). These specifications were maintained throughout all initial as well as subsequent LMM tests. An additional specification was not applied in all models. Where pairwise comparisons of gender, ethnicity or both were conducted, a Bonferroni correction was specified as the statistical adjustment for multiple comparisons. This correction systematically decreased the likelihood of Type I error by statistically making analyses more conservative (i.e., increasing the requirements for significance) for each comparison added to the model.

The initial LMM tests produced results for descriptive data, model fit, estimates of fixed effects, and covariance parameters (i.e., random effects). Variables were examined for their contribution to the model. It is not uncommon for researchers using

mixed model analysis to drop model terms based solely on non-significance (Snijders & Bosker, 1999). However, previous research supports many of the predictors of adolescent health behavior change being investigated in the current study (Ajzen & Manstead, 2007; Bandura, 1977; Prochaska & DiClimente, 1983). Therefore, a single criterion (e.g., theoretical reason, *p* value) was considered insufficient evidence for removing a model term with previous research support.

In each LMM the non-significant variables ($p > .05$) were further analyzed using a model chi-square difference test. This test computed the probability of *d*, model chi-square difference, which is an estimate of the probability that two models differ significantly (Snijders & Bosker, 1999). That is, the test was conducted to determine whether the parameters estimates of non-significant model terms could be assumed to be different from zero (0). Additionally, when a single term is the difference between the models being tested, the resulting probability estimate reflects the significance of that variable's contribution to the model. Clearly, the model chi-square difference test provides valuable data for deciding whether to drop a term from the model. Moreover, the model chi-square test increased the comprehensiveness and precision of the overall decision-making process of each LMM.

To perform the model chi-square difference test for non-significant factors, ML estimation was specified so to obtain the model comparison statistic (-2 Log Likelihood) useful with both random and fixed factors (Snijders & Bosker, 1999). Next, the model was tested again but without the non-significant term. This was done to obtain the -2 Log Likelihood of the model without the non-significant term. Using the -2 Log Likelihood

estimates from two separate models, a coefficient difference was calculated. The -2 Log Likelihood coefficient difference and degrees of freedom (i.e., the number of terms removed from the model) were then inserted into the model chi-square difference test, which was located as a numeric function (i.e., Sig.Chisq) in the "compute variable" option in SPSS 15.0. Results of the model chi-square test generated a probability estimate that the models being compared were significantly different from each other. When a single term was the only difference between models, test results indicated the probability that the specific variable makes a significant contribution to the model.

Results from the model chi-square difference tests guided decisions to drop a term from the model. In general, terms reflecting a significant difference between models were retained and terms reflecting a non-significant difference between models were dropped. If no terms were dropped from the model it was unnecessary to re-run the same LMM, thus, the final model has been reached. When model terms were removed, the LMM was re-run without the dropped terms. A new LMM was tested for each dependent variable. For each LMM, results were interpreted and decisions were made based on the exact steps described for each initial LMM. For instance, new LMM were examined for non-significant terms, model chi-square difference tests were used when appropriate, and decisions were made to retain or drop model terms. Every step in the process of retesting and evaluating each new LMM was repeated until all variables were retained and a final model was reached. The steps in the process of achieving a final model are visually represented in Figure 4.
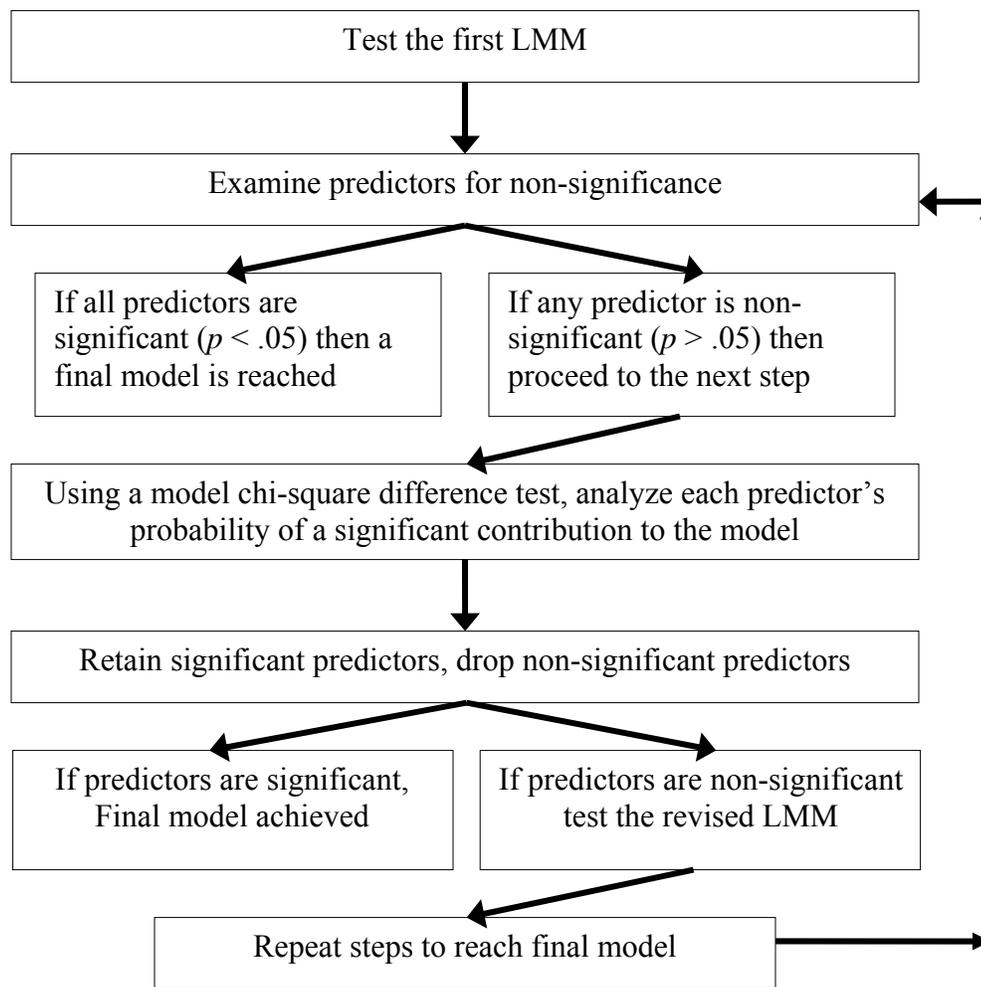
```
┌─────────────────────────────────────────────────┐
│              Test the first LMM                 │
└─────────────────────────────────────────────────┘
                        │
                        ▼
┌─────────────────────────────────────────────────┐
│      Examine predictors for non-significance    │◄──┐
└─────────────────────────────────────────────────┘   │
            ╱                       ╲                   │
           ▼                         ▼                  │
┌──────────────────────┐  ┌──────────────────────┐    │
│ If all predictors are│  │ If any predictor is  │    │
│ significant (p < .05)│  │ non-significant      │    │
│ then a final model   │  │ (p > .05) then       │    │
│ is reached           │  │ proceed to next step │    │
└──────────────────────┘  └──────────────────────┘    │
                                 │                      │
                                 ▼                      │
┌─────────────────────────────────────────────────┐   │
│ Using a model chi-square difference test,       │   │
│ analyze each predictor's probability of a       │   │
│ significant contribution to the model           │   │
└─────────────────────────────────────────────────┘   │
                        │                               │
                        ▼                               │
┌─────────────────────────────────────────────────┐   │
│ Retain significant predictors, drop             │   │
│ non-significant predictors                      │   │
└─────────────────────────────────────────────────┘   │
            ╱                       ╲                   │
           ▼                         ▼                  │
┌──────────────────────┐  ┌──────────────────────┐    │
│ If predictors are    │  │ If predictors are    │    │
│ significant, Final   │  │ non-significant test │    │
│ model achieved       │  │ the revised LMM      │    │
└──────────────────────┘  └──────────────────────┘    │
                                 ╲                      │
                                  ▼                     │
┌─────────────────────────────────────────────────┐   │
│       Repeat steps to reach final model         │───┘
└─────────────────────────────────────────────────┘
```

Figure 4. A General Stepwise Progression of the Actions Taken to Achieve Optimal Mixed Model Solutions

Model testing for intentions to reduce fat consumption. The first model testing student intentions to reduce fat consumption included a total of 11 model terms: the dependent variable (i.e., intentions to reduce fat consumption), one random factor (school), three fixed factors (gender, ethnicity, and gender by ethnicity), and six nested covariates (i.e., in school) modeled as fixed factors. Three of the covariates were general

assessments shared between models (cancer worry, cancer knowledge, and student engagement) and three of the covariates were specific measurements of categorical predictors (self-efficacy, behavioral beliefs, and subjective norms) related to intentions to reduce fact consumption. Multiple terms had a non-significant effect on students intentions to reduce fat consumption ($p > .05$), including the fixed effects of gender ($p = .146$), ethnicity ($p = .518$) and gender by ethnicity ($p = .591$), as well as the random effect of school ($p = .326$). The model contributions of the fixed factors were addressed first.

Model chi-square difference tests were performed for each non-significant fixed factor. Three additional versions of the model, each with one non-significant factor removed, were tested to examine the contribution of each factor. The gender by ethnicity interaction term demonstrated a non-significant contribution to the model ($p > .05$) but independently, gender and ethnicity each showed a significant contribution to the overall model, $p < .05$. Additionally, previous research was considered before making a decision to retain or drop the variables from the model. It is relevant to note that research on adolescent health behavior change has failed to demonstrate a consistent relationship between either gender or ethnicity and the intentions of youth to reduce fat consumption (USDHHS, 2006a). Due to the non-significant findings in the current study and the lack of consistent research findings, gender, ethnicity and gender by ethnicity were all dropped from the model.

A model chi-square difference test was also used to further examine the contribution of the random factor, school. A model without the factor school was tested in order to compute the model difference coefficient. The test revealed a significant

estimate of the probability that the models were significantly different, *p* < .05. Despite

needing to further examine the relative contribution of school, it continues to be a key

component of the model, particularly for the additional results it produces as a result of

its function as an upper level factor. Due to its structural, as well as statistical, importance

to the model, school was retained as a random factor.

Following the removal of the fixed factors gender, ethnicity, and gender by

ethnicity, a second model was tested. Results were examined for non-significant model

terms. The fixed factor model terms were each significant at the .05 level while the

random factor school continued to be non-significant (*p* = .354). School was retained

without performing another model chi-square difference test, which would have been

unnecessarily redundant. The final predictor model for intentions to reduce fat

consumption was therefore achieved with the second test of the model. This solution was

altered from the initial model due to the removal of three fixed factors: gender, ethnicity,

and gender by ethnicity.

Model testing for intentions to conduct self-examinations. As each model started,

the first model predicting students intentions to conduct self-examinations included a

total of 11 model terms: the dependent variable (i.e., intentions to conduct self-

examinations), one random factor (school), three fixed factors (gender, ethnicity, and

gender by ethnicity), and six nested covariates (i.e., in school) modeled as fixed factors.

Three covariates were common to each initial model (cancer worry, cancer knowledge,

and student engagement) and three were specifically related to conducting self-

examinations (self-efficacy, behavioral beliefs, and subjective norms). Non-significant

model terms were identified for the gender by ethnicity interaction ($p = .852$) and for the

random factor, school ($p = .268$).

Model chi-square difference tests were performed for both non-significant terms.

Two additional versions of the model, each without one of the non-significant terms,

were performed in order to examine the probability of each factor significantly

contributing to the overall model. The gender by ethnicity interaction term did not

demonstrate a significant model contribution ($p > .05$), but the model contribution of

school was statistically significant ($p < .05$). The interaction term was removed from the

model due its non-significant contribution to the model and because it lacked theoretical

support for its effect on intentions to conduct self-examinations (USPSTF, 2007). In

contrast, the random factor school was retained in the model. This decision was based on

the same reasons for retaining it in the previous model (i.e., a significant chi-square

difference test and school is especially important to the model).

A second model was tested without the gender by ethnicity interaction term.

Results showed that each fixed factor model term was significant, $p < .05$. The only non-

significant model term identified was the random factor school ($p = .266$), which was

retained without further testing. Thus, the second test of the model yielded a final

solution, which differed from the initial model as a result of dropping the gender by

ethnicity interaction term.

Model testing for intentions to exercise. The initial model predicting students

intentions to exercise 30-minutes five days-a-week, included 11 terms: the dependent

variable (i.e., intentions to exercise), one random factor (school), three fixed factors

(gender, ethnicity, and gender by ethnicity), and six nested covariates (i.e., in school) modeled as fixed factors. There were three common covariates (cancer worry, cancer knowledge, and student engagement) and three covariates specific to exercise (self-efficacy, behavioral beliefs, and subjective norms). Initial model testing found a total of seven terms to be non-significant ($p > .05$): the fixed factors of gender ($p = .053$), ethnicity ($p = .392$), and gender by ethnicity interaction ($p = .810$); the general covariates of cancer worry ($p = .097$) and cancer knowledge ($p = .465$); the specific behavioral belief covariate ($p = .073$); and, the random factor, school ($p = .416$). The model contributions of the fixed factors were addressed first, followed by the covariates, and lastly, the random factor school.

The non-significant fixed effects of gender, ethnicity, and gender by ethnicity were further examined as a group. A single version of the model was tested that excluded these three terms. Testing the cumulative model contribution of multiple variables required that the degrees of freedom entered in the model chi-square difference test be equal to the number of terms removed the initial model. Degrees of freedom was therefore set to 3 in order to test the three non-significant terms that were removed. Results indicated that as a whole, the three factors contributed significantly to the model. Thus, each term was tested separately for its contribution to the model. To test each non-significant fixed factor, three separate models, each with a different factor removed, were tested. Results of the model chi-square difference tests revealed significant ($p < .05$) contributions to the model for gender as well as ethnicity, but not for the interaction between them. The individual terms were retained in order to test a hypothesis predicting

the specific effects of gender and ethnicity in the intentions to exercise model. However, the effect of the interaction term gender by ethnicity was not specifically hypothesized and was therefore dropped from the model.

The model contributions of the non-significant covariates were also first examined as a group. A model chi-square difference test was performed comparing the initial model and a version of it without three covariates: cancer worry, cancer knowledge, and exercise-specific behavioral beliefs. The models were shown to be significantly different ($p < .05$), thus, each covariate was tested individually against new models, each without the respective term being examined. Results indicated that each covariate contributed significantly ($p < .01$) to the model. Based on these significant results as well as theoretical support for each variable (Ajzen & Manstead, 2007), all three covariates were retained.

The model contribution of the non-significant random factor, school, was also tested against a version of the initial model with school removed. The model chi-square test revealed a non-significant difference ($p = .110$) between models, typically indicating that the term should be removed from the model. However, SPSS output from the model without the random factor school included a warning stating that a satisfactory model solution was not reached, and therefore, "The validity of subsequent results cannot be ascertained." This warning was not issued for any of the initial models, or versions thereof. Due to the warning, the non-significant result of the model chi-square difference test for the random factor of school was suspect, and thus, difficult to interpret. However, as noted in previous models, the school is an integral component of the model because it

generates additional data relevant to hypothesis testing while also creating hierarchical

data for more nuanced interpretations. Based on these reasons and the equivocal results of

the model chi-square difference test, the random factor of school was retained.

After removing the gender by ethnicity interaction term, the revised model for

intentions to exercise was tested and results indicated that a final model solution was

reached. The results specifically showed that of the six previously non-significant model

terms retained in the new model, five remained non-significant: Ethnicity ($p = .398$),

exercise-specific behavioral beliefs ($p = .077$), cancer worry ($p = .096$), cancer

knowledge ($p = .477$), and school ($p = .420$). Non-significant terms were not retested for

model contribution. Gender was the only variable to cross the threshold of significance (p

$< .05$) from initial to revised models. Statistically significant terms from the initial model

remained significant in the revised model, $p < .05$.

Outcomes of the final model solution for intentions to reduce fat consumption.

The final predictor model of students intentions to reduce fat consumption was comprised

of one random factor (i.e., school) and six nested covariates, each modeled as fixed

effects. It is worth reiterating that the variables of gender and ethnicity were dropped

from the initial model solution and therefore were not included in the final model

predicting students intentions to reduce fat consumption.

General statistical outcomes show that student intentions to reduce fat

consumption do not differ by schools. As measured by the parameter estimate of the

intercept (Est. = .007), differences between schools demonstrated a non-significant effect

on the dependent variable ($p < .05$). Yet differences between individuals demonstrated a

significant effect on the dependent variable ($p < .001$), as measured by the parameter

estimate of the residual (Est. = .736). Discrepant results between the intercept and

residual indicate that the variance in the dependent variable is predominantly due to

student-level differences, which are measured by the covariates as opposed to the random

factor, school.

A general estimate of the model's fixed factors show that students intentions to

reduce fat consumption are significantly influenced by the fixed effects in the model, $F(1,$

$3.1) = 3997.1, p < .001$. Results of individual fixed effects show that five of the six

covariates positively influence student intentions to reduce fat consumption at the .01 or

.001 levels of significance. Despite cancer knowledge being significant ($p < .05$),

statistically, it is a relative outlier. The most robust fixed effect predicting student

intentions to reduce fat consumption is self-efficacy to reduce fat consumption, $F(3, 965)$

$= 74.2, p < .001$. The next most significant predictor is cancer worry, $F(3, 965) = 10.0, p$

$< .001$. Yet the cancer worry F statistic is more than 65 points less than that of self-

efficacy.

Additional fixed effects outcomes (e.g., parameter estimates and t tests) further

demonstrate many significant findings. The significant parameter estimate of the fixed

effects intercept (Est. = 3.48; $t = 63.22, p < .001$) indicates that the mean of the dependent

variable for all cases (i.e., intercept parameter estimate) is significantly different from

zero (0). However, this interpretation is only applicable to the intercept and is not an

accurate interpretation of individual fixed factor parameter estimates. Rather, fixed factor

parameter estimates are correctly interpreted as the amount of change in the dependent variable for every one-unit change in the fixed factor.

Results of the model fixed effects were generated for six covariates, each nested within schools. As noted earlier, when modeling the fixed effect of a nested covariate, results of the covariate's influence on the dependent variable are generated specifically for each category of the nesting variable. For nested terms, estimates of fixed effects were calculated only for categories of the nesting variable and not for a general or average estimation of the covariate.

Each model predictor has a statistically significant effect on the dependent variable, but there are substantial differences between variables. Self-efficacy to reduce fat consumption demonstrated the strongest effect with the greatest parameter estimates, ranging from 0.397 to 0.557, and the greatest t scores, ranging from 5.64 to 10.89. The effect of self-efficacy is also consistently significant across schools, $p < .001$. No other predictor matches this consistency. In general, self-efficacy outcomes overshadow the results of the other predictors; however, statistical comparisons provide a broader understanding of the relative contributions of all predictor variables. Table 14 displays results of the mixed model examining student intentions to reduce fat consumption.

Table 14

F Tests, Raw (Unstandardized) Coefficients, Standard Error (SE), and t Tests for the Multivariable Mixed Model Predicting Students Intentions to Reduce Fat Consumption

Fixed effects	*F* (Sig.)	Estimate	*SE*	*df*	*t*	*p*
Intercept		3.478	0.055	3.12	63.22	<.001
Self-efficacy to reduce fat consumption	74.21 (<.001)					
School A		0.484	0.057	965.3	8.50	<.001
School B		0.397	0.070	965.1	5.64	<.001
School C		0.557	0.051	965.7	10.89	<.001
Behavioral beliefs about reducing fat consumption	5.34 (.001)					
School A		0.087	0.066	965.7	1.33	.184
School B		0.284	0.076	966.0	3.76	<.001
School C		0.015	0.052	965.5	0.29	.775
Subjective norms for reducing fat consumption	3.94 (.008)					
School A		0.090	0.032	965.5	2.86	.004
School B		0.031	0.034	965.2	0.91	.364
School C		0.046	0.027	965.4	1.68	.093
Cancer worry	10.02 (<.001)					
School A		0.078	0.046	965.2	1.69	.091
School B		0.218	0.051	965.3	4.28	<.001
School C		0.117	0.039	965.1	2.99	.003
Cancer knowledge	3.13 (.025)					
School A		-0.032	0.037	965.2	-0.859	.390
School B		-0.050	0.038	965.2	-1.32	.188
School C		0.079	0.030	965.2	2.63	.009
Student Engagement	4.67 (.003)					
School A		0.021	0.010	965.3	2.19	.029
School B		0.028	0.009	965.5	3.04	.002
School C		0.001	0.008	965.3	0.09	.932

Table 14 continues

Random effects

Residual	0.736	0.034	<.001
Intercept (school variance)	0.007	0.007	.354

Relative to self-efficacy, for instance, no other predictor variable was statistically significant in each school. Cancer worry and student engagement are both significant in two schools, while the remaining variables are significant in only one. Cancer worry demonstrates the next largest t score (4.28), yet it is over a full point less than the lowest self-efficacy t score and more than 6.5 points less than the largest self-efficacy t score. The next largest parameter estimates compared to self-efficacy are for the behavioral belief about consuming fat (Est. = 0.284) and two estimates of cancer worry (Est. = 0.218 and 0.117). Moreover, the remaining parameter estimates are all lower than 0.100. The parameter estimates of predictors, within schools, are also presented visually in Figure 5.
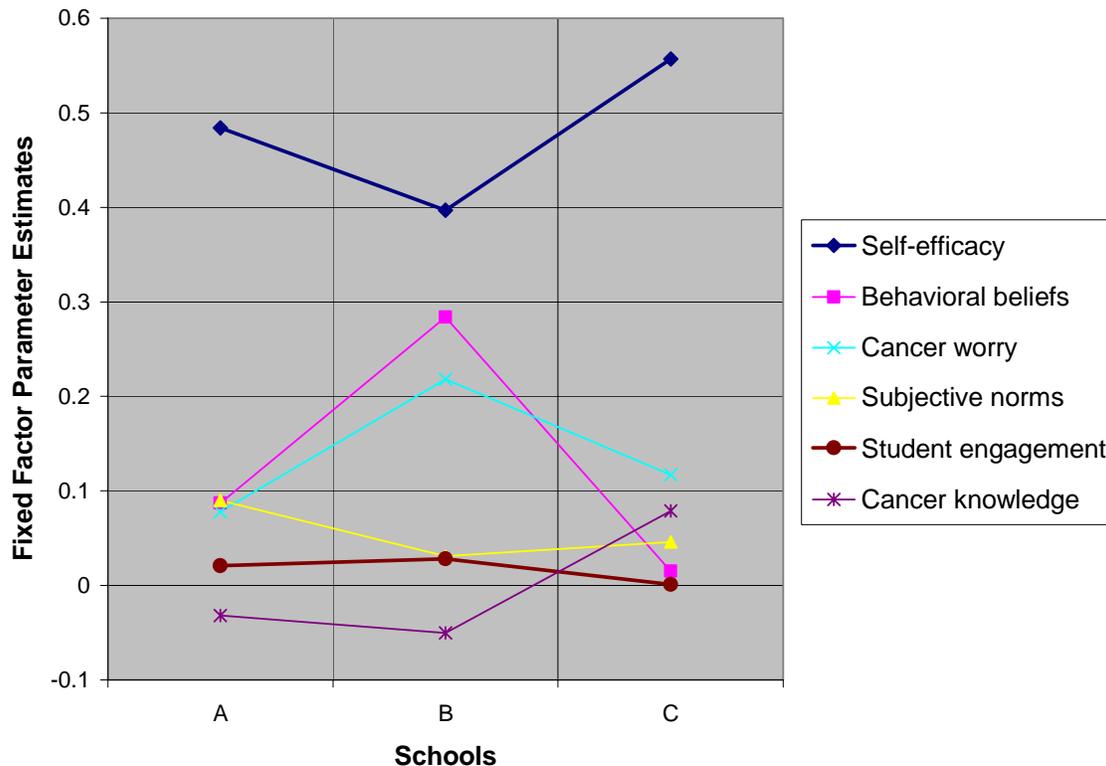
Figure 5. Fixed Effects Parameter Estimates of Students Intentions to Reduce Fat Consumption

Due to the similar findings of most covariate predictors, a correlation matrix was computed to examine the relationships between variables. Table 15 shows the correlations between the covariates that were included in the final model predicting student intentions to reduce fat consumption. Results show that all correlations are statistically significant, $p < .01$. The strongest relationship is evidenced between self-efficacy to reduce fat consumption and subjective norm to reduce fat consumption (.41). Student engagement is most correlated with self-efficacy to reduce fat consumption (.28) and is least correlated with cancer knowledge (.15).

Table 15

Correlation Matrix of the Covariates in the Final Predictor Model for Student Intentions to Reduce Fat Consumption

_____

	Variable					
Variable	1	2	3	4	5	6
1. Self-efficacy: reduce fat consumption	–					
2. Behavioral belief: reduce fat consumption	.36	–				
3. Subjective norm: reduce fat consumption	.41	.25	–			
4. Cancer worry	.21	.17	.11	–		
5. Cancer knowledge	.25	.35	.17	.14	–	
6. Student engagement	.28	.21	.23	.22	.15	–

Note: All Pearson's *r* correlation coefficients are statistically significant at the .01 level.

Outcome data of the cumulative variance explained by the model as well as the variance attributable to individual predictors was computed. The cumulative variance accounted for by the entire final model solution for student intentions to reduce fat consumption, including all fixed and random effects, totals 40.3%. The vast majority of variance is attributable to the fixed effects, 39.4%, or, relative to the total explained variance, fixed effects are responsible for 97.8%. The variance attributable to individual predictors was computed specifically for self-efficacy and student engagement. As a percentage of the model's total explained variance, self-efficacy and student engagement

account for 38.5% and 8.0%, respectively. The model variance estimates noted here are

presented in Table 16, which also contains variance data for the other two models

examined in the current study.

Table 16

Measures of Percent of Variance for Three Linear Mixed Models

Linear mixed model for intentions to:	Cumulative fixed factor variance (%)	Random factor variance (%)	Student engagement variance (%)	Self-efficacy variance (%)
Reduce fat consumption	39.4	0.90	3.22	15.50
Conduct self-examinations	52.7	3.63	1.89	28.59
Exercise	43.3	0.56	0.69	30.12

Note: Attributable variance is also noted to be an unstandardized measure of effect size, according to Snijders and Bosker's (1999) recommendation for mixed models. Effect size was calculated by comparing the explained variances between the final model and a model without the specified factor.

Outcomes of the final model solution for intentions to conduct self-examinations.

The mixed model predicting student intentions to conduct self-examinations was

comprised of one random factor for school, two fixed factors of gender and ethnicity, and

six nested covariates, each modeled as fixed effects. Results of the estimates of

covariance parameters provided general effects of individual- and group-level differences

on the dependent variable. The random effect of school, as measured by the covariance

intercept, demonstrates a non-significant effect on student intentions to conduct self-examinations, $p > .05$. Conversely, the parameter estimate of the residual term for indicates that differences in student intentions to conduct self-examinations are significantly influenced by individual-level differences ($p < .001$), which are measured by fixed factors and covariates.

The effect of individual differences on student intentions to conduct self-examinations is corroborated by significance of the collective influence of the fixed effects, $F(1, 3.2) = 1753.86$, $p < .001$. All of the individual fixed effects are shown to significantly predict the student intentions to conduct self-examinations. Except for cancer knowledge and ethnicity, which are significant at the .05 level, all fixed effects are significant at $p < .01$. Overall, results of the current model's fixed effects appear to resemble findings of individual fixed effects in predictor model for student intentions to reduce fat consumption. For instance, self-efficacy is the strongest predictor among multiple significant fixed effects, which within themselves show diverse model contributions. These outcomes and further results of the mixed model test examining student intentions to conduct self-examinations are presented in Table 17.

Table 17

F Tests, Raw (Unstandardized) Coefficients, Standard Error (SE), and t Tests for the Multivariable Mixed Model Predicting Students Intentions to Conduct Self-Examinations

Fixed effects	*F* (Sig.)	Estimate	*SE*	*df*	*t*	*p*
Intercept		3.467	0.105	7.55	32.91	<.001
Gender	19.01 (<.001)					
Male		0.219	0.050	909.3	4.36	<.001
Female		Referent				
Ethnicity	3.13 (.044)					
Caucasian		-0.089	0.071	909.3	-1.25	.211
African American		0.062	0.084	910.4	0.737	.461
Other		Referent				
Self-efficacy to conduct self exams	127.62 (<.001)					
School A		0.557	0.054	908.9	10.27	<.001
School B		0.560	0.052	909.2	10.83	<.001
School C		0.532	0.041	908.9	12.88	<.001
Behavioral beliefs about conducting self exams	4.56 (.004)					
School A		0.081	0.048	909.0	1.67	.095
School B		0.003	0.047	909.0	0.06	.952
School C		0.114	0.034	909.1	3.31	.001
Subjective norms for conducting self exams	11.85 (<.001)					
School A		0.045	0.018	909.0	2.44	.015
School B		0.081	0.021	909.0	3.91	<.001
School C		0.054	0.014	909.1	3.78	<.001
Cancer worry	5.84 (.001)					
School A		0.078	0.041	909.1	1.93	.055
School B		0.166	0.045	909.4	3.70	<.001
School C		0.025	0.034	909.1	0.73	.467
Cancer knowledge	2.68 (.046)					

Table 17 continues

School A		0.001	0.031	909.0	0.02	.983
School B		-0.072	0.029	908.9	-2.53	.012
School C		-0.034	0.025	909.5	-1.33	.183
Student Engagement	4.66 (.003)					
School A		0.026	0.009	909.0	2.98	.003
School B		0.010	0.008	909.1	1.26	.209
School C		0.014	0.008	909.3	1.89	.060

Random effects

Residual	0.501	0.024		<.001
Intercept (school variance)	0.019	0.017		.266

Self-efficacy to conduct self-examinations is clearly the most significant predictor in the model, $F(3, 909) = 127.6$, $p < .001$. The fixed factor of gender is the next most significant predictor, $F(3, 909) = 19.0$, $p < .001$. Student engagement is the fifth most significant predictor, $F(3, 909) = 4.7$, $p < .01$. Parameter estimates measured within schools range from 0.532 to 0.560, a difference of more than 0.300 compared to the next largest fixed factor parameter estimates: gender (Est. = 0.219), cancer worry (Est. = 0.166) and behavioral beliefs (Est. = 0.114). Self-efficacy's effect on student intentions to conduct self-examinations demonstrates significant t scores across each level of the nesting variable, $p < .001$. Subjective norms are also significant on the dependent variable as measured within schools, but not at the .001 level in each school. Figure 6 visually displays the parameter estimates of fixed effects for the covariates nested within schools

that were included in the final model solution for student intentions to conduct self-
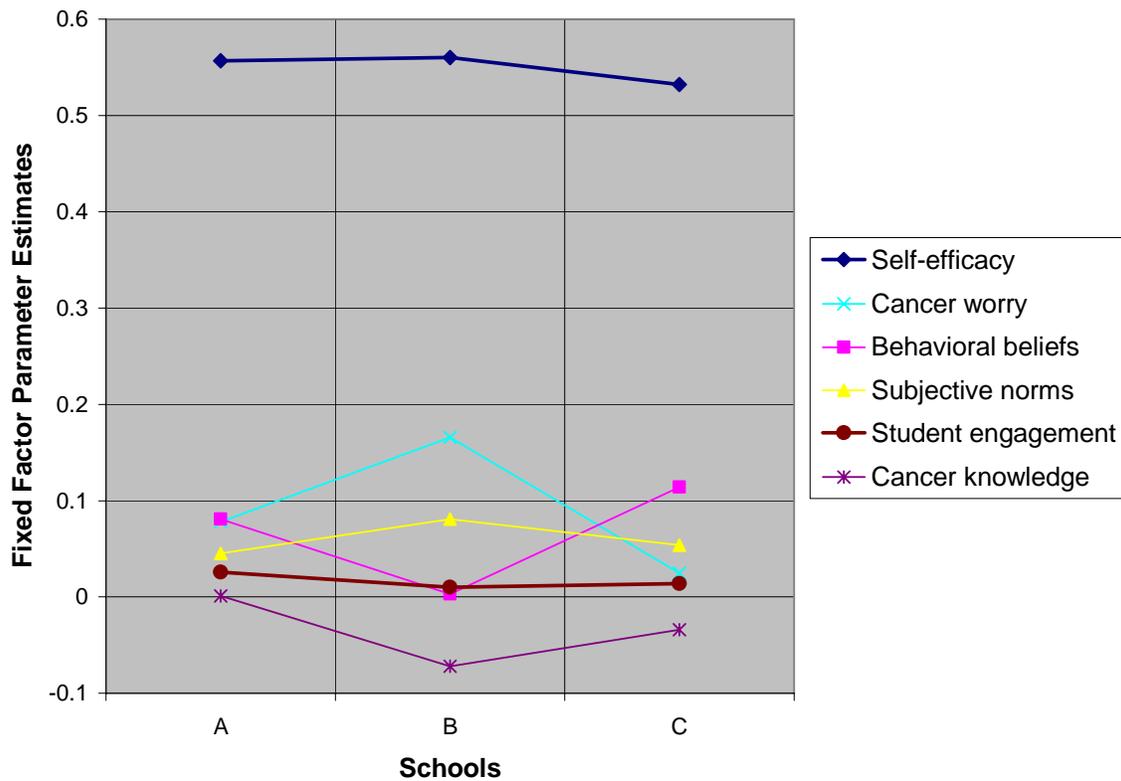
examinations.

Figure 6. Fixed Effects Parameter Estimates of Students Intentions to Conduct Self-
Examinations

It is noteworthy that one of the parameter estimates of cancer knowledge is shown

to be negative as well as statistically significant, $t(1, 909) = -2.53$, $p = .012$. However,

cancer worry is shown to be non-significant on the other two levels of the nested variable.

This pattern of inconsistent results is further supported because the non-significant

parameter estimates of cancer worry included one that was positive (Est. = 0.001) and

one that was negative (Est. = -0.034).

Due to the similar findings of most covariate predictors, a correlation matrix was computed to examine the relationships between variables. Table 18 shows the correlations between the covariates that were included in the final model predicting student intentions to conduct self-exams. Results show that all correlations are statistically significant, $p < .01$. The strongest relationship is evidenced between self-efficacy to conduct self-exams and subjective norm to conduct self-exams (.38). Student engagement is most correlated with self-efficacy to conduct self-exams (.32) and is least correlated with cancer knowledge (.15).

Table 18

Correlation Matrix of the Covariates in the Final Predictor Model for Student Intentions to Conduct Self-Exams

	Variable					
Variable	1	2	3	4	5	6
1. Self-efficacy: conduct self-exams	–					
2. Behavioral belief: conduct self-exams	.35	–				
3. Subjective norm: conduct self-exams	.38	.26	–			
4. Cancer worry	.13	.19	.16	–		
5. Cancer knowledge	.20	.16	.07	.14	–	
6. Student engagement	.32	.26	.31	.22	.15	–

Note: All Pearson's *r* correlation coefficients are statistically significant at the .01 level except for cancer knowledge and subjective norm (.07), which is significant at the .05 level.

The final model solution predicting student intentions to conduct self-examinations accounts for 56.3% of the cumulative variance. Fixed effects are responsible for 52.7% of cumulative variance, and 93.6% of the total model variance explained. The data presented in Table 14 show that the mixed model predicting student intentions to conduct self-examinations explained more model variance than either of the models predicting student intentions (i.e., to reduce fat consumption and to exercise). Regarding specific model terms, self-efficacy to conduct self-examinations is the most robust effect in the model, as evidenced by it accounting for 28.6% of the model's total cumulative variance, or approximately half (50.8%) of the explained model variance. By comparison, the cumulative variance attributable to student engagement (1.89%) is shown to represent 3.4% of the total variance explained by the model.

Outcomes of the final model solution for intentions to exercise. The final solution of the mixed model predicting student intentions to exercise 30 minutes five days a week included nine total variables: one random factor of school, two fixed factors of gender and ethnicity, and six nested covariates modeled as fixed effects. General results indicate that student intentions to exercise were not significantly influenced by group-level differences between schools ($p > .05$). Model terms measuring individual-level differences (i.e., the fixed effects), however, were shown to significantly affect the dependent variable, $p < .001$.

Findings of the overall influence of fixed effects on student intentions to exercise are statistically significant, $F(1, 4.6) = 7230.1$, $p < .001$. Results of specific fixed effects for student intentions to exercise show that four of the eight model terms are statistically

significant: Self-efficacy to exercise ($p < .001$), subjective norms for exercise ($p < .01$),

student engagement ($p = .010$), and gender ($p < .05$). These data are displayed in Table

19, which contains additional results for student intentions to exercise.

Table 19

F Tests, Raw (Unstandardized) Coefficients, Standard Error (SE), and t Tests for the
Multivariable Mixed Model Predicting Students Intentions to Exercise

Fixed effects	*F* (Sig.)	Estimate	*SE*	*df*	*t*	*p*
Intercept		3.899	0.080	42.11	48.68	<.001
Gender	3.97 (.047)					
Male		0.105	0.053	948.3	1.99	.047
Female		Referent				
Ethnicity	0.92 (.398)					
Caucasian		-0.054	0.075	947.8	-0.72	.471
African American		-0.118	0.008	949.0	-1.33	.182
Other		Referent				
Self-efficacy to exercise	134.73 (<.001)					
School A		0.588	0.053	946.5	11.09	<.001
School B		0.589	0.055	946.7	10.66	<.001
School C		0.594	0.046	946.4	13.02	<.001
Behavioral beliefs about exercising	2.29 (.077)					
School A		0.086	0.054	946.3	1.59	.113
School B		-0.043	0.059	946.4	-0.72	.471
School C		0.089	0.046	946.4	1.95	.051
Subjective norms for exercising	3.89 (.009)					
School A		0.073	0.028	946.3	2.64	.009
School B		0.049	0.031	946.4	1.55	.120
School C		0.035	0.023	946.4	1.52	.128

Table 19 continues

Cancer worry	2.12 (.096)					
School A		0.086	0.042	947.2	2.02	.043
School B		0.025	0.047	946.5	0.53	.594
School C		-0.049	0.036	946.3	-1.38	.167
Cancer knowledge	0.83 (.477)					
School A		0.013	0.035	946.4	0.36	.717
School B		0.048	0.033	946.2	1.45	.148
School C		0.015	0.028	947.2	0.54	.590
Student Engagement	3.83 (.010)					
School A		0.012	0.009	946.6	1.32	.187
School B		0.021	0.008	946.2	2.48	.013
School C		0.014	0.007	947.1	1.93	.054
Random effects						

Residual	0.588	0.027		<.001
Intercept (school variance)	0.003	0.004		.420

The non-significant effect of ethnicity contradicts the findings of prior research (USDHHS, 2006a). Pairwise comparisons of ethnic groups were therefore not examined. The categorical fixed factor of gender, however, does demonstrate a significant effect on student intentions to exercise ($p = .047$). The marginally significant effect for gender is further demonstrated by its parameter estimate, which shows that the intentions to exercise scores of male students are only 0.105 greater than female students. These data are displayed in Table 20, which presents findings from each model for the fixed effects of gender and ethnicity.

Table 20

Pairwise Comparisons of Gender and Ethnicity for Three Linear Mixed Models of Student Intentions

Fixed effect variable	Reduce fat consumption[a]			Conduct self-examinations			Exercise 30-minutes 5 days a week		
	M	M-diff.	*SE*	*M*	M-diff.	*SE*	*M*	M-diff.	*SE*
Gender									
Male	–			3.69			3.97		
Female	–			3.47			3.87		
Male – Female		–	–		.219**	.050		.105*	.053
Ethnicity									
White	–			3.50			3.92		
Black	–			3.65			3.86		
Other	–			3.59			3.97		
White – Other		–	–		-.089	.071		-.054	.075
Black – Other		–	–		.062	.084		-.118	.088

[a] The fixed effects variables of gender and ethnicity were removed from the final model due to non-significant results.
M = mean; M-diff. = mean difference; SE = standard error.
* $p < .05$.
** $p < .001$.

Self-efficacy is shown to be the strongest predictor of student intentions to exercise for all fixed effect outcome statistics. The *F* statistic for self-efficacy (134.7) is much greater than the estimates of gender (3.97), subjective norms for exercise (3.89), and student engagement (3.83). Across the outcomes for each school, self-efficacy demonstrates the most robust parameter estimates (i.e., ranging from 0.588 to 0.594), the greatest *t* scores (i.e., ranging from 10.7 to 13.0), and the strongest significance levels, *p*

< .001. By comparison, gender shows the next largest parameter estimate (Est. = 0.105), normative beliefs for exercise shows the next highest *t* score (2.64), and each of the significant nested covariates (i.e., normative beliefs for exercise and student engagement) are significant in only one school. Differences in the parameter estimates between self-efficacy and other nested covariate predictors are displayed in Figure 7, which visually portrays the results.
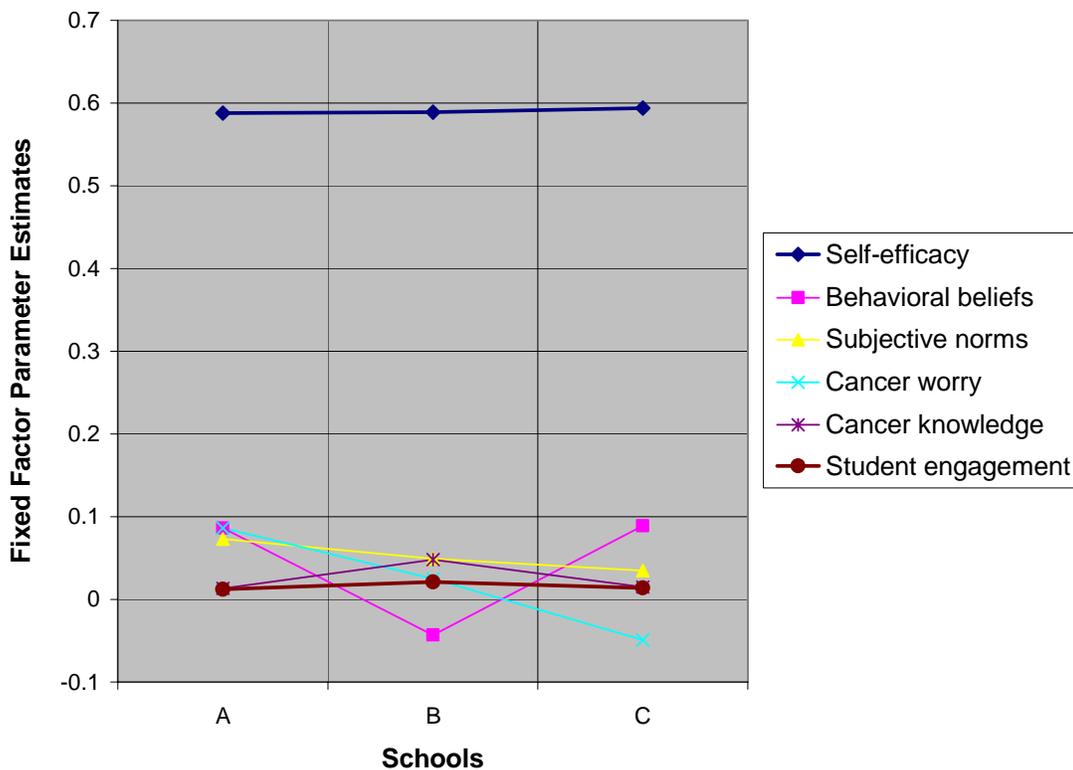

Figure 7. Fixed Effects Parameter Estimates of Students Intentions to Exercise

Due to the similar findings of most covariate predictors, a correlation matrix was computed to examine the relationships between variables. Table 21 shows the

correlations between the covariates that were included in the final model predicting

student intentions to exercise. Results show that all correlations are statistically

significant, $p < .01$. The strongest relationship is evidenced between self-efficacy to

exercise and subjective norm to exercise (.35). Student engagement is most correlated

with cancer worry (.22) and is least correlated with cancer knowledge (.15).

Table 21

Correlation Matrix of the Covariates in the Final Predictor Model for Student Intentions to Exercise

	Variable					
Variable	1	2	3	4	5	6
1. Self-efficacy: exercise	–					
2. Behavioral belief: exercise	.32	–				
3. Subjective norm: exercise	.35	.26	–			
4. Cancer worry	.18	.19	.09	–		
5. Cancer knowledge	.22	.38	.17	.14	–	
6. Student engagement	.21	.21	.20	.22	.15	–

Note: All Pearson's *r* correlation coefficients are statistically significant at the .01 level.

Outcome data for the mixed model testing student intentions to exercise was

calculated for multiple estimates of variance. The cumulative variance explained by the

final model solution is 43.9%. Model fixed effects contribute approximately 99% of the

total explained variance. The variance attributable to individual fixed effects shows that the majority of the total explained variance (68.6%) is due to a single variable – self-efficacy to exercise. In contrast, student engagement is also a significant predictor of student intentions to exercise, yet its effect is only explains 1.6% of the model.

Summary

Data presented throughout the results section were pertinent to the current study's general research questions and specific hypotheses. Assumptions about the data for EFA and LMM were outlined first, followed by results of missing data analyses and a description of the sample characteristics. These preliminary data management steps were included at the beginning to provide a statistical context in which to couch subsequent results.

Results of the EFA were presented in a linear fashion, beginning with a description of how items were selected. A total of three EFA tests were conducted to achieve a final solution. The process of reaching a final solution was tedious and complicated, requiring many thoughtful decisions. In an effort to make the process transparent, the rationale for each decision was methodically described. In order to support each step of the EFA, a variety of statistics were presented throughout the process as evidence for each decision. The final solution yielded one factor and included six of the seven items initially entered in the EFA.

Results of the LMMs were preceded by a brief reiteration of the test's assumptions about the data and the reasons for choosing to use the LMM procedure. The preliminary data management step of centering was described and justified. An outline of

the general steps performed for each of the three LMMs was presented first. Next, the

specific steps taken to reach the best model solution for each LMM were described and

when appropriate, accompanying data were provided to support each decision. Lastly,

based on the unique final solution obtained for each respective model, outcome data

relevant to the study's aims and hypotheses were presented.

Chapter 5

Discussion

Results from the statistical analyses demonstrate mixed support for the study's research hypotheses. The one-factor solution identified from the exploratory factor analysis (EFA) did not support the hypothesis predicting that the structure of student engagement would consist of three different types. Results of the mixed model analyses support the hypotheses that student engagement would have a significant effect on student intentions to reduce fat consumption, conduct a self-examination, and exercise. Results also supported the hypothesis predicting that the predictor model for student intentions to conduct self-examinations would account for more variance than the other respective models. Yet, findings did not support hypothesized differences between predictor models for the effects of gender and ethnicity.

Exploratory Factor Analysis: Six Items, One Factor

Results of the EFA for student engagement were relatively straightforward and interpretable. The six program evaluation items from the BRIDGE survey were consistently shown to hang together according multiple statistical outcomes (e.g., inter-item correlations, factor loadings, eigenvalues). The reliable findings, however, did not support the hypothesis that student engagement is multi-factorial, including behavioral, cognitive, and emotional types (Fredricks et al., 2004). After briefly discussing the removal of intentions to set a goal from the EFA final solution, plausible reasons explaining the outcome are described and implications of the results are discussed.

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Intentions to set a goal removed. The one-factor final solution did not include one of the initial EFA items – student intentions to set a goal. It was removed prior to the final EFA due to a pattern of results demonstrating its poor fit relative to the other items. These results validate both the initial hesitance to include the item in the analysis as well as the discussions with senior researchers concerning whether the item actually measured student engagement. The item was included because it was perceived to be a cognitive and/or behavioral task that was part of BRIDGE, thus measuring an aspect of being engaged in the program. It appears that the question wording of *intention* may indicate that behavior or cognition to set a goal did not necessarily occur during the BRIDGE program. Yet, it is also possible that intention to set a goal does not measure student engagement. In retrospect, it seems that intention to set a goal was included with the hope that it would serve as a proxy for students' actual cognition and behavior during the BRIDGE program. Although there was ultimately a precedent for testing it, the data clearly showed that it does not belong in the final factor solution for student engagement.

Only one factor? The recent comprehensive review of literature on student engagement concluded that it is multifaceted construct, comprised of behavior, cognition, and emotion (Fredricks et al., 2004). Seven items were selected from the BRIDGE survey that appeared to reflect previous measurements of the different student engagement types. Emotional items measured "fun", "liking", and "talking openly" with family members; cognitive items measured how "important" the topics were, how much was "learned," and whether to "recommend" the program to others; lastly, the item ultimately dropped (i.e., intentions to set a goal) was the only identified behavioral measure. Findings from

the EFA did not support the differentiation of items into the predicted categories of student engagement type.

A significant limitation of the EFA may likely explain the one-factor outcome. It appears that an insufficient number of items were included to produce the multi-factorial solution predicted by the hypothesis. Recommended research practices for conducting EFAs continually note the importance of including numerous appropriate variables (i.e., garbage in, garbage out), which recommends at least three to five items per expected construct (Kahn, 2006). Moreover, when examining constructs that are expected to be more complex or multifaceted (i.e., student engagement), researchers especially emphasize including a sufficient number of items so to reflect the entire construct (Kahn, 2006; Russell, 2002; Thompson, 2004). Despite the lack of items restricting the identification of separate factors, statistics of individual items were expected to show patterns predicted by the hypothesis. However, there was very little statistical differentiation between the final six items. This unexpected result opens the discussion to explanations that can account for the one factor solution.

Fredricks and colleagues (2004) acknowledged in their summary of student engagement that, "The engagement literature is marked by duplication of concepts and lack of differentiation in definitions across various types of engagement" (p. 65). For example, they note that *effort* is a variable that overlaps the cognitive and behavioral categories, but is typically not measured precisely enough to capture this distinction (e.g., not differentiating the mental effort of working on math problems from the physical effort of getting to school on time). Items in the current study may not have precisely

measured discrete student engagement categories, despite efforts to identify previous measurements resembling each item included in the EFA. For example, student perceptions of how much "fun" the program was and how much they "liked" it appeared represent assessments of emotional engagement, yet they could be too ambiguous. Students may have interpreted these items differently; that is, for some students "fun" was possibly based on the program's interpersonal emphasis, but for others "fun" was based on the cognitive challenge of completing the homework activities. Imprecise items create measurement error, which may have caused overlap with the other student engagement categories. Although Fredricks and colleagues (2004) note that being multifaceted is an important quality of the construct, as this example shows, it can also be a drawback that leads to student engagement serving as a *catch all* variable that becomes poorly defined and measured.

The one-factor solution may also be the result of examining student engagement within a context never before studied (Fredricks et al., 2004). The context-specific measurement gathered from BRIDGE, a brief school-based health promotion and education program, may have uniquely influenced student responses in a way that nullified the expected measurement of items into different types of student engagement. Moreover, unique aspects of the environment may have influenced the results in systematically different ways, especially in comparison to traditional school environments where research has typically occurred.

A seemingly important difference in the context of the BRIDGE program was the relatively brief period of time students were exposed to the program, which was a total of

6 hours (i.e., 1 hour each week for 6 weeks). Student responses to the engagement items were thus based on their limited experience in the program. Yet, research typically measures student engagement in the general context of school (Fredricks et al., 2004), where student responses are drawn from months if not years of various experiences (i.e., teachers, classes, activities). Student responses to items about the BRIDGE program, however, were based on limited experience and comparably limited variance that were likely to be substantially less than the general school experience. The one-factor solution identified from the results of the current EFA may reflect the manifestation of this relationship.

This proposed relationship may be undergirded by different cognitive processes used by students in the BRIDGE program. Brief exposure to BRIDGE may have left students without the familiarity or repetition of experience necessary to form complex (i.e., multifaceted) impressions about the program; instead, less frequent exposure likely contributed to students relying more on cognitive shortcuts, such as the availability heuristic and anchoring (Tversky & Kahneman, 1974). The general one-factor solution identified for student engagement, which contrasts the multifaceted description of the construct, may be the result of student responses that were based on different cognitive processes. This explanation seems further plausible considering that items were selected for their similarity to previous measurements of student engagement, which were typically conducted in general school environments where variance of experience was much greater.

Poor differentiation of student engagement items into the proposed categories may also be due in part to the cognitive development of ninth grade students. According to Piaget (2002), students in the current study have just entered the formal operations stage, which is where abstract and critical thought take greater precedence over concrete thinking. Based on this developmental consideration, the one-factor EFA solution may have partially been the result of students not fully understanding how to differentially respond to questions concerning emotion, behavior, and thought. To address this concern in future research, items should be clearly worded but also very descriptive so that students understand exactly what the question is asking. Additionally, detailed instructions may further serve to help students clearly understand how to best respond to each item.

In retrospect, the EFA conducted in the current study was an overly ambitious attempt to capture a construct that was noted to be multi-dimensional, ambiguously defined, and poorly measured. The current study's findings may not represent a comprehensive measure of student engagement, but the strong cohesion between items reflects the presence of a meaningful single factor; which, can be understood as a context-specific measurement that is related to the general construct of student engagement. This interpretation accurately reflects the strengths and limitations that were evidenced by the results and discussed herein. Results were cautiously interpreted as not to aggrandize the conclusions or, as discussed next, overgeneralize their application.

Applications of the one-factor measure of student engagement. The one-factor solution of student engagement has strengths and weakness that affect its external

validity. First and foremost, it appears to be a consistent and significant example of program evaluation for adolescents using self-report to measure a related version of student engagement. Future research intervention programs conducted through the Life Skills Center should continue to include these items and researchers can make interpretations with greater certainty that findings are related to the general construct of student engagement. However, caution is warranted when interpreting the individual items as measurements of student engagement categories because results failed to show item differentiation by categories.

Applications beyond the Life Skills Center are less certain. The current study's findings have been interpreted to show an apparent difference between student engagement when measured in a specific context (e.g., the BRIDGE program) compared to a general context (e.g., school). This interpretation restricts the applicability of the measure to contexts that share certain characteristics of the setting used in the current study. These unique aspects include: an educational context for youth or adolescents, brief and specific interventions, the delivery of instruction by non-school staff, and instruction designed to be developmentally engaging. Intervention settings with these qualities are likely appropriate for successfully utilizing the current measure of engagement as a component of program evaluation.

Findings also support the application of the one-factor measure of student engagement to health promotion and educational settings. The paucity of research on student engagement within health education contexts has created an opportunity for the current study's findings to extend the application of student engagement beyond

traditional school-related subjects and settings. It appears that student engagement is relevant in the academic school environment as well as the arena of health promotion and education, which further supports the multifaceted application of the construct.

Although the items comprising the one-factor solution were based on previous measurements of student engagement, similarity between items does not necessarily indicate that the current measure shares the various conclusions that previous research has found using related measures of student engagement (Fredricks et al., 2004). Results of the study must be understood within the unique context of the current investigation. From this view, interpretations were relatively straightforward, demonstrating significant results as well as adequate reliability and validity. Results are also indicative of a measure of student engagement that will yield interpretable results when tested further. Mixed model tests were therefore conducted to investigate student engagement as a predictor within a social contextual model of adolescent health behavior change.

Predicting Students Behavioral Intentions

Findings from tests of the LMMs pertain to four previously stated research hypotheses. Generally, predictions were made regarding the effect of student engagement within and between models, for differences in overall model fit, and for model differences by gender and ethnicity. Relevant outcomes will be discussed in the context of each hypothesis.

The relative significance of student engagement. Findings for student engagement were obtained amid previously established predictors of health behavior change (e.g., self-efficacy, normative beliefs) within a social contextual model of adolescent health

behavior change, which is based on previously established theoretical models (Ajzen, 1985; Ajzen & Fishbein, 1980; Bandura, 1977; Prochaska & DiClimente, 1983). Student engagement was included as a novel predictor of change for adolescents due to developmental and educational support from the literature (Beale et al., 2007; Elliott et al., 2005; Loveless, 2006). Results from the three mixed models showed that student engagement, as measured by the one-factor solution obtained from the EFA, was a statistically significant predictor of students intentions to reduce fat consumption, conduct a self-examination, and exercise 30 minutes five days a week. Moreover, these findings were significant on each dependent variable beyond the effects of differences between schools. However, although the research hypotheses predicted student engagement to show significant results for each model, the effects were expected *above and beyond* other predictor variables. This specification was unmet due to limitations in the statistical procedure that were not recognized earlier.

The overall tests of student engagement showed that it was significant equal to or below the .01 level for each dependent variable. Although this finding is encouraging, further results undermine this relative significance. To examine the effect of student engagement in greater detail, it was tested as a nested variable within schools. Although the overall effect of student engagement was significant for each dependent variable, its effect was never significant at all three schools. This closer examination reveals inconsistent findings for the effect of student engagement on each outcome variable, questioning the relative predictive significance of the current measure of student engagement.

The significance of student engagement relative to other predictors. Parameter estimates for student engagement reflected inconsistent significance on each dependent variable. The significant parameter estimates showed that for each single unit increase in student engagement, student intentions increased by an amount ranging from 0.021 to 0.028. Although student engagement has a much greater range (25) than the dependent variables range (4), the clinical significance of this effect appears small. For instance, to increase a student's intention to conduct a self-examination just a quarter of the way from one point (e.g., *agree*) to the next highest point (e.g., *strongly agree*), approximately a 6% increase overall, student engagement must increase by approximately 10 units, which is equivalent to a 40% score increase. Thus, the percent change ratio of student engagement to student intentions to conduct a self-examination is 20% : 3%. By comparison, a single-unit increase in self-efficacy (i.e., a 25% score increase) results in a 0.550 increase in student intentions to conduct self-examinations (i.e., approximately a 14% increase overall). This percent change ratio, self-efficacy to student intentions to conduct a self-examination, is approximately 5% : 3%. The comparison of ratios shows that self-efficacy's effect is approximately four times greater than the effect of student engagement, which illustrates the relative strength of self-efficacy and relative weakness of student engagement as model predictors.

The inconsistent and relatively small effect of student engagement, as it is measured in the current study, provides weak support for it being a relevant factor in models of adolescent health behavior change. In and of themselves, initial results of the student engagement measure indicted that its effect on student health behavior intentions

were negligible. However, compared to these initial findings, additional interpretations show promising evidence for student engagement as a model predictor for adolescent health behavior change. Discussion will also focus on the mixed evidence for student engagement's practical and theoretical relevance.

To better understand student engagement as a predictor of adolescent health behavior change, conclusions are aided by comparing student engagement to other predictors. Findings generally show that, aside from self-efficacy, student engagement outcomes were relatively similar to most of the previously established predictors of health behavior change (e.g., behavioral beliefs, worry, and normative beliefs).

Self-efficacy was clearly the most significant model predictor for each dependent variable. This finding is generally not surprising given the substantial body of research that supports self-efficacy as a key antecedent of intentions in models of health behavior change (Ajzen, 1985, 2002; Ajzen & Manstead, 2007; Bandura, 1977; Francis et al., 2004). The magnitude of the differences between the effects of self-efficacy and other model variables, however, was somewhat surprising; previous research has shown that self-efficacy's model effect is frequently strong on various health behavior outcomes, but its effect is not always the most prominent nor drastically larger than other important predictors such as behavioral beliefs, normative beliefs (Ajzen & Manstead, 2007), or worry (Janz & Becker, 1984). Reasonable interpretations of the overall effect of self-efficacy have not been identified and it is unclear what may be accounting for this abnormally large difference. However, a relevant interpretation of this effect for a specific model has been identified.

The variance attributed to self-efficacy in the model to reduce fat consumption (15.5%) was approximately half as much compared to its attributed variance in self-examinations (28.6%) and exercise (30.1%) models. Variances were not analyzed for statistical significance, yet these differences appear to be relatively important. This finding may be related to a specific variable – perceived behavioral control – which, resembles self-efficacy, but is a more practical measure of an individual's ability to perform a behavior that includes the consideration of foreseeable obstacles (Ajzen, 1985). Perceived behavioral control is especially important for youth because they often have less control over the choices they make about health, particularly diet (e.g., buying groceries, having money to buy groceries, food choices at school). Perceived behavioral control was not included in the current study because it was not included in the BRIDGE survey, yet it may be responsible for explaining differences in self-efficacy variances between models. Based on the likelihood that 9th graders perceive themselves to have less control of their diet than they have of examining or exercising their bodies, it is theoretically reasonable to conclude that the relatively smaller effect of self-efficacy on intentions to reduce fat was due to borrowed variance from the unaccounted-for variable, perceived behavioral control. This example illustrates a drawback of conducting a retrospective study. The current investigation would have included an assessment of perceived behavioral control if it instead had been prospective.

Despite extremely robust model effects, self-efficacy was not the only relevant predictor of student intentions. The relationship between self-efficacy and the other predictors appears to mirror a lesson from the bible, which is described in the following

passage, "Man does not live by bread alone" (Deuteronomy 8:3 New International

Version). The statement alludes to the existence of other human necessities such as

interpersonal relationships, communication, aesthetic stimulation, spirituality, etc. This

lesson is relevant to the aforementioned relationship between self-efficacy and the other

predictors, such that it may be said: Ninth grade students do not change by self-efficacy

alone.

Results showed that student engagement predicted change in the dependent

variables that was similar to the effects of most other predictors. The specific statistics

that demonstrate this conclusion are outlined in the results section and will not be

reiterated here. Each predictor variable was significant for at least one school in each

model; yet simultaneously, each predictor demonstrated inconsistent effects within and

between models. Although categorical analyses of these comparisons were not

performed, a lack of consistency is clearly evident. For example, student engagement was

significant on each model but in different schools: In schools B and C for reducing fat

consumption, in school A for conducting self-exams, and in school B for exercising. This

pattern is similar to the inconsistent significances for behavioral beliefs, subjective

norms, cancer worry, and cancer knowledge. These significant findings may potentially

be evidence of a Type I error, perhaps due in part to a large sample. However, these

results do not present an easily distinguishable pattern, except, ironically, that there

appears to be a consistent pattern of inconsistency.

Results did, however, show further similarities between predictors. Parameter

estimates of the predictor variables demonstrated effects that were relatively similar in

magnitude, yet small relative to self-efficacy. As respective percentages of the median

self-efficacy parameter estimates, the significant predictors for reducing fat consumption

ranged from 22% to 45% (i.e., save one outlier: 59%), from 8% to 30% for conducting

self-examinations, and from 12% to 18% for exercising. The specific parameter estimates

of student engagement were 22% and 29%, 23%, and 18% on each dependent variable,

respectively. These comparisons provide the clearest evidence that, in models of

adolescent health behavior change similar to those in the current study, the effect of

student engagement is comparable to the effect of previously established variables.

Based on comparisons between student engagement and similar predictor

variables, overall findings indicate mixed support for student engagement as a significant

predictor in theoretically-based models of adolescent health behavior change. It appears

that additional research is likely necessary to resolve the current study's discrepant

findings. Specific future directions are discussed in a section below.

The significance of student engagement between models. The percent of model

variance attributable to student engagement was greatest for predictions of student

intentions to reduce fat consumption. Statistical analysis was not used to test for

significant differences; however, unique model variances were calculated as estimates of

effect sizes, a recommended procedure to use with mixed models tests (Snijders &

Bosker, 1999). Although effect sizes are relatively small, differences are apparent and

interpretable.

Different effect sizes of student engagement between models may indicate that

the student engagement items are being misinterpreted. Instead of measuring student

engagement during the actual BRIDGE program, items may have measured student's prior exposure to, and personal interest in, the BRIDGE program topics. The following rationale describes evidence supporting this interpretation.

Two of the most common messages that adolescents receive from the majority or mainstream culture in the United States are to be healthy (USDHHS, 2000) and attractive (Sweeney, 2008). These messages are particularly influential for 9th graders. Developmentally, adolescents are acutely concerned with social acceptability and personal identity, which accompany the psychosocial developmental stage of identity versus role confusion (Erikson, 1959) and that are inextricably related to being healthy and attractive. A specific example of a cultural message currently bombarding adolescents and promising to make them healthy and attractive is reducing the amount of fat in their diet (Martin, 2007; USDHHS, 2000).

Adolescents' developmental susceptibility increases the social pressure exerted by these types of messages. It is possible that students in the BRIDGE program were primed (Tversky & Kahneman, 1974) by cultural messages to be interested in reducing fat consumption more than conducting self-examination or exercising. Thus, the student engagement items based on evaluations of the BRIDGE program, including "like", "recommend", and "fun," may actually be measuring students' personal interests in the content (i.e., to reduce fat consumption), which they were exposed to and urged to follow before the BRIDGE program. In other words, the items measuring student engagement may be piggybacking on a stronger influence in the lives of students, causing an assessment error due to misperception. However, by this rationale, the variance

attributable to student engagement in the models for exercise and reducing fat consumption would likely be similar because cultural messages often pair exercise and diet together as important health behaviors. Yet, variance attributed to student engagement was lower for exercise than for self-examinations. This is surprising because the importance of conducting self-examinations is promoted much less frequently (McClenahan et al., 2007; Weiss, 2004).

Due to the presence of supportive and unsupportive evidence of student engagement as a predictor of student behavioral intentions, it is somewhat difficult to draw definitive conclusions. Mixed support is not an indication that that the measure of student engagement is irrelevant and nor does it mean the measured construct is problem-free. One thing it does indicate is that more research is needed to parse out its significant effect relative to variables previously established as predictors in health behavior change models. Specific recommendations for future research to address these concerns are further described in the section below.

Interpreting overall model differences. The variances in the dependent variables explained by each model were calculated. Differences between models were not analyzed statistically but the raw data provide evidence that is interpretable. The model predicting student intentions to conduct self-exams was shown to account for the largest amount of cumulative variance (52.7), followed by the model for exercise (43.3), and lastly the model for reducing fat consumption (39.4). This finding supports the research hypothesis that predicted student intentions to conduct self-examinations would account for the most

model variance. The feasibility of performing each of the specific intended health

behaviors may explain the differences between models for total cumulative variance.

The feasibility of performing each of the health behaviors described in the

dependent variables seems to be relatively different. As a measure of student intentions in

the next month, "reducing fat consumption" is vague and not well defined, "exercise for

30 minutes five days a week" requires greater effort and commitment, but "conducting a

self-examination" is a brief procedure that seems fairly easy to accomplish during the

next month. Another explanation of the self-examination model having the best fit is that

in the BRIDGE program an entire workshop was devoted to teaching this skill. Exercise

and diet, however, were taught in combination with other lifestyle factors (e.g., tobacco

education, sunscreen use) during a single workshop. The increased focus on self-

examinations may have contributed to this outcome. Moreover, self-examinations are

also much less common relative to diet and exercise principles (McClenahan et al., 2007;

Weiss, 2004), which may have increased the 9th graders' attention and focus toward this

unfamiliar health behavior.

Hypothesized differences of the effects of gender and ethnicity across models

were also tested. Results did not support the hypothesis that gender and ethnicity would

each demonstrate significant effects in the model predicting intentions to exercise, but not

in the other models. Overall, findings were non-significant or minimally significant. This

appears to contradict previous literature for youth and adolescents showing that males are

typically more physically active than females and whites are generally more physically

active than Blacks (USDHHS, 2006a). However, reports of actual exercise may not

necessarily reflect the student intentions to exercise as measured in the current study (i.e., 30 minutes 5 days a week during the next month). The high frequency of exercise intention may have been outside the typical range of exercise behavior and therefore a skewed measurement that would not capture previous gender and ethnic differences.

The final model solution predicting student intentions to exercise demonstrated more non-significant findings than either other model; only three of the six covariate predictors were significant compared to all six in both other models. This evidence further supports the possible conclusion that the measurement of exercise in the dependent variable was not a realistic representation of students' intentions to exercise.

A notable statistically significant finding for intentions to conduct self-examinations showed that boys had greater intentions than girls. This was by far the strongest effect demonstrated for either gender or ethnicity in any model. Anecdotal evidence gathered during the implementation of the BRIDGE program also supported this finding. The boys appeared to be more comfortable than the girls with self-examinations in general. The girls were more reserved and shy during the specific self-examinations workshops, which included practicing with models and participating in workshop discussions. Girls were also observed laughing and giggling more frequently during the BSE workshop and when the topic surfaced otherwise.

The statistical and anecdotal evidence for differences by gender are likely due to the socialization of different gender norms for boys and girls, particularly related to being comfortable and knowledgeable about one's physical body (Jacobs et al., 2002). Gender socialization of boys and girls, although still developing, often has well-defined roles and

norms by 9th grade (Erikson, 1959; Kritskaya, 2001). Specifically, the acceptability of exploring, using, and knowing one's body has mainly been the purview of boys, not girls (Jacobs et al., 2002). These normative differences appear to clearly explain why boys reported significantly greater intentions to conduct self-examinations than girls. As this finding indicates, socialization can have a significant effect on health behavior.

The potential for negative health effects resulting from traditional gender socialization is a significant reason why, despite being somewhat controversial, it is important to teach girls how to perform breast self-examinations (BSE). As described in the literature review, BSEs are not recommended for girls (USDHHS, 2002), due in part to the clinical etiology of breast cancer and high false positive rates that have previously been identified (Thomas et al., 2002). However, there are still important and compelling reasons to teach girls how to conduct self-examinations.

First, teaching is different from making a recommendation. As the current study shows, teaching self-examinations yielded significantly lower intentions to conduct BSEs among girls relative to their male counterparts' intentions to conduct TSEs. As discussed earlier, this appears to be an example of the negative effects that can result from traditional gender socialization. Teaching self-examinations can impact one area of health, but by re-socializing girls to be more comfortable, investigative, and protective of their bodies, these secondary effects of teaching BSEs become positive outcomes that are important in their own right (Harris & Kinsinger, 2002). Knowing and feeling comfortable conducting a BSE can counteract the *secret* of being a woman that taught girls to be ignorant of their bodies and to fear losing their female identity if they

uncovered the secrets. Re-socialization by teaching self-examinations can help eliminate the discomfort girls have with their bodies and the subsequent avoidance of important health behaviors, which the current study demonstrates for intentions to conduct self-examinations. Therefore, familiarizing girls with their physical bodies may specifically lead to quicker identification of breast cancer symptoms and potentially healthy habits that last a lifetime.

Additionally, doctors no longer regularly teach self-exam techniques (Harris & Kinsinger, 2002). This is partially due to strong evidence from the famous Shanghai trial, where learning to conduct BSEs did not reduce cancer mortality (Thomas et al., 2002). The study included approximately a quarter of a million women and lasted 10 years. Results showed no differences in breast cancer mortality between the intervention group that was taught to conduct BSEs and the control group (Thomas et al., 2002). Further, the intervention group reported more breast biopsies and more false positives than the control group.

Currently there are few places where girls or women are taught the correct method for conducting BSE. Despite strong findings from the Shanghai trial that learning BSEs does not reduce the rate of false positives or increase earlier detection, there are other outcomes of learning to conduct BSE that are important. Danish, Chopin, and Conley (2008) provide reasons why teaching BSE is important. They describe the Shanghai study as an example illustrating how knowledge is not sufficient for behavior change and that psychological factors must also be emphasized in order to produce behavior change. Danish and colleagues further conclude that teaching self-examination

techniques in schools can reduce health disparities. Last, they suggest that BSEs, as well as TSEs, may be part of a paradigm shift in personal healthcare that represents moving away from an over-reliance on machines and toward learning "how to take care of ourselves" (Danish et al., 2008, Conclusion section, ¶ 4). This final point is particularly relevant to adolescents because they are in the process of forming health habits that will likely last throughout their lifetime.

Missing Data: Explanations and Implications

The current investigation took steps to understand, as much as possible, the identified patterns of missing values in the dataset. This was important because missing data can have detrimental effects on research investigations, leading to problems such as spurious results and poor generalizability (Kahn, 2006; Snijders & Bosker, 1999). Previous researchers have sought to understand the causes and antecedents that undergird missing data so to better interpret study outcomes and to guide decisions that attenuate the negative effects caused by missing data (Graham & Hoffer, 2000; Rudas, 2005; Wolfe, 2003). Within general areas of investigation, research has identified specific contributing factors of missing data patterns: Individual differences regarding self-control (Watkins & Melde, 2007); environmental characteristics including complexity (Drew, Mion, & Meldon, 2004), variable qualities including emotional sensitivity (Huang, Lan, & Kuo, 2005), and different methodologies such as paper- versus internet-based data collection (Green, Rafaeli, & Bolger, 2006).

Patterns of missing data in the current study may be the result of several factors.

Missing values constituted a small percentage of the total overall number of responses. They were present in all but one variable and distributed relatively evenly throughout approximately one fifth of all cases. These outcomes may have been due to the BRIDGE survey's length, question content, or both. Students generally spent 30 to 40 minutes responding to the more than 120 questions that comprised the 15-page survey; thus, fatigue may have negatively affected student motivation or attention for responding to all questions. Students were also responding to questions that were very personal by nature, and therefore, generally private. It is plausible that many students were uncomfortable answering certain items, but due to a variety of diverse personal questions, missing values were generally distributed evenly across items.

Missing data greater than 4% were found in nine variables. Total cancer knowledge was one of these variables which may have had a higher percentage due to the combined nature of the variable (i.e., it was the summed total of 8 true/false questions); that is, failure to answer even one item resulted in a missing value. A higher percentage was also found for subjective norms to conduct self-examinations, which was the combination of two items: student perceptions of their parents' beliefs about the importance of conducting self-examinations and student perceptions of their parents' self-examination behavior. Due to the extra-sensitive and unfamiliar nature of these questions, it is perhaps surprising that the percentage of missing data was not substantially greater, rather than resembling the much less innocuous measure of cancer knowledge. This may be attributable to the experience and professionalism of the instructors from Hadassah's "Check it Out!" program. Members of this international Jewish women's organization

taught the BRIDGE workshop on self-examinations, which was an extension of the organization's mission to reduce cancer risk by teaching youth self-examination skills.

The remaining seven variables with greater than 4% of missing data were six individual student engagement items and the aggregate of these items. Fatigue may have been a factor because the post survey was identical to the pre survey except for an additional program evaluation items that were added on to the end of the survey. It is important to specifically note that the questions were added to the back of the final page, which was previously blank in the pre survey. Therefore, in addition to fatigue, students may have accidentally skipped these questions entirely as a result of being eager to finish, inattentive, or lacking self-control (Watkins & Melde, 2007). This explanation is supported by findings from mismatched correlation matrices; the percentage of missing data from any combination of two student engagement items was less than 1% greater than that of either individual item relative to the general population. Furthermore, combinations involving any student engagement item and either total cancer knowledge or behavioral beliefs for self-examinations produced increases in the percentage of missing data that were between 2% and 3% greater than either individual item relative to the total sample. These results indicate that, in general, student engagement items were answered entirely, or not at all. An important implication of this conclusion is that because of the all-or-nothing responses to student engagement items, the sample used in current study excluded a subgroup of students who, as described next, were systematically different from students in the larger sample.

Concerning responses to the six student engagement items from the EFA final solution, students without missing data were shown to have significantly greater cancer knowledge and stronger beliefs that reducing fat helps prevent cancer than students with missing data. Cancer prevention knowledge and awareness is lower among the students failing to respond to student engagement items, possibly due to inattention or indifference toward the survey. However, responding to the student engagement items, which were new and at the very end of the survey, may indicate a thorough, careful, even contentious approach to completing the survey that was responsible stronger cancer knowledge and awareness outcomes.

The student comparisons noted above impact the study's results because they reflect systematic differences between the sample used to test the research hypotheses and an excluded subgroup of students. The sample used for analyses was comprised of students who, relative to the excluded subgroup, appeared to possess qualities that were conducive to academic achievement. The study has therefore investigated a sample that is not entirely representative of each high school's 9th grade students, and subsequently, has drawn conclusions from a skewed sample of students with stronger qualities facilitative of learning and achievement.

Comparisons for each of the seven individual student engagement items were also made between students without any missing data on the entire survey and students with at least one missing value. The only significant difference was that students with missing data reported less intention to set a goal for health. However, the remaining items showed a consistent but non-significant pattern: Students with missing data reported greater

engagement in the program. Yet, these students had less intention to set a goal. This apparent inconsistency may be due to a subgroup of students who enjoyed the BRIDGE program for reasons other than what the program offered. The prototypical student in this subgroup could meet this description: Feeling indifferent to the program and maybe school in general, missing values resulted from superficially completing the survey; however, program evaluation was more positive, not because of anything inherent to the program, but because it replaced the monotony experienced on typical school days; and finally, less intention to set a goal may also be the result of an indifference and boredom with school, which students who conscientiously respond to all survey items might not necessarily experience, even despite lower evaluations of the program.

Strengths and Limitations

The current investigation of student engagement and its contribution to models of adolescent health behavior change was a multifaceted analysis with many strengths and limitations that are discussed in this section. A number of particular strengths and weaknesses were noted in earlier sections and are reiterated in this discussion, but with added contextual description pertaining to the study's findings. Strengths of the investigation will be described first, followed by the limitations.

Strengths. An overall strength of the study was its multi-method approach to examining student engagement. Fredricks and colleagues (2004) noted scant multi-method studies of student engagement and recommended that the approach be used more frequently because, they assert, multiple methods can generate information that, "is essential for creating finely tuned interventions that target specific aspects of the

environment" (p. 87). Conclusions described earlier were frequently based on context-specific (i.e., facets of the BRIDGE program) interpretations of results and therefore aligned with Fredricks and colleagues' recommendation.

The multi-method approach of the study included an exploratory factor analysis (EFA) for student engagement and mixed model analyses of adolescent health behavior change, which included student engagement as measured by the final EFA solution. Both methods of analysis possessed unique strengths that increased the soundness of the overall study.

The EFA technique generated a substantial amount of interpretable data that were used to achieve an optimal factor solution. Specific results were used to determine that the goal setting intentions item was not an accurate measure of student engagement. Further results from the initial EFA test did not generally support a two-factor solution. However, the EFA permitted the researcher to specify a two-factor solution and apply a factor rotation; additional results were produced for the sake of interpretation, which helped make the study more comprehensive. The variety of data generated by the EFA was also important because different statistics were needed in order to make well-informed decisions. Interpreting a variety of data made the study more transparent because every step documented what statistic(s) was interpreted, why it was being interpreted, and how it was interpreted.

Many of the strengths of mixed modeling that were mentioned earlier are also discussed here as they relate to findings from the study. One of the most important aspects was the flexibility of mixed models. Each model tested numerous relationships

that would have required multiple separate analyses if mixed models were not used. Although by definition there were fixed and random effects in each model, it also supported interactions, nested variables, and non-categorical predictors. The flexibility to test many different relationships simultaneously produced results that were comprehensive and parsimonious, which are both important characteristics that help prevent overestimations of significance while at the same time generating abundant data.

An especially important aspect of flexibility was that the mixed models analyzed levels of the random factor as independent groups and not as a fixed effect (Snijers & Bosker, 1999). Although results showed that the random effect of school was not significant in any model, it still contributed to the model in a meaningful way by producing results that were assuredly more accurate than results from other procedures (e.g., regression and a general linear model).

There are additional strengths of the study apart from the statistical procedures. The sample of 1,101 students was particularly large and sufficient by any recommendation for EFA and mixed model analyses (Snijers & Bosker, 1999; Thompson, 2004). The large sample also increased the study's power, which strengthened outcome data, including estimates of effect size. This was especially important in the mixed model analyses where the random effect of school divided groups into smaller units of analysis. Group mean centering of the covariate predictor variables was a strength of the study as well; it made the parameter estimates easier to interpret, which likely reduced the possibility of arriving at false conclusions. Results from the

missing data analysis also contributed to achieving an accurate and comprehensive understanding of the dataset and the outcomes produced from the dataset.

The theoretical reasons for testing student engagement as a predictor of adolescent health behavior change are supported by previous literature (Ajzen & Manstead, 2007; Breinbauer & Maddaleno, 2005; Francis et al., 2004). The overall predictor model testing student health behavior intentions also demonstrates strengths of the study. For instance, in each model there was a high degree of correspondence between many predictor variables and the dependent variable, which is very important when testing models of health behavior change (Ajzen, 2006).

Limitations. The current study possesses a number of limitations that affect different aspects of the investigation. Most limitations were described earlier but are discussed here in terms of their influence on the study's findings.

A major limitation of the current study is the average, below average, or sometimes non-existent psychometric data that characterize most of the variables being studied. Specific variable limitations include one- or two-item measurements, limited or no evidence of reliability, limited or no evidence of validity, and inconsistently worded items. These measurement problems reduce the precision and consistency of data, which make it unclear as to what degree the data for a variable represent a valid measurement of the stated construct. Moreover, these problems decrease the probability that interpretations, and subsequent conclusions, are valid and reliable.

The seven items included in the EFA were insufficient for testing the stated hypothesis predicting a multi-factorial structure. This limitation is based on previous

research describing how to appropriately conduct EFA, which recommends including a minimum number of items between three and five for each anticipated factor (Kahn, 2006; Russell, 2002; Thompson, 2004). The current study unrealistically anticipated two or three separate factors to emerge from seven items; the resulting one-factor solution is a typical example of what researchers report is a possible consequence of not including enough items (Kahn, 2006; Russell, 2002).

The item limitation in the current study made it nearly impossible to identify multiple factors (i.e., six items comprised the final solution but recommendations require three items per factor). It is important to note, however, that failing to include enough items did not necessarily influence the outcome statistics of the individual items. That is, results of individual items were still relevant and interpretable. Specifically, the current study identified multiple statistics of convergent evidence among six of the EFA items as well as strong divergent evidence between the six common items and one outlier – intentions to set a goal. Therefore despite not including enough items to yield results supporting the research hypothesis, results were still interpretable as well as pertinent to the research hypotheses.

The items included in the final solution of the EFA were selected from the BRIDGE survey and generally had not been thoroughly examined for psychometric properties. Although the items were developed by Life Skills Center research staff to evaluate an earlier intervention program for youth, a single Cronbach's α (.89) was the only documented psychometric property of all the items (Forneris, Fries, & Danish, 2006). Description of the process of developing the items had not been published and

limited information describing the process was found in the Life Skills Center archives. Available information indicated that items were developed without testing their psychometric properties, which current standards do not recommend (Kahn, 2006). The current study appears to be the first multi-level analysis of these items, which were originally developed to evaluate intervention programs, not as specific measurements of student engagement. Moreover, although the items were included in the current study because they closely resemble previous measurements of student engagement, prior to including these items in current study there appeared to be no empirical evidence to suggest that the items were valid or reliable measures of student engagement.

Future research investigating student engagement will benefit from using a previously established measure. The most commonly used instrument to measure multiple types of engagement is the Rochester School Assessment Package (RAPS; Wellborn & Connell, 1987). Among other currently available instruments (e.g., Connell, Halpern-Felsher, Clifford, Crichlow, & Usinger, 1995; Lee & Smith, 1995; Marks, 2000), the RAPS appears to be the most comprehensive and psychometrically validated measure of engagement (Fredricks et al., 2004). It contains five separate but integrated measurement tools for behavioral and emotional engagement in school, and assessments are conducted from multiple perspectives, including student, teacher and parent, as well as student records as a measure of engagement. Depending on the specific aims of future investigations, researchers may want to include the entire measure or a component, such as the subscale measuring student engagement (i.e., RAPS-S), which has previously been shown to have sound psychometric properties (Wellborn & Connell, 1987). Other

researchers have created discrete scales to measure specific types of engagement (see

Miller et al., 1996; Nystrand & Gamoran, 1991; Patrick, Skinner, & Connell, 1993;

Skinner & Belmont, 1993). As demonstrated by results from the current study, student

engagement continues to be ambiguously defined and imprecisely measured. Future

research studying student engagement faces a double-bind: engagement is often measured

as a context-specific assessment, yet this further contributes to poor definition and

measurement, and as described by Fredricks and colleagues (2004), it creates a generally

messy construct.

Limitations of the study were also present in the items included in the predictor

models for adolescent health behavior change. As noted earlier, the psychometric data

supporting most variables ranged from average to non-existent. Results from the model

tests do not demonstrate obvious signs that the predictor variables were unreliable or

invalid measurements of the stated constructs. For instance, the one-item measure of self-

efficacy was significant and therefore similar to previous research (Bandura, 2004),

whereas the 10-item measure of cancer knowledge was inconsistently significant, which

was also similar to previous research (Orlandi & Dalton, 1998). These examples do not

imply that results were interpreted with absolute confidence of their validity and

reliability. Uncertainty caused by suboptimal measurement is an occasional difficulty of

applied community-based intervention research (Epstein & Sheldon, 2006), where

obstacles frequently alter many components of an ideal study. For example, in BRIDGE,

time constraints forced researchers to choose a survey that was either broad or in-depth.

Although including each was ideal, a survey with both would have taken students longer

than a single class period (i.e., the time allotted by schools) to complete and therefore it was not an option.

A specific measurement limitation pertained to the assessment of student intentions to exercise 30 minutes five days a week. Although this precise type of measurement has been recommended when testing models of health behavior change (Ajzen, 2006), there are developmentally inappropriate aspects of this measurement for use with adolescents. Adults typically measure exercise based on time spent exercising and type of exercise because of the proven health benefits of these specifics. However, youth and adolescents do not conceptualize exercise in the same manner. Youth and adolescents engage in exercise behavior predominantly through sport (Danish et al., 2005) and are motivated by enjoyment, social interaction, and athletic achievement (Weiss, 2004). Developmental factors such as these are not represented in the current study's measurement of student intentions to exercise. This limitation can be avoided in future studies by including measurements of exercise that are developmentally appropriate.

Despite many inherent strengths of the mixed model statistical procedure, it limited the study in one particularly important way. The research hypotheses predicting a significant effect of student engagement for each model also stipulated that significance would be *above and beyond* other model predictors. The researcher mistakenly assumed that the mixed model procedure supported this specific type of significance testing, such as the measurement of the R^2 change statistic in hierarchical regression. For the many options available in mixed models, calculating the above and beyond effect of student

engagement was unattainable. Mixed modeling in SPSS supports a method that calculates the sequential improvement of each variable entered in the model – Type I sums of squares (Snijers & Bosker, 1999). However, this approach is not analogous to the R^2 change calculation of hierarchical regression that computes the incremental improvement of specified variables; moreover, there are two key statistics in hierarchical regression that are based on R^2 change and further demonstrate the above and beyond effect: (1) The percentage of variance accounted for by the above and beyond variables; (2) the statistical significance (i.e., p value) of specified variables above and beyond other variables. These statistics are not calculated in SPSS mixed modeling and results from the Type I sums of squares do not satisfy the above and beyond conceptualization of the hypotheses. Results therefore did not support the specifically predicted above and beyond effect of student engagement.

Missing data was also a limitation to this study. The results previously described indicate that over 18% of cases in the entire sample contained at least one missing value, which was substantially greater than the 5% recommended when using linear mixed models (Graham & Hoffer, 2000). Analyses of the missing data revealed that there were specific significances, which were discussed earlier in terms of their effects on the results. Despite contributions to the conclusions of current study that were due to results from the missing data analyses, previous research has effectively used different procedures to examine missing data , including mixture models of missing data (Rudas, 2005) and logistic regression (Wolfe, 2003). Despite being useful in previous research, it is unclear whether these tests would have revealed additional information about the

patterns and characteristics of the dataset that would be pertinent to the current study's findings.

Future Directions and Recommendations

The current study produced a variety of findings that indicate the need for further research in particular areas. Student engagement possesses many opportunities for future research due to its multifaceted nature alone. However, the future directions outlined here are based specifically on the results of the current investigation.

The current study showed that the measure of student engagement predicting student intentions was significant for each model. Yet, the six items comprising the measure were originally developed to evaluate student perceptions of health intervention programs. In accordance with previous recommendations to continue to better define and refine the construct of student engagement (Fredricks et al., 2004), this aim can be reached in part by future research that seeks to differentiate general program evaluation and different types of student engagement. Clarifying the similarities and differences of these two areas will improve the definition of student engagement and will further examine the role of student engagement as a predictor of health outcomes. The current study's measure of student engagement could serve as a building block for this research. As results from the current study show, the measure should include additional items when used in future research. This recommendation makes it appropriate to study student engagement in a unique setting where specific contextual aspects should be measured and could be added to the assessment.

In their seminal paper on student engagement as a construct of interest, Fredricks and colleagues (2004) described important areas that future research should address. Specifically, they noted, "Future research needs to determine whether engagement becomes less context-dependent as individuals become more invested in the value of learning and schooling" (p. 85). Although the current study did not address this research question exactly, it tested a novel context for examining student engagement that would be an appropriate setting for future research addressing Fredricks and colleagues' recommendation.

Furthermore, although academic school environments represent the vast majority of settings where student engagement has previously been researched (Fredricks et al., 2004), the current investigation shows that other options are available. In addition to school-based health promotion programs, after-school programs and community sport programs are settings where youth experience many types of engagement (Csikszentmihalyi, 1997) and therefore appear to be viable settings for making comparisons with schools. Additionally, student engagement may have relevant research opportunities for health education and behavior change in settings such as Boys and Girls Clubs and summer camps (i.e., academic and leisure).

It is important that further studies examine student engagement inside and outside of academic environments, yet there appear to be key cultural differences within each context that should also be addressed. Fredricks and colleagues (2004) acknowledge that research on student engagement has too often neglected group differences and assumed the construct could be applied broadly, across factors including race, ethnicity, culture,

gender, and socioeconomic status. Educational environments are becoming increasingly diverse and research on student engagement has not answered key questions about diversity such as: (1) Does student engagement predict achievement and dropout equally across diverse groups of students?; (2) Are specific types of student engagement more facilitative of achievement for specific groups of students?; (3) What ethnic/cultural factors are related to preferred types of student engagement?. It is essential for research to address these areas and not assume that student engagement is a universally applicable construct.

As student engagement research continues to explore adolescent health education and behavior change more frequently, important considerations should be addressed. For instance, it will be important to study how to best measure student engagement based on chronological age as well as developmental stage. Moreover, researchers may want to consider what age or stage has the greatest potential for making positive health behavior changes. To achieve this goal it will behoove researchers to generate specific hypotheses that are theoretically-based. Moreover, hypotheses should be tested using precise and reliable measures where the outcome data indicate unequivocally whether the hypotheses have been met. It is also noteworthy to mention that the current study found that general measurements of engagement that are context-specific may not differentiate between the types of engagement.

Student engagement was a significant predictor of student intentions to reduce fat consumption, conduct a self-examination, and exercise, but its effect was different in each model. These differences are potential areas for future research. In particular, effect

sizes were not analyzed for statistical significance, yet the strongest effect was shown for intentions to reduce fat consumption and the weakest effect was shown for intentions to exercise. Future research is warranted on the predictive validity of student engagement on health behaviors and behavioral intentions, including comparisons between familiar and novel health outcomes.

The researcher briefly considered using structural equation modeling (SEM) to test the research hypotheses, yet this statistical procedure was not used for practical and theoretical reasons. There were obstacles to obtaining, affording, and becoming proficient with the software; the practical inconvenience of these factors influenced the researcher's decision not to use SEM. Researchers recommend using SEM for testing models where the relationships between variables have previously been established and when the model variables are measured with psychometrically sound instruments (Snijders & Bosker, 1999). However, the current study tested a developmentally-appropriate but novel predictor within a general model of adolescent health behavior change; it also contained many variables that were inadequately measured. Based on these factors, SEM was inappropriate for the current study and was therefore not used.

SEM does, however, appear to be the most simultaneously robust and flexible statistical procedure currently available for testing models of health behavior change (Ajzen, 2006; Snijders & Bosker, 1999). It can incorporate complex models where many different types of variables are include and where numerous relationships between variables are tested. Furthermore, the path analyses of SEM generate results indicating the direction and strength of the proposed model relationships. An additional statistical

procedure, PROC MIXED in SAS, is also capable of testing mixed models and is a

popular option among current researchers (Long & Pellegrini, 2003; McQueen et al.,

2008; Meischke et al., 2000). In general, future research on models of health behavior

change will benefit from using SEM; it will avail the researcher of the best statistical

procedure available for investigating the complexities inherent to model testing.

List of References

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About Komen. (2007). Retrieved July 10, 2007, from the Susan G. Komen for the Cure
    Web site: http://cms.komen.org/komen/AboutUs/index.htm

Ajzen, I. (1985). *From intentions to actions: A theory of planned behavior*. Heidelberg:
    Springer.

Ajzen, I. (2006, January). *Constructing a TpB questionnaire: Conceptual and
    methodological considerations*. Retrieved July 10, 2007 from
    http://www.people.umass.edu/aizen/pdf/tpb.measurement.pdf

Ajzen, I., & Fishbein, M. (1980). *Understanding attitudes and predicting social
    behavior*. Englewood Cliffs, NJ: Prentice-Hall.

Ajzen, I., & Manstead, A. S. R. (2007). Changing health-related behaviors: An approach
    based on the theory of planned behavior. In K. van den Bos, M. Hewstone, J. de
    Wit, H. Schut & M. Stroebe (Eds.), *The scope of social psychology: Theory and
    applications* (pp. 43-63). New York: Psychology Press

Allien, B. (2003). Stimulating brain power. In M. Tokoro & L. Steels (Eds.), *The
    future of learning: Issues and prospects* (pp. 223-236). Burke, VA: IOS Press,
    Inc.

Altman, D. G., & Jackson, C. (1998). Adolescent tobacco use and the social context. In S.
    S. Shumaker, E. B. Schron, J. K. Ockene & W. L. McBee (Eds.), *Health Behavior
    Change (2nd ed.)* (pp. 59-84). New York: Springer.

American Cancer Society (2007). *Cancer Prevention and Early Detection Facts and
    Figures 2007*. Atlanta: author.

Antos, J. R., & Rivlin, A. M. (2007, March). *Restoring Fiscal Sanity 2007: The Health
    Spending Challenge*. Retrieved August 31, 2007 from The Brookings Institution
    Web site:
    http://www.brookings.edu/es/research/projects/budget/fiscalsanity2007.htm

Appleton, J. J., Christenson, S. L., Kim, D., & Reschly, A. L. (2006). Measuring

cognitive and psychological engagement: Validation of the Student Engagement Instrument. *Journal of School Psychology, 44*, 427-445.

Bandura, A. (1977). *Social learning theory.* Englewood Cliffs, NJ: Prentice Hall

Bandura, A. (1982). Self-efficacy mechanism in human agency. *American Psychologist, 37*(2), 122-147.

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational Psychologist, 28*(2), 117-148.

Bandura, A. (2004). Health promotion by social cognitive means. *Health Education and Behavior, 31*, 143-164.

Baranowski, T., Perry, C. L., & Parcel, G. S. (2002). How individuals, environments, and health behavior interact. In K. Glanz, B. K., Rimer, & F. M. Lewis (Eds.), *Health Behavior and Health Education: Theory, Research, and Practice* (3rd ed.) (pp. 165-184). San Francisco, CA: John Wiley & Sons.

Bauman, A. E. (2004). Updating the evidence that physical activity is good for health: An epidemiological review 2000-2003. *Journal of Science and Medicine in Sport, 7*(1Suppl), 6-19.

Baumeister, R. F., Twenge, J. M., & Nuss, C. K. (2002). Effects of social exclusion on cognitive processes: Anticipated aloneness reduces intelligent thought. *Journal of Personality and Social Psychology, 83*(4), 817-827.

Beale, I. L., Kato, P. M., Marin-Bowling, V. M., Guthrie, N., & Cole, S. W. (2007). Improvement in cancer-related knowledge following use of a psychoeducational video game for adolescents and young adults with cancer. *Journal of Adolescent Health, 41*, 263-270.

Befford, T. (2006). Learning styles: A review of English-language literature. In R. R. Sims & S. J. Sims (Eds.), *Learning styles and learning: A key to meeting the accountability demands in education* (pp. 19-42). New York: Nova Science Publishers, Inc.

Blunsdon, B., Reed, K., McNeil, N., & McEachern, S. (2003). Experiential learning in social science theory: An investigation of the relationship between student enjoyment and learning. *Higher Education Research & Development, 22*(1), 43-56.

Breaslu, N., & Peterson, E. L. (1996). Smoking cessation in young adults: Age at

initiation of cigarette smoking and other suspected influences. *American Journal of Public Health, 86*(2), 214-220.

Breinbauer, C., & Maddaleno, M. (2005). *Youth: Choices and change: Promoting healthy behaviors in adolescents*. Washington, DC: Pan American Health Organization.

Bronfenbrenner, U. (1977). Toward and experimental ecology of human development. *American Psychologist, 32*(7), 513-531.

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology, 22*(6), 723-742.

Buss, D. M. (2000). The evolution of happiness. *American Psychologist, 55*(1), 15-23.

Camino, L. (2005). Pitfalls and promising practices of youth-adult partnerships: An evaluator's reflections. *Journal of Community Psychology, 33*(1), 75-85.

Carter, M., McGee, R., Taylor, B., & Williams, S. (2007). Health outcomes in adolescence: Associations with family friends and school engagement. *Journal of Adolescence, 30*, 51-62.

Catalano, R. F., Berglund, M. L., Ryan, J. A. M., Lonczak, H. S., & Hawkins, J. D. (2004). Positive youth development in the United States: Research findings on evaluations of positive youth development programs. *Annals of the American Academy of Political and Social Science, 591*, 98-124.

Centre for Public Policy (2003). *Young people's attitudes to education in the North East*. Newcastle: Northumbria University Centre for Public Policy.

Coenen, O. J.-M. D. (2003). The motivated brain. In M. Tokoro & L. Steels (Eds.), *The future of learning: Issues and prospects* (pp. 189-209). Burke, VA: IOS Press, Inc.

Comrey, A. L., & Lee, H. B. (1992). *A first course in factor analysis* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Connell, J. P., Halpern-Felsher, B. L., Clifford, E., Crichlow, W., & Usinger, P. (1995). Hanging in there: Behavioral, psychological, and contextual factors affecting whether African American adolescents stay in school. *Journal of Adolescent Research, 10*, 41-63.

Costello, A. B., & Osborne, J. W. (2005, July). Best practices in exploratory factor

analysis: Four recommendations for getting the most from your analysis. *Practical Assessment Research & Evaluation, 10*(7). Retrieved February 28, 2008, from http://pareonline.net/pdf/v10n7.pdf

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row.

Csikszentmihalyi, M. (1997). *Finding flow: The psychology of engagement with everyday life*. New York: HarperCollins Publishers, Inc.

Csikszentmihalyi, M. (2000). *Beyond boredom and anxiety: Experiencing flow in work and play* (Rev. ed.). San Francisco, CA: Jossey-Bass Publishers.

Cullen, K. W., Baranowski, T., & Rittenberry, L. (2000). Social-environmental influences on children's diets: Results from focus groups with African-, Euro-, and Mexican-American children and their parents. *Health Education Research, 15*(5), 581-590.

Damon, W. (2004). What is positive youth development? *Annals of the American Academy of Political and Social Science, 591*, 13-24.

Danish, S. J. (1996). Interventions for enhancing adolescents' life skills*. The Humanistic Psychologist, 24*, 365-381.

Danish, S. J. (1997). Going for the Goal: A life skills program for adolescents. In G. W. Albee & T. P. Gullotta (Eds.), *Primary Prevention Works* (pp. 291-312). Thousand Oaks, CA: Sage.

Danish, S. J., Chopin, S. M., & Conley, K. (2008). Rethinking Breast Self-Examinations: Are We Asking the Right Questions? Unpublished manuscript, Virginia Commonwealth University.

Danish, S. J., Forneris, T., & Wallace, I. (2005). Sport-based life skills programming in the schools. *Journal of Applied School Psychology, 21*(2), 41-62.

Deci, E. L., & Ryan, R. M. (2000). The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry, 11*(4), 227-268.

Deci, E. L., Vallerand, R. J., Pelletier, L. G., Ryan, R. M. (1991). Motivation and education: the self-determination perspective. *Educational Psychologist, 26*(3 & 4), 325-346.

Dewey, J. (1974). *John Dewey on education: Selected writings* (R. D. Archambault, Ed.). Chicago, IL: The University of Chicago Press.

Drew, B. L., Mion, L. C., & Meldon, S. W. (2004). Effect of environment and research participant characteristics on data quality. *Western Journal of Nursing Research, 26*(8), 909-921.

Dubbert, P. M. (2002). Physical activity and exercise: recent advances and current challenges. *Journal of Consulting and Clinical Psychology, 70*(3), 526-536.

Elders, M. J., Perry, C. L., Erikson, M. P., & Giovino, G. A. (1994). The report of the surgeon general: Preventing tobacco use among young people. *American Journal of Public Health, 84* (4) 543-547.

Elliott, J. G., Hufton, N. R., Willis, W., & Illushin, L. (2005). *Motivation, engagement and educational performance: International perspectives on the contexts for learning*. New York: Palgrave Macmillan, St. Martin's Press, LLC.

Ellis, J. (2005). Creative classroom teaching. In J. L. Kincheloe (Ed.), *Classroom teaching: An introduction*. New York: Peter Lang Publishing, Inc.

Enders, C. K., & Tofighi, D. (2007). Centering predictor variables in cross-sectional multilevel models: A new look at an old issue. *Psychological Methods, 12*(2), 121-138.

Epstein, J. L., & Sheldon, S. B. (2006). Moving forward: Ideas for research on school, family, and community partnerships. In C. F. Conrad & R. Serlin (Eds.), *Handbook for research in education: Engaging ideas and enriching inquiry* (pp. 117-138). Thousand Oaks, CA: Sage Publications.

Erikson, E. H. (1959). *Identity and the Life Cycle*. New York: International Universities Press.

Finn, J. D. (1993). *School engagement and students at risk*. Washington, DC: National Center for Education Statistics.

Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley Publishing Company.

Fishbein, M., & Cappella, J. N. (2006). The role of theory in developing effective health communications. *Journal of Communication, 56*, S1-S17.

Forneris, T., Danish, S. J., & Scott, D. L. (2007). Setting goals, solving problems, and seeking social support: Developing adolescents' abilities through a life skills program. *Adolescence, 42*(165), 103-114.

Forneris, T., Fries, E., & Danish, S. J. (2006). *How the design of a health-oriented intervention effects program perceptions and outcomes*. Unpublished manuscript, Virginia Commonwealth University.

Francis, J. J., Eccles, M. P., Johnston, M. J., Walker, A., Grimshaw, J., Foy, R. et al. (2004). *Constructing questionnaires based on the theory of planned behaviour: A manual for health services researchers*. Newcastle, United Kingdom: Centre for Health Services Research.

Fredricks, J. A., Blumenfeld, P. C., & Paris, A. H. (2004). School engagement: Potential of the concept, state of the evidence. *Review of Educational Research, 74*(1), 59-109.

Fries, E., Meyer, A., Danish, S. J., Stanton, C., Figueiredo, M., Green, S. et al. (2000). Cancer prevention in rural youth: Teaching goals for health: The pilot. *Journal of Cancer Education*, *16*, 99-104.

Galor, O., & Moav, O. (2005). Natural selection and the evolution of life expectancy. *Minerva Center for Economic Growth Paper No. 02-05*. Retrieved October 28, 2007 from Social Science Research Network Web site: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=563741

Gerrard, M., Gibbons, F. X., Benthin, A. C., & Hesslin, R. M. (1996). A longitudinal study of the reciprocal nature of risk behaviors and cognitions in adolescents: What you do shapes what you think, and vice versa. *Health Psychology, 15*(5), 344-354.

Glanz, K., Rimer, B. K., & Lewis, F. M. (2002a). The scope of health behavior and health education. In K. Glanz, B. K., Rimer, & F. M. Lewis (Eds.), *Health Behavior and Health Education: Theory, Research, and Practice*(3rd ed.) (pp. 3-21). San Francisco, CA: John Wiley & Sons.

Glanz, K., Rimer, B. K., & Lewis, F. M. (2002b). Theory, research, and practice in health behavior and health education. In K. Glanz, B. K., Rimer, & F. M. Lewis (Eds.), *Health Behavior and Health Education: Theory, Research, and Practice*(3rd ed.) (pp. 22-39). San Francisco, CA: John Wiley & Sons.

Goldstein, H. (1995). *Multilevel statistical models*. New York: Halstead Press.

Gordon, R. A. (1990). Informational bases of behavioral intentions and behavioral expectations or self-predictions. *Basic and Applied Social Psychology, 11*(4), 433-442.

Gorsuch, R. L. (1983). *Factor analysis* (2nd ed.). Hillsdale, NJ: Lawrence Erlbaum.

Graham, J. W., & Hoffer, S. M. (2000). Multiple imputation in multivariate research. In T. D. Little, K. U. Schnable, & J. Baumert (Eds.), *Modeling longitudinal and multilevel data: Practical issues, applied approaches, and specific examples* (pp. 201−218). Mahwah, NJ: Erlbaum.

Green, A. S., Rafaeli, E., & Bolger, N. (2006). Paper or plastic? Data equivalence in paper and electronic diaries. *Psychological Methods, 11*(1), 87-105.

Groos, K. (1976). *The play of man* (E. L. Baldwin, Trans.). New York: Arno Press.

Hafner, A., Ingels, S., Schneider, B., & Stevenson, D. (1990). *A profile of the American teenager: NELS: 88. Student descriptive summary*. Washington, D.C.: US Government Printing Office.

Haggbloom, S. J., Warnick, R., & Warnick, J. E. (2002). The 100 most eminent psychologists of the 20th century. *Review of General Psychology*, *6*(2), 139–152.

Hamburg, D. (1997). Toward a strategy for healthy adolescent development. *American Journal of Psychiatry*, *154*, 7-12.

Hare, W. (1973). Learning: Experience and enjoyment. *Educational Forum, 37*(3), 319-322.

Harmon, A. L., Westerberg, A. L., Bond, D. S., Hoy, K. N., Fries, E. A., & Danish, S. J. (2005). Cancer prevention among rural youth: Building a "bridge" to better health with genealogy. *Journal of Cancer Education, 20*(2), 103-107.

Harris, R., & Kinsinger, L. S. (2002). Routinely teaching breast self-examination is dead. What does this mean? *Journal of the National Cancer Institute, 94*(19), 1420-1421.

Heine, S. J., Lehman, D. R., Markus, H. R., & Kitayama, S. (1999). Is there a universal need for positive self-regard? *Psychological Review, 106*(4), 766-794.

Helms, J. E., Henze, K. T., Sass, T. L., & Mifsud, V. A. (2006). Treating Cronbach's alpha reliability coefficients as data in counselling research. *The Counseling Psychologist, 34*, 630-660.

Hox, J. J. (2002). *Multilevel analysis: Techniques and applications*. Mahwah, NJ: Lawrence Erlbaum Associates.

Huang, K., Lan, C., & Kuo, M. (2005). Detecting untruthful answering in randomized response sampling. *Quality & Quantity: International Journal of Methodology, 39*(5), 659-669.

Jackson, S. A. (2000). Joy, fun, and flow state in sport. In Y. L. Hanin (Ed.), *Emotions in Sport* (pp. 135-155). Champaign, IL: Human Kinetics.

Jacobs, J., Lanza, S., Osgood, D., Eccles, J., & Wigfield, A. (2002). Changes in children's self-competence and values: Gender and domain differences across grades one through twelve. *Child Development, 73*, 509-527.

James, D. L. (2001). Split a gut and learn: theory and research. Retrieved October 1, 2007 from: http://www.eric.ed.gov/ERICWebPortal/Home.portal

Janz, N. K., & Becker, M. H. (1984). The Health Belief Model: A decade later. *Health Education Quarterly, 11*(1), 1-47.

Johnson, M. K., Crosnoe, R., & Elder, G., Jr., (2001). Students' attachment and academic engagement: The role of race and ethnicity. *Sociology of Education, 74*, 318-340.

Kann, L., Brener, N. D., & Wechsler, H. (2006). Overview and summary: School health policies and programs study. *Journal of School Health, 77*(8), 385-397.

Kritskaya, O. V. (2001). Transforming ethnocultural tradition in a modern environment: Context for personal development. In M. Hedegaard (Ed.), *Learning in Classrooms: A Cultural-Historical Approach* (pp. 166-188). Headington, Oxford, United Kingdom: Aarhus University Press.

Larson, R., Walker, K., & Pearce, N. (2005). A comparison of youth-driven and adult-driven youth programs: Balancing inputs from youth and adults. *Journal of Community Psychology, 33*(1), 57-74.

Lazarus, R. S. (2000). Cognitive-motivational-relational theory of emotion. In Y. L. Hanin (Ed.), *Emotions in sport* (pp. 39-63). Champaign, IL: Human Kinetics.

Lee, V. E., & Smith, J. B. (1995). Effects of high school restructuring and size on early gains in achievement and engagement. *Sociology of Education, 68*, 241-270.

Lohaus, A., Klien-Hessling, J., & Ball, J. (2004). The prediction of health-related behavior in elementary school children. *Journal of Health Psychology, 9*(3), 375-379.

Long, J. D., & Pellegrini, A. D. (2003). Studying change in dominance and bullying with

linear mixed models. *School Psychology Review, 32*(3), 401-417.

Loveless, T. (2006, October). *The 2006 Brown Center Report on American Education: How well are American Students Learning, with Special Sections on the Nation's Achievement, the Happiness Factor in Learning, and Honesty in State Test Scores*. Retrieved August 31, 2007, from The Brookings Institution Web site: http://www.brookings.edu/gs/brown/bc_report/2006/2006report.htm

Lowry, R. Wechsler, H., Galuska, D. A., Fulton, J. E., & Kann, L. (2002). Television viewing and its associations with overweight, sedentary lifestyle, and insufficient consumption of fruits and vegetables among US high school students: Differences by race ethnicity, and gender. *Journal of School Health, 72*(10), 413-421.

Luszcynska, A., & Schwarzer, R. (2005). Multidimensional health locus of control: Comments on the construct and its measurement. *Journal of Health Psychology, 10*, 633-642.

Maddock, J., Takeuchia, L., Nett, B., Tanakab, C., Irvin, L., Matsuokab, C. et al. (2006). Evaluation of a statewide program to reduce chronic disease: The Healthy Hawaii Initiative, 2000–2004. *Evaluation and Program Planning, 29*, 293-300.

Marks, H. M. (2000). Student engagement in instructional activity: Patterns in the elementary, middle, and high school years. *American Educational Research Journal, 37*, 153-184.

Martin, A. (2007). The school cafeteria, on a diet. *The New York Times*. Retrieved April 11, 2008 from http://www.nytimes.com

McCaul, K. D., Mullens, A. B. Romanek, K. M., Erickson, S. C., & Gatheridge, B. J. (in press). Thought, worry, and motivation to quit smoking cigarettes. *Cognition and Emotion*

McClenahan, C., Shevlin, M., & Adamson, G. (2007). Testicular self-examination: A test of the health belief model and the theory of planned behavior. *Health Education Research, 22*(2), 2007, 272-284.

McQueen, A., Swank, P. R., Bastian, L. A., & Vernon, S. W. (2008). Predictors of perceived susceptibility of breast cancer and changes over time: A mixed modeling approach. *Health Psychology, 27*(1), 68-77.

Meischke, H., Sellers, D. E., Robbins, M. L., Goff, D. C., Daya, M. R., Meshack, A. et al. (2000). Factors that influence personal perceptions of the risk of an acute myocardial infarction. *Behavioral Medicine, 26*(1), 4-13.

Merton, R. K. (1938). Social structure and anomie. *American Sociological Review, 3*(5), 672-682.

Meyer, A., Nicholson, R., & Danish, S. (2000). A model to measure program integrity of peer-led health promotion programs in rural middle schools: Assessing the implementation of the sixth grade goals for health program. *Journal of Educational and Psychological Consultation, 11*(2), 223-252.

Miller, R. B., Greene, B. A., Montalvo, G. P., Ravindran, B., & Nichols, J. D. (1996). Engagement in academic work: The role of learning goals, future consequences, pleasing others, and perceived ability. *Contemporary Educational Psychology, 21*, 388-422.

Millstein, S. G., Peterson, A. C., & Nightingale, E. O. (1993). Adolescent health promotion: Rationale, goals and objectives. In S. G. Millstein, A. C. Peterson & E. O. Nightingale (Eds.), *Promoting the health of adolescents: New directions for the twenty-first century* (pp.3-10). New York: Oxford University Press.

Motl, R. W., Dishman, R. K., Saunders, R., Dowda, M., Felton, G., & Pate, R. R. (2001). Measuring enjoyment of physical activity in adolescent girls. *American Journal of Preventive Medicine, 21*(2), 110-117

Moultrie Turner, A. (2007). *Recipe for great teaching: 11 essential ingredients*. Thousand Oaks, CA: Corwin Press.

National Research Council (U.S.), Committee on Increasing High School Students' Engagement and Motivation to Learn, Board on Children, Youth, and Families, Division of Behavioral and Social Sciences and Education, National Research Council, Institute of Medicine of the National Academies (2004). *Engaging Schools: Fostering High School Students' Motivation to Learn*. Washington, DC: The National Academies Press.

National Survey of Student Engagement. (2007). *About NSSE*. Retrieved October 15, 2007 from the National Survey of Student Engagement Web site: http://nsse.iub.edu/index.cfm

Newmann, F. M., Wehlage, G. G., & Lamborn, S. D. (1992). The significance and sources of student engagement. In F. M. Newmann (Ed.), *Student engagement and achievement in American secondary schools* (pp. 11-39). New York: Teachers College Press.

Nolen-Hoeksema, S., Girgus, J. S., & Seligman, M. E. P. (1986). Learned helplessness in children: A longitudinal study of depression, achievement, and explanatory style. *Journal of Personality and Social Psychology, 51*(2), 435-442.

Norman, G. J., Vaughn, A. A., & Roesch, S. C. (2004). Development of decisional balance and self-efficacy measures for adolescents sedentary behaviors. *Psychology and Health, 19*(5), 561-575.

Nystrand, M., & Gamoran, A. (1991). Instructional discourse, student engagement, and literature achievement. *Research in the Teaching of English, 25*, 261-290.

Orlandi, M. A., & Dalton, L. T. (1998). Lifestyle interventions for the young. In S. S. Shumaker, E. B. Schron, J. K. Ockene & W. L. McBee (Eds.), *Health behavior change (2nd ed.)* (pp. 59-84). New York: Springer Publishing Company, Inc.

Patrick, B. C., Skinner, E. A., & Connell, J. P. (1993). What motivates children's behavior and emotion? Joint effects of perceived control and autonomy in the academic domain. *Journal of Personality and Social Psychology, 65*, 781-791.

Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research. Educational Psychologist, 37(2), 91-105.

Piaget, J. (2002). *Judgment and Reasoning in the Child*. London: Routledge.

Prochaska, J. O. (1979). *Systems of psychotherapy: A transtheoretical analysis*. Homewood, IL: Dorsey Press.

Prochaska, J. O., & DiClimente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology, 51*(3), 390-395.

Prochaska, J. O., DiClemente, C. C., & Norcross, J. C. (1992). In search of how people change: Applications to addictive behaviors. *American Psychologist, 47*(9), 1102-1114.

Prochaska, J. O., Velicer, W. F., Rossi, J. S., Goldstein, M. G., Marcus, B. H., Rakowski, W. et al., (1994). Stages of change and decisional balance for 12 problem behaviors. *Health Psychology, 13*, 39–46.

Ravitch, D. (2005, June 20). Ethnomathematics. *The Wall Street Journal*. Retrieved August 31, 2007, from The Brooking Institute Web site: http://www.brookings.edu/views/op-ed/ravitch/20050620.htm

Rice, J. (2004). Modifying adolescent health behaviors. *Current Opinion in Psychiatry, 17*(2), 129-132.

Rimer, B. K., Glanz, K., & Rasband, G. (2001). Searching for evidence about health education and health behavior interventions. *Health Education and Behavior, 28*, 231-248.

Rudas, T. (2005). Mixture models of missing data. *Quality & Quantity: International Journal of Methodology, 39*(1), 19-36.

Russell, D. W. (2002). In search of underlying dimensions: The use (and abuse) of factor analysis in *Personality and Social Psychology Bulletin. Personality and Social Psychology Bulletin, 28*, 1629-1646.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist, 55*(1), 68-78.

Scanlan, T. K., & Simons, J. P. (1992). The construct of sport enjoyment. In G. C. Roberts (Ed.), *Motivation in sport and exercise* (pp. 199-215). Champaign, IL: Human Kinetics Books.

Schonfeld, D.J., Bases. H., Quackenbush, M., Mayne, S., Morra, M., Cicchetti, D., et al. (1993). Improving the health of US children: The need for early interventions in tobacco use. *Preventive Medicine*, *22*, 513-519.

Seligman, S. E. P., & Csikszentmihalyi, M. (2000). Positive psychology: An introduction. *American Psychologist, 55*(1), 5-14.

Sheppard, B. H., Hartwick, J., & Warshaw, P. R. (1988). The theory of reasoned action: A meta-analysis of past research with recommendations for modifications and future research. *Journal of Consumer Research, 15*(3), 325-343.

Shernoff, D. J., Csikszentmihalyi, M., Schneider, B., & Steele Shernoff, E. (2003). Student engagement in high school classrooms from the perspective of flow theory. *School Psychology Quarterly, 18*(2), 158-176.

Simpson, K., & Freeman, R. (2004). Critical health promotion and education—a new research challenge. *Health Education Research, 19*(3), 340-348.

Skinner, E. A., & Belmont, M. J. (1993). Motivation in the classroom: Reciprocal effect of teacher behavior and student engagement across the school year. *Journal of Educational Psychology, 85*, 571-581.

Smith, B. N., Bean, M. K., Mitchell, K. S., Speizer, I. S., & Fries, E. A. (2007). Psychosocial factors associated with non-smoking adolescents' intentions to smoke. *Health Education Research, 22*(2), 238-247.

Snider, V. E. (2006). *Myths and misconceptions about teaching*. Lanham, MD: Rowman and Littlefield Publishers, Inc.

Snijders, T., & Bosker, R. (1999). *Multilevel analysis: An introduction to basic and advanced multilevel modeling*. Thousand Oaks, CA: Sage.

Stanton, C. A., Fries, E. A., & Danish, S. J. (2003). Racial and gender differences in the diets of rural youth and their mothers. *American Journal of Health Behavior, 27*(4), 336-347.

Steinberg, L., Dornbusch, S. M., & Brown, B. B. (1992). Ethnic differences in adolescent achievement: An ecological perspective. *American Psychologist, 47*(6), 723-729.

Sternberg, R. J. (1997). Thinking styles. New York: Cambridge University Press.

Sweeney, C. (2008, April 3). A girl's life, with highlights. *The New York Times*. Retrieved April 10, 2008, from http://www.nytimes.com

Thomas, D. B., Gao, D. L., Ray, R. M., Wang, W. W., Allison, C. J., Chen, F. L. et al., (2002). Randomized trial of breast self-examination in Shanghai: Final results. *Journal of the National Cancer Institute, 94*, 1445-1457.

Thompson, B. (2004). *Exploratory and confirmatory factor analysis: Understanding concepts and applications*. Washington, DC: American Psychological Association.

Tinsley, H. E. A., & Tinsley, D. J. (1987). Uses of factor analysis in counseling psychology research. *Journal of Counseling Psychology, 34*(4), 414-424.

Trost, S. G., Owen, N., Bauman, A. E., Sallis, J. F., & Brown, W. (2002). Correlates of adults' participation in physical activity: review and update. *Medicine and Science in Sport and Exercise, 34*(12), 1996-2001.

Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science, 185*, 1124-1130.

U.S. Cancer Statistics Working Group. (2006). *U.S. Cancer Statistics: 2003 Incidence and Mortality*. Atlanta: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention *and* National Cancer Institute.

U.S. Department of Health and Human Services. (2000). *Healthy People 2010: Understanding and improving health*. 2nd ed. Washington, DC: US Government Printing Office.

U.S. Department of Health and Human Services. (2002). *Health Services Technology/Assessment Texts (HSTAT): Guide to Clinical Preventive Services, 3rd Edition: Recommendations and Systematic Evidence Reviews, Guide to Community Preventive Services*. Rockville, MD: Agency for Healthcare Research and Quality. Retrieved July 1, 2007 from http://www.ncbi.nlm.nih.gov/books/bv.fcgi?rid=hstat3.chapter.27509

U.S. Department of Health and Human Services. (2006a). *Youth Risk Behavior Surveillance – United States, 2005*. Atlanta: Centers for Disease Control. Retrieved July 1, 2007 from http://www.cdc.gov/HealthyYouth/yrbs/index.htm

U.S. Department of Health and Human Services. (2006b). *SHPPS 2006 School Health Policies and Programs Studies: Tobacco Use Prevention*. Atlanta: Centers for Disease Control. Retrieved July 1, 2007 from http://www.cdc.gov/HealthyYouth/shpps/2006/factsheets/index.htm

U.S. Department of Health and Human Services. (2006c). *Indicators for School Health Programs: Coordinated School Health Programs Conducted by State Education Agencies*. Atlanta: Centers for Disease Control. Retrieved July 1, 2007 from http://www.cdc.gov/HealthyYouth/evaluation/indicators-facts.htm

U.S. Department of Health and Human Services. (2007). *Preventing and Controlling Cancer: The Nation's Second Leading Cause of Death*. Atlanta: Centers for Disease Control. Retrieved July 1, 2007 from http://www.cdc.gov/cancer/dcpc/library/online/general.htm

U.S. Preventive Services Task Force. (2007). *Guide to Clinical Preventive Services*. Retrieved from U.S. Department of Health and Human Services Web site: Retrieved July 1, 2007 from http://www.ahrq.gov/clinic/pocketgd07/index.html

Vallerand, R. J., Blanchard, C., Mageau, G. A., Koestner, R., Ratelle, C., Leonard, M. et al. (2003). Les passions de l'ame: On obsessive and harmonious passion. *Journal of Personality and Social Psychology, 85*(4), 756-767.

Van Voorhis, F. L. (2003). Interactive homework in middle school: Effects on family involvement and students' science achievement. *Journal of Educational Research, 96*(9), 323-339.

Van Voorhis, F. L. (2004). Reflecting on the homework ritual: Assignments and designs. *Theory Into Practice, 43*, 205-212.

Walker, J., Marczak, M., Blyth, D., & Borden, L. (2005). Designing youth development programs: Toward a theory of developmental intentionality. In J. L. Mahoney, R.

W. Lawson, & J. S. Eccles (Eds.), *Organized activities as contexts of development: Extracurricular activities, after-school and community programs* (pp. 399-418). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Waller, H., Eiser, C., Heller, S., Knowles, J., & Price, K. (2005). Adolescents' and their parents' views on the acceptability and design of a new diabetes education programme: A focus group analysis. *Child: Care, Health & Development, 31*(3), 283-289.

Walton, G. M., & Cohen, G. L. (2007). A question of belonging: Race, social fit, and achievement. *Journal of Personality and Social Psychology, 92*(1), 82-96.

Warwick, I., Aggleton, P., Chase, E., Schagen, S., Blenkinsop, S., Schagen, I. et al. (2005). Evaluating health schools: Perceptions of impact among school-based respondents. *Health Education research, 20*(6), 697-708.

Watkins, A. M., & Melde, C. (2007). The effect of self-control on unit and item nonresponse in an adolescent sample. *Journal of Research in Crime and Delinquency, 44*(3), 267-294.

Weber, M. (1958). *The Protestant ethic and the spirit of capitalism* (T. Parsons, Trans.). New York: Charles Scribner's Sons.

Weiss, M. R. (2004). *Developmental sport and exercise psychology: A lifespan perspective*. Morgantown, WV: Fitness Information Technology, Inc.

Wellborn, J. G., & Connell, J. P. (1987). *Manual for the Rochester Assessment Package for Schools*. Rochester, NY: University of Rochester. Retrieved April 15, 2008, from http://www.irre.org/publications/pdfs/RAPS_manual_entire_1998.pdf

Wing, R. R. (2000). Cross-cutting themes in maintenance of behavior change. *Health Psychology, 19*(1), 84-88.

Wolfe, E. W. (2003). Using logistic regression to detect item-level non-response bias in surveys. *Journal of Applied Measurement, 4*(3), 234-248.

Wolters, C., Yu, S., & Pintrich, P. R. (1996). The relation between goal orientation and students' motivational beliefs and self-regulated learning. *Learning and Individual Differences, 8*, 211-238.

World Health Organization. (1998). *Obesity: Preventing and managing the global epidemic*. Geneva, Switzerland.

Yazzie-Mintz, E. (2007). *Voices of student engagement: A report of the 2006 High*

School Survey of Student Engagement. Retrieved July 15, 2007 from the Indiana University, School of Education, Center for Evaluation & Educational Policy Web site: http://www.indiana.edu/~ceep/hssse/

Zimmerman, B. J. (1989). A social cognitive view of self-regulated academic learning. *Journal of Educational Psychology, 81*(3), 329-339.

Appendix

BRIDGE Questionnaire Items

Demographics

Below are questions that describe who you are. Please circle one answer for each question.

1. How old are you?

    [1] 13 years old or younger
    [2] 14 years old
    [3] 15 years old
    [4] 16 years old
    [5] 17 years old or older

2. What is your sex?

    [1] Female
    [2] Male

3. How do you describe yourself? (Select one or more responses.)

    [1] American Indian or Alaska Native
    [2] Asian
    [3] Black or African American
    [4] Hispanic or Latino
    [5] Native Hawaiian or Other Pacific Islander
    [6] White

Behavioral intentions

Below are statements relating to your future behavior (Intentions). Please circle one response per statement.

1.   I plan to lower the amount of fat in my diet in the next month.

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

2.   I plan to conduct a breast / testicular self-exam in the next month.

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

3.   I plan to exercise for 30 minutes five days a week in the next month.

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

Behavioral beliefs

Below are some questions about your thoughts relating to health related behaviors and Cancer. Please circle one response for each question.

1. Eating a low fat, high fiber diet can help reduce my risk of getting cancer.

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

2. Performing regular self-examinations (breast or testicular) can help reduce my risk of getting cancer.

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

3. Exercising regularly can help reduce my risk of getting cancer.

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

Behavioral self-efficacy

Below are statements relating to your beliefs about your ability to live a healthy lifestyle (Efficacy). Please circle one response for each statement.

1. I am sure I can switch to eating foods that are lower in fat.

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

2. I am sure I can conduct a breast or testicular self-examination.

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

3. I am sure I can exercise 30 minutes a day that will make me sweat and/or breathe hard.

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

Cancer knowledge

Below are questions about Health. Please circle True or False for each question.

1. Cancer is a group of diseases characterized by uncontrolled growth and spread of abnormal cells.

        True   False

1. Cancer is the 2nd leading cause of death in the United States.

        True   False

2. There is nothing you can do to help decrease your risk of developing cancer.

        True   False

3. Only women can develop breast cancer.

       True   False

4. The main cause of skin cancer is excessive exposure to pollution.

       True   False

5. A diet that consists of mostly foods that are high in fat, especially from animal sources, can increase your risk of developing colorectal cancer.

       True   False

6. Most lung cancer is caused by cigarette smoking.

       True   False

7. People can decrease their risk of cancer by eating healthy.

       True   False

8. To be healthy, it is recommended that you get at *least* 30 minutes of exercise 5 days per week.

       True   False

9. To help make your goals reachable, it is important to state them vaguely and frequently.

       True   False

Risk perception

1. I worry that I will get some type of cancer in my lifetime.

[1] Strongly Disagree	[2] Disagree	[3] Not Sure	[4] Agree	[5] Strongly Agree

Subjective norms

The following statements refer to beliefs and behaviors of families. Please answer each question as it relates to your experience in YOUR FAMILY.

Beliefs

1. My family thinks it is important to eat foods that are low in fat

[1]   [2]   [3]   [4]   [5]
Strongly   Disagree   Not Sure   Agree   Strongly
Disagree   Agree

2a. My family thinks it is important to self-screen for breast cancer

[1]   [2]   [3]   [4]   [5]
Strongly   Disagree   Not Sure   Agree   Strongly
Disagree   Agree

2b. My family thinks it is important to self-screen for testicular cancer

[1]   [2]   [3]   [4]   [5]
Strongly   Disagree   Not Sure   Agree   Strongly
Disagree   Agree

3. My family thinks it is important to exercise.

[1]   [2]   [3]   [4]   [5]
Strongly   Disagree   Not Sure   Agree   Strongly
Disagree   Agree

Behaviors

1. When I have meals with my family our meals are usually low in fat

[1]   [2]   [3]   [4]   [5]
Strongly   Disagree   Not Sure   Agree   Strongly
Disagree   Agree

2a. In my family women screen for breast cancer

[1]   [2]   [3]   [4]   [5]
Strongly   Disagree   Not Sure   Agree   Strongly
Disagree   Agree

2b. In my family, men screen for testicular cancer

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

3. My parents exercise regularly

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

<u>Student engagement</u>

1. How much did you like the BRIDGE program?

[1]	[2]	[3]	[4]	[5]
Not at all	A little Bit	Somewhat	Quite a bit	Very much

2. How important to you were the topics in the BRIDGE program?

[1]	[2]	[3]	[4]	[5]
Not at all	A little Bit	Somewhat	Quite a bit	Very much

3. How much fun was the BRIDGE program?

[1]	[2]	[3]	[4]	[5]
Not at all	A little Bit	Somewhat	Quite a bit	Very much

4. How much did you learn from the BRIDGE program?

[1]	[2]	[3]	[4]	[5]
Not at all	A little Bit	Somewhat	Quite a bit	Very much

5. I think other students my age should be introduced to this program.

[1]	[2]	[3]	[4]	[5]
Not at all	A little Bit	Somewhat	Quite a bit	Very much

6. I feel that a program like BRIDGE enables me to talk openly with my family and relatives.

[1]	[2]	[3]	[4]	[5]
Not at all	A little Bit	Somewhat	Quite a bit	Very much

7. I plan to set a goal to achieve within the next month.

[1]	[2]	[3]	[4]	[5]
Strongly Disagree	Disagree	Not Sure	Agree	Strongly Agree

VITA

Ian Joseph Wallace was born on December 19, 1977 in Chicago, Illinois and is an American citizen. He graduated from Glen Ridge High School, Glen Ridge, New Jersey, in 1996. He enrolled at The College of New Jersey (TCNJ) in the fall of 1996 as a psychology major and received his Bachelor of Arts in Psychology from TCNJ in 2000. During his undergraduate years, he studied abroad at the University of Northumbria at Newcastle, in Newcastle, England. In college he also worked as a community advisor, volunteered in mental health settings, and financially supported himself by waiting tables. Ian completed a senior independent study under the direction of Dr. Ruth Hall, entitled "The Mental Aspects of Training for a Marathon." Upon graduating, he enrolled in the Clinical Psychology Masters program at Pepperdine University, with a focus on marriage and family therapy. During this time, he lived in Los Angeles and participated on a research team directed by Dr. Tara Scanlan in the International Center for Talent Development at The University of California, Los Angeles. Ian also gained additional clinical experience working at a private psychiatric facility as a Marriage and Family Therapy Intern in the state of California. He enrolled in the Doctoral program at Virginia Commonwealth University (VCU) in the fall of 2003 under the advisement of Dr. Steven J. Danish. His current research interests are in health, exercise, and sport psychology. While at VCU Ian has co-authored research articles, presented his research at national conferences, and has co-edited the book: "Applying to Graduate School in Psychology: Advice from Successful Students and Prominent Psychologists." Ian is also an avid sportsman who particularly enjoys basketball, running, and weight training.